

Towards a Sustainable European e-Infrastructure: Research Infrastructure Projects funded by the European Commission Unit INFSO-F3 "GÉANT & e-Infrastructure"

This document provides an overview of the e-Infrastructure projects presently being funded by the Commission. It includes a description of the project, project outputs (including academic publications) and quick facts. The information presented in this document is gathered from various sources, including official project websites, Commission websites, web pages pertaining to e-Infrastructure dissemination, project deliverables and other documents.

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1. Enabling Global Virtual Research Communities

1.1 D4Science: Building virtual research environments for socio-ecological Modelling

e-Infrastructures enable the formation of Global Virtual Research Communities (GVRCs) with the objective of sharing resources like processing capacity, applications, scientific instruments and data to realise synergies and to answer cross-domain questions. The DIstributed colLaboratories Infrastructure on Grid ENabled Technology 4 Science (D4Science) is an EU e-Infrastructure project that makes possible such collaboration between two scientific user communities - Environmental Monitoring & Fisheries and Aquaculture Resources Management. The purpose of this collaboration is to conduct *socio-ecological modelling* pertaining to aquaculture management, conservation and exploitation through integration of remote sensing satellite data, climate data, hydrographical data and trade data. D4Science deploys the e-Infrastructures built so far by the EGEE and DILIGENT projects. This is the first of many planned GVRC-based activities.

The D4Science project has built various data and service collaboratories, referred to as Virtual Research Environments (VREs). The VREs are based on shared computation, storage, and generic service resources offered by EGEE and DILIGENT at a European level, as well as on data and domain-specific service resources offered by large international organizations, such as the European Space Agency, Food and Agriculture Organisation, and the Consultative Group on International Agricultural Research (D4Science, 2008). The VREs are essential for data selection and aggregation to produce required outputs. These outputs are then used in the VREs together with the computing processing power of the grid to undertake modelling, detailed mapping and report production. An example of VRE created by D4Science is "AquaMaps".

The AquaMaps VRE is designed to provide fisheries and aquaculture scientists with a collection of species distribution maps and images that show the species distributions of a large number of economically important species across all major oceans and continents. This would enable good fisheries and aquaculture management and could potentially reduce the problem of over-fishing around the world. The novelty and inherent strength of AquaMaps is that it uses a combination of survey data with environmental data and habitat profiles (Venton, 2009). While the former identifies where a species has been found, the latter offers indication as to where a species should be found. The AquaMaps collections have been generated by processing data of 9154 species. The species distribution maps are available not only as a two-dimensional map of the earth, but also as three-dimensional views from the poles, three-dimensional views for the continents, and three-dimensional views for the oceans.

In addition to the AquaMaps VRE, D4Science is creating the following four VREs:

Acronym	VRE Name	Purpose
FCPPS	Fishery Country Profiles Production System	FCPPS will support the generation of fisheries and aquaculture reports containing focused information in a country-specific format to enhance decision-making and promote advocacy in the sustainable use and conservation of aquatic resources.
ICIS	Integrated Capture Information System	ICIS will integrate regional and global capture and distribution information of aquatic species, from a number of Regional Fishery Management Organisations (RFMOs) and international organisations (FAO, WorldFish Center) into a common system.
GCM	Global Ocean Chlorophyll Monitoring	GCM will integrate heterogeneous satellite data of microscopic marine plants and sea surface temperature maps with a pool of different sources of information related to Earth Science data and products.
GVM	Global Land Vegetation Monitoring	GVM will integrate heterogeneous satellite images of vegetative land cover with a pool of different sources of information related to Earth Science data and products.

D4Science VREs

Scientific Publications/Selected Articles:

Candela L., Castelli D. and Pagano P. (2009). On-demand virtual research environments and the changing roles of librarians. *Library Hi Tech*, vol. 27 (2) pp. 239 - 251. Emerald Group Publishing Limited.

Guidetti V. (2009). Earth Science as an e-Infrastructures Application: Practices at the ESA . In *Zero-In Second edition eMagazine on "Earth sciences and astronomy"*.

Tsangaris M., Kakalettris G., Killapi H., Papanikos G., Pentaris F., Polydoros P., Sitaridi E., Stoumpos V. and Ioannidis Y. (2009). Dataflow Processing and Optimization on Grid and Cloud Infrastructures. *Bulletin of the IEEE Computer Society Technical Committee on Data Engineering*, 32(1).

Simeoni F. and Lievens D. (2009). Matchmaking for Covariant Hierarchies. In *proceedings of the 8th Workshop on Aspects, Components, and Patterns for Infrastructure Software (ACP4IS '09)*.

Pagano P., Simeoni F., Simi M. and Candela L. (2009). Taming Development Complexity in Service-Oriented e-Infrastructures, In *Zero-In First edition eMagazine on "Building Insights, Breaking Boundaries"*.

Castelli D. (2008). e-Infrastructures designed for demanding science. In *eStrategies Europe – special issue on “Europe's new flagship for innovation”*, 2(4). British Publishers.

Fusco L., Cossu R., van Bemmelen J., Guidetti V., Li Santi E., and Rossi A. (2008). The Advance Technology Fusion for EO Application. In *proceedings of the 21st International CODATA Conference, Scientific Information for Society - from Today to the Future*.

Assante M. and Frosini L. (2008). Extensible Digital Library User Portals for e-Infrastructures. In *proceedings of the 1st Workshop on Very Large Digital Libraries, VLDL2008*, Aarhus, Denmark.

Assante M., Candela L., Castelli D., Frosini L., Lelii L., Manghi P., Manzi A., Pagano P., Simi M. (2008). An Extensible Virtual Digital Libraries Generator. In *proceedings of the 12th European Conference on Research and Advanced Technology for Digital Libraries, ECDL 2008*, Aarhus, Denmark. pp 122-134.

Simeoni F., Castelli D., Pagano P., Simi M. and Connor R. (2008). Application-level Research e-Infrastructures: the gCube Approach. In *proceedings of the UK e-Science All Hands Meeting 2008*.

Floros E., Kakalettris G., Polydoros P. and Ioannidis Y. (2008). Query Processing Over The Grid: The Role Of Workflow Management. In *Grid Computing*, Springer, pp 1-12.

Castelli D. and Michel J. (2008). D4Science - Deploying Virtual Research Environments. In *ERCIM News 74 Special theme: Supercomputing at Work*, pp 8-9.

Candela L., Castelli D. and Pagano P. (2008). gCube: A Service-Oriented Application Framework on the Grid. In *ERCIM News 72 Special theme: The Future Web*, pp 48-49.

Quick Facts:

Project acronym	D4Science
• Start date	01/01/2008
• Duration	24 months
• Total budget	3 916 736 €

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Project participants	
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Consiglio Nazionale delle Ricerche (CNR)	Italy
National and Kapodistrian University of Athens (NKUA)	Greece
European Organization for Nuclear Research (CERN)	Switzerland
Engineering - Ingegneria Informatica – SpA	Italy
University of Strathclyde	UK
Universität Basel	Switzerland
European Space Agency (ESA)	France
The Food and Agriculture Organization of the United Nations (FAO)	Italy

International Center for Living Aquatic Resources Management (WorldFish Center)	Malaysia
4D SOFT Számítástechnikai Kft	Hungary

Keywords	environmental monitoring, fishery resources management, virtual research environments, grid, e-Infrastructure
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Collaboration with other EC funded projects	CASPAR, DRIVER II, EGEE-II, EGI-DS, NeON, GENESI-DR, NEON
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Quick facts: D4Science

References:

D4Science. (2008). DIstributed colLaboratories Infrastructure on Grid ENabled Technology 4 Science – Project Summary. Available online www.d4science.eu/files/d4science_summary.pdf. Last accessed August, 2009.

Venton, D. (2009). Plenty more fish in the sea? OMII-UK News, June 2009. Available online www.omii.ac.uk/attach/Newsletter/Newsletter%20Jun%202009.pdf. Last accessed August, 2009.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. Available online http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

1.2 ETICS-2: Software engineers of the world unite!

e-Infrastructure for Testing, Integration and Configuration of Software – Phase 2 (ETICS-2) is a distributed software development approach that is primarily aimed at developing large-scale distributed systems. The developments of such systems usually require collaboration among various centres of excellence that maybe spread across the globe. ETICS-2 provides the e-Infrastructure required for testing, integration and configuration of software that is created in such distributed fashion. The distributed, high quality, high availability open infrastructure provided by ETICS can be used by user communities to build and test their software. Also, the user communities are able to submit new requirements to improve and extend the core services offered by ETICS.

The main objective of ETICS-2 is to expand the availability, flexibility and efficiency of the existing ETICS services to new infrastructures and new communities. The project therefore aims to will reach out to existing and emerging infrastructures beyond the currently supported communities, capturing commonalities and promoting open standards on software build, testing and quality assurance. The High Performance Computing and the Aerospace Engineering communities are the initial targets of this expansion (ETICS-2, 2008). Services offered by ETICS are already used by several e-Infrastructure projects like EGEE (which uses the system as the foundation of the build and integration process of the gLite middleware) and D4Science (which uses ETICS services as its build and integration platform).

The ETICS system helps software developers, managers and users to better manage the complexity and to improve the quality of their software by providing an all-in-one solution that helps configure and build software, and at the same time check its quality. With regards to the former, this system provides tools and resources to build and test runs, thereby simplifying complex and often repetitive activities. In case of the latter (software quality), the ETICS system provides software professionals with an “out-of-the-box” build and test system enriched with an Automated Quality Certification Model (A-QCM). The A-QCM, provides a way to automatically evaluate and certify aspects such as functionality, reliability, maintainability and portability of any kind of software, while following current ISO software quality guidelines (Matranga, 2009).

The ETICS platform was developed in two phases (ETICS and ETICS-2) over three years and is continuously being refined in collaboration with users. New functions are also being developed for ETICS-2 that will enable software developers to design and run complex tests over distributed networks – a rarity even in high-end commercial test and management applications. The ETICS-2 team is now working together with users to enhance ETICS’ interoperability testing features (ICT Results, 2009).

Scientific Publications/Selected Articles:

Meglio, A.D., Bégin, M-E., Couvares, P., Ronchieri, E. and Takacs, E. (2008). *Journal of Physics Conferences Series*, **119** (2008) 042010 (11pp).

Bégin, M-E., Ronco, S.D., Sancho, G.D-A, Gentilini, M., Ronchieri, E. and Selmi, M. (2008). *Journal of Physics Conferences Series*, **119** (2008) 042004 (10pp).

Quick Facts:

Project acronym	ETICS-2
• Start date	01/03/2008
• Duration	24 months
• Total budget	3 783 569 €

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National Institute of Nuclear Physics (INFN)	Italy
Engineering - Ingegneria Informatica – SpA	Italy
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University of Wisconsin-Madison	USA
MTA SZTAKI	Hungary
Forschungszentrum Jülich	Germany
Vega IT GmbH	Germany

Keywords	e-Infrastructure, software engineering, quality assurance, build system, test system
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Collaboration with other EC funded projects	EGEE, D4Science, OMII-Europe
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Quick facts: ETICS-2

References:

Matranga, I. (2009). ETICS-2 offers help to software professionals. International Science Grid This Week (Issue 126: iSGTW 27 May 2009). Available online <http://www.isgtw.org/?pid=1001819>. Last accessed August, 2009.

ETICS-2. (2008). Brochure: e-Infrastructure for Testing, Integration and Configuration of Software. Available online <http://etics.web.cern.ch/etics/pdf/Etics2brochure.pdf>. Last accessed August, 2009.

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ICT Results. (2009). Taking the hard work out of software (Feature). Available online <http://cordis.europa.eu/ictresults/>. Last accessed November, 2009.

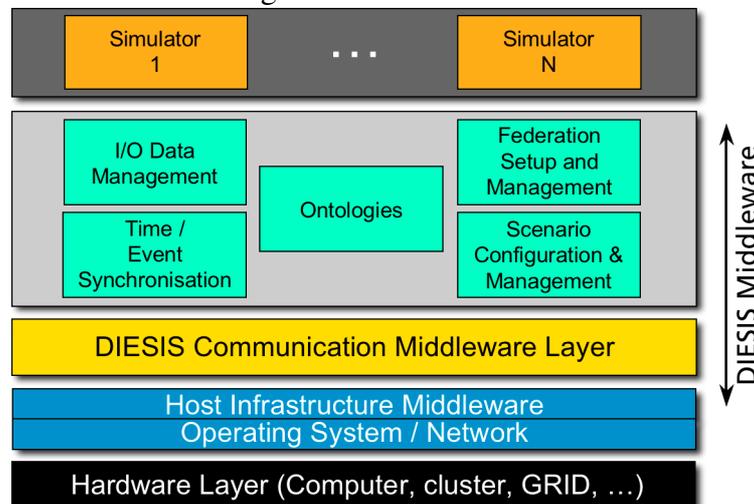
1.3 DIESIS: e-Infrastructures answer what-if questions on protection of critical European infrastructures!

The European Commission proposes measures to strengthen the EU's prevention, preparedness and response to terrorist attacks on critical infrastructure. Critical infrastructures are those physical and information technology facilities, networks, services and assets which, if disrupted or destroyed, would have a serious impact on the health, safety, security or economic well-being of citizens or the effective functioning of governments in the Member States (European Commission, 2006). Examples of critical infrastructure include healthcare facilities, energy and water networks, communication and ICT networks, transport networks, facilities associated with banking and investment, etc. Critical Infrastructure Protection (CIP) involves the identification of critical infrastructures, the analysis of their vulnerabilities and interdependence, and providing solutions to protect them. However, the disruptions to critical infrastructures cannot be studied in real time and the researchers therefore rely on Modelling and Simulation (M&S) environments to assess the potential weaknesses of and risks to these complex infrastructure networks (Fraunhofer Institute for Intelligent Analysis and Information Systems, 2008). Although several simulators of this kind currently exist in Europe, but none are capable of simulating the interactions between multiple dependent infrastructures. An e-Infrastructure geared-up for executing M&S simulations of critical infrastructures could therefore be advantageous as this would enable interoperation of the various CIP simulations that are in-existence or are being developed in Europe. Also such an e-Infrastructure will provide the computational power required to execute large and complex CIP simulations. DIESIS proposes to establish such a European M&S e-Infrastructure based upon open standards to foster and support research on all aspects in the field of CIP.

DIESIS studied the feasibility of creating a centre (European Infrastructures Simulation and Analysis Centre) for distributed European e-Infrastructure for supporting interoperable federated simulations and conducting related research activities on CIP (Rome et al., 2009). Towards this end, DIESIS performed a thorough conceptual design study in order to prepare the establishment of an M&S research e-Infrastructure. The results of the design study are as follows:

- (a) A detailed analysis of the requirements by researchers, industrial stakeholders, decision makers and governmental organisations for the research e-Infrastructure;
- (b) An ontology for systems of Critical Infrastructures (CI) and a communication middleware for distributed federated CI simulations;
- (c) A middleware enabling interoperability among heterogeneous and distributed modelling and simulation technologies that could also serve as a basis for a standard for interoperable simulations in the field of CIP;
- (d) An Information and Communication Technology (ICT) architecture for a distributed European e-Infrastructure on top of existing GRID approaches in order to support federated, interoperable simulations and research on CIP;
- (e) A prototypical realisation of a distributed federated CI simulation using the new technologies, coupling four simulators as a proof of concept.
- (f) A Design Study document assessing the feasibility (scientific, technical, and financial) and the potential impact (scientific and technical) of such an e-Infrastructure.

Although the main focus of the project is on research in the critical infrastructure domain, it is expected that the developed concepts, protocols and technologies will be applicable to all kinds of research where federated simulation is useful (DIESIS, 2008). The proposed integration architecture of DIESIS middleware layer with existing simulators is shown in Figure 1 below.



DIESIS middleware and its relationship to existing computing resources and simulators (Rome, Bologna, Gelenbe, Luijff, Masucci, 2009)

Scientific Publications/Selected Articles:

V. Masucci, F. Adinolfi, G. Dipoppa, P. Servillo, and A. Tofani (2009): Critical Infrastructures Ontology based Modelling and Simulation. In: *Proceedings of the Third Annual IFIP Working Group 11.10 International Conference on Critical Infrastructure Protection*, pp. 229–242. Dartmouth College, Hanover, New Hampshire, USA, March 22–25, 2009.

R. Lent (2009): Improving Federation Executions with Migrating HLA/RTI Central Runtime Controllers. In: *Proceedings of the 14th IEEE International Workshop on Computer Aided Modelling and Design of Communication Links and Networks (IEEE CAMAD 2009)*, pp. 1–5. Pisa, Italy, June 12, 2009.

E. Rome, S. Bologna, E. Gelenbe, E. Luijff, V. Masucci (2009): DIESIS – Design of an Interoperable European Federated Simulation Network for Critical Infrastructures. In: *Proceedings of the 2009 SISO European Simulation Interoperability Workshop (ESIW '09)*, pp. 139–146, Istanbul, Turkey, July 13–16, 2009.

G. Görbil, E. Gelenbe (2009): Design of a Mobile Agent-Based Adaptive Communication Middleware to Enable Federations of Critical Infrastructure Simulations. In: *Pre-proceedings of the fourth International Workshop on Critical Information Infrastructures Security (CRITIS '09)*, Erich Rome, Robin Bloomfield (eds.), Sankt Augustin: Fraunhofer IAIS, 2009, pp. 145-160. Conference: Bonn, Germany, September 30–October 2, 2009.

E. Castorini, A. Tofani, P. Palazzari and P. Servillo (2010): Ontological framework to model Critical Infrastructures and their interdependencies. To appear: *Proceedings of*

the Workshop on Complexity in Engineering (COMPENG 2010), IEEE, Rome, Italy, Feb 22–24, 2010.

R. Lent, O. Abdelrahman, G. Gorbil and E. Gelenbe (2010): Fast Message Dissemination for Emergency Communications. To appear: *Proceedings of the first workshop on Pervasive Networks for Emergency Management (PerNEM 2010)*, Mannheim, Germany, March 2010.

E. Rome, R. Bloomfield (eds.) (2010): Post-Proceedings of the fourth International Workshop on Critical Information Infrastructures Security 2009 (CRITIS'09). Revised papers. Springer, Berlin Heidelberg, LNCS 6027. Conference: Bonn, Germany, September 30-October 2, 2009 (to appear).

Quick Facts:

Project acronym	DIESIS
• Start date	01/02/2008
• Duration	26 months
• Total budget	1 537 350 €

Web site	www.diesis-project.eu
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The Fraunhofer-Institute for Intelligent Analysis and Information Systems (IAIS)	Germany
Consorzio Campano di Ricerca per l'Informatica e l'Automazione Industriale (CRAI)	Italy
Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)	Italy
Imperial College London (ICL)	UK
The Netherlands Organisation for Applied Scientific Research (TNO)	The Netherlands

Keywords	Critical infrastructures, federated simulation, research infrastructure, middleware
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Collaboration with other EC funded projects	Integrated Risk Reduction of Information-based Infrastructure Systems (IRRIIS), RAMIRI, BELIEF, CESSDA, LIFEWATCH, EMILI, ERN-CIP
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Quick facts: DIESIS

References:

DIESIS. (2008). D5.2a Report on the first DIESIS workshop. Available online <http://www.diesis-project.eu/DiesisFirstWorkshop/DiesisWorkshopReport.pdf>. Last Accessed August 2009.

European Commission. (2006). Critical infrastructure protection - Summaries of EU legislation. *Available online* http://europa.eu/legislation_summaries/justice_freedom_security/fight_against_terrorism/l33259_en.htm. Last Accessed August 2009.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

Fraunhofer Institute for Intelligent Analysis and Information Systems. (2008). Protecting Europe's critical infrastructures. *Available online* <http://cordis.europa.eu>. Last Accessed August 2009.

1.4 IMPACT: Using technology to improve the functional classification of proteins

IMPACT aims to harness existing technologies (such as web services and distributed computing) and use them to dramatically improve existing information resources on protein families (e.g., a database called InterPro).

Scientific Publications/Selected Articles:

Letunic I, Doerks T, Bork, P (2009) "SMART 6: Recent updates and new developments". *Nucleic Acids Res.* **37**:D229-32. (doi:10.1093/nar/gkn808)

Hunter S, *et al.* (2009) "InterPro: The integrative protein signature database". *Nucleic Acids Res.* **37**: D211-5. (doi:10.1093/nar/gkn785)

Wilson D, Pethica R, *et al.* (2009) "SUPERFAMILY – Sophisticated comparative genomics, data mining, visualization and phylogeny". *Nucleic Acids Res.* **37**: D380-6. (doi:10.1093/nar/gkn762)

Lees J, Yeats C, Redfern O, Clegg A, Orengo C. (2010) "Gene3D: merging structure and function for a Thousand genomes." *Nucleic Acids Res.* **38**:D296-300.

Yeats C, Redfern OC, Orengo C. (2010) "A fast and automated solution for accurately resolving protein domain architectures." *Bioinformatics.* **29**. [Epub ahead of print]

Pethica, R., Barker, G., Kovacs, T. and Gough, J. (2010) "TreeVector: Scalable, Interactive, Phylogenetic Trees for the Web." *PLoS ONE* **5**(1):e8934

Chothia, C. and Gough, J. (2009) "Genomic and Structural Aspects of Protein Evolution." *Biochem. J.* **419**(1):15-28.

Madera, M., Calums, R., Thiltgen, G. Karplus, K. and Gough, J. (2010) "Improving protein secondary structure prediction using a simple k-mer model." *Bioinformatics* doi: 10.1093/bioinformatics/btq020.

Chang C, Coggill P, Bateman A, Finn RD, Cymborowski M, Otwinowski Z, Minor W, Volkart L, Joachimiak A. (2009) "The structure of pyogenecin immunity protein, a novel bacteriocin-like immunity protein from *Streptococcus pyogenes*." *BMC Struct Biol.* **9**:75.

Finn RD, Mistry J, Tate J, Coggill P, Heger A, Pollington JE, Gavin OL, Gunasekaran P, Ceric G, Forslund K, Holm L, Sonnhammer EL, Eddy SR, Bateman A. (2010) "The Pfam protein families database." *Nucleic Acids Res.* **38** (Database issue):D211-22.

Xu Q, Bateman A, Finn RD, Abdubek P, Astakhova T, Axelrod HL, Bakolitsa C, Carlton D, Chen C, Chiu HJ, Chiu M, Clayton T, Das D, Deller MC, Duan L, Ellrott K, Ernst D, Farr CL, Feuerhelm J, Grant JC, Grzechnik A, Han GW, Jaroszewski L, Jin KK, Klock HE, Knuth MW, Kozbial P, Krishna SS, Kumar A, Marciano D, McMullan D, Miller MD, Morse AT, Nigoghossian E, Nopakun A, Okach L, Puckett

C, Reyes R, Rife CL, Sefcovic N, Tien HJ, Trame CB, van den Bedem H, Weekes D, Wooten T, Hodgson KO, Wooley J, Elsliger MA, Deacon AM, Godzik A, Lesley SA, Wilson IA. (2010) "Bacterial pleckstrin homology domains: a prokaryotic origin for the PH domain." *J Mol Biol.* **396(1)**:31-46.

Bateman A, Finn RD, Sims PJ, Wiedmer T, Biegert A, Söding J. (2009) "Phospholipid scramblases and Tubby-like proteins belong to a new superfamily of membrane tethered transcription factors." *Bioinformatics.* **25(2)**:159-62.

Blankenburg H, Finn RD, Prii?? A, Jenkinson AM, Ramírez F, Emig D, Schelhorn SE, Büch J, Lengauer T, Albrecht M. (2009) "DASMI: exchanging, annotating and assessing molecular interaction data." *Bioinformatics.* **25(10)**:1321-8.

Quick Facts:

Project acronym	IMPACT
• Start date	01/01/2008
• Duration	36 months
• Total budget	3 776 220 €

Web site	www.ebi.ac.uk/impact
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Project participants	
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Wellcome Trust Sanger Institute	UK
University of Manchester	UK
Swiss Institute of Bioinformatics	Switzerland
University College London	UK
University of Bristol	UK
INRIA	France
University of Cape Town	South Africa

Keywords	Protein, Function, Web services, Database, DAS, HMM.
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Collaboration with other EC funded projects	
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Quick facts: IMPACT

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online*

http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

1.5 EUFORIA: e-Infrastructures accelerate the search for cleaner ways of producing energy on a large scale

EUFORIA will provide a comprehensive framework and infrastructure for core and edge transport and turbulence simulation, linking grid and High Performance Computing (HPC), to the fusion modelling community.

Scientific Publications/Selected Articles:

Castejón, F. et al. (2009). Parameter Scan for PIC simulations. *In Proceedings of the 4th User Forum/OGF*, Catania (Italy), March 2-6, 2009.

Gómez, A. et al. (2009). A Grid-Oriented Genetic Algorithm for confinement improvement in Fusion. *In Proceedings of the 4th User Forum/OGF*, Catania (Italy), March 2-6, 2009.

Gómez, A. et al. (2009). Mutation-Based Genetic Algorithm and the Grid to Optimise Nuclear Fusion Devices. *In Proceedings of the International Conference on Adaptive and Natural Computing Algorithms*, Kuopio (Finland), April 23-25, 2009.

Castejon, F. et al. (2009). Grid Computing for Fusion Research. *In Proceedings of the 3rd Iberian Grid Infrastructure Conference*, Valencia (Spain), May 20-22, 2009.

Plasencia, I.C. et al. (2009). Modelling Mixed Workflows between Grid and HPC in EUFORIA. *In Proceedings of the 3rd Iberian Grid Infrastructure Conference*, Valencia (Spain), May 20-22, 2009.

Gómez, A. et al. (2009). A Grid-Oriented Crossover Genetic Algorithm to Optimise Nuclear Fusion Devices. *In Proceedings of the 3rd Iberian Grid Infrastructure Conference*, Valencia (Spain), May 20-22, 2009.

Cárdenas, M. et al. (2009). Grid Application Taxonomies And Models for its Adaptation. *In Proceedings of the 3rd Iberian Grid Infrastructure Conference*, Valencia (Spain), May 20-22, 2009.

Gómez, A. et al. (2009). Scatter Search and Grid Computing to Improve Nuclear Fusion Devices. *In Proceedings of the 7th International Conference on Large-Scale Scientific Computations*, Sozopol (Bulgaria), June 4-8, 2009.

Castejon, F. et al. (2008). EUFORIA: Grid and High Performance Computing at the Service of Fusion Modelling. *In Proceedings of the 2nd Iberian Grid Infrastructure Conference*, Porto (Portugal), May 12-14, 2008.

Stotzka, R. et al. (2008). EUFORIA - Simulation Environment for ITER Fusion Research. *In Proceedings of the 34th Euromicro Conference - Software Engineering and Advanced Applications*, Parma (Italy), September 2-5, 2008.

Hardt, M. et al. (2008). EUFORIA / EU Fusion for ITER Applications. *In Proceedings of the EGEE'08 Conference*, Istanbul (Turkey), 22-26 September, 2008.

Quick Facts:

Project acronym	EUFORIA
• Start date	01/01/2008
• Duration	36 months
• Total budget	4 473 072 €

Web site	www.euforia-project.eu
• Point of contact	Par Strand
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• Fax	+46 31 772 1884

Project participants	
Chalmers University of Technology	Sweden
Max Plank Institute for Plasma Physics (IPP)	Germany
Centro Superior de Investigaciones Científicas (CSIC)	Spain
Centro de Investigaciones Energéticas, Medio Ambientales y Tecnológicas (CIEMAT)	Spain
Forschungszentrum Karlsruhe (FZK)	Germany
Finnish IT Center for Science (CSC)	Finland
Abo Akademi University (ABO)	Finland
University of Edinburgh	UK
Barcelona Supercomputing Center	Spain
French Atomic Energy Commission (CEA)	France
University Louis Pasteur - Strasbourg I (ULP)	France
University of Ljubljana (UOL)	Slovenia
Poznan Supercomputing and Networking Center (PSNC)	Poland
Italian National Agency for New Technologies, Energy and the Environment (ENEA)	Italy

Keywords	Grid, HPC, Fusion, ITER
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Collaboration with other EC funded projects	EGEE-II, DEISA, INT.EU.GRID (FP6), DORII (FP7)
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Quick facts: EUFORIA

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

1.6 neuGRID: e-Infrastructures help neuroscientists in the study of degenerative brain diseases

neuGRID will be a new user-friendly Grid-based research e-Infrastructure enabling the European neuroscience community to carry out research required for the pressing study of degenerative brain diseases. In neuGRID, the collection/archiving of large amounts of imaging data will be paired with computationally intensive data analyses. Neuroscientists will be able to identify neurodegenerative disease markers through the analysis of 3D magnetic resonance brain images via the provision of sets of distributed medical and Grid services.

Scientific Publications/Selected Articles:

maat Gknowledge. (2008). maat Gknowledge, on the Cutting Edge of Biomedical Technology. European Parliament magazine, issue 271. Available online <http://www.e-pages.dk/dods/76/fullpdf/full4a964613b480d.pdf> . Last accessed August 2009.

Redolfi A. et al. "Grid infrastructures for computational neuroscience: the neuGRID example", Future Neurology (2009) 4(6), 703-722 2.

Anjum A. et al. "A Service Oriented Analysis Environment from the neuGRID Project", submitted.

Anjum A. et al. "Reusable Services from the neuGRID Project for Grid-Based Health Applications", submitted.

Mehmood Y. et al. "A Middleware Agnostic Infrastructure for Neuro-imaging Analysis", submitted.

Quick Facts:

Project acronym	neuGRID
• Start date	01/02/2008
• Duration	36 months
• Total budget	3 058 911 €

Web site	www.neuGRID.eu
• Point of contact	Giovanni B Frisoni
• Email	gfrisoni@fatebenefratelli.it
• Telephone	+39 030 3501261
• Fax	+39 030 3501313

Project participants	
Provincia Lombardo Veneta Ordine Ospedaliero di San Giovanni di Dio – Fatebenefratelli (FBF)	Italy
Prodema Informatics (formerly Neuralyse Europe GmbH) (NE)	Switzerland
University of the West of England	UK

Maat G Knowledge SL (MAAT)	Spain
Vereniging voor christelijk hoger onderwijs, wetenschappelijk onderzoek en patiëntenzorg (VUmc)	The Netherlands
Karolinska Institutet	Sweden
HealthGrid	France
CF consulting Finanziamenti Unione europea s.r.l. (CFc)	Italy

Keywords	Grid Computing, Alzheimer's Disease, Computational Neuroscience
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Collaboration with other EC funded projects	ENIR, Innomed/AddNeuroMed, MammoGrid, Health-E-Child
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Quick facts: neuGRID

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

1.7 e-NMR: An e-Infrastructure platform for biomolecular NMR data analysis

Nuclear magnetic resonance (NMR) plays an important role in life sciences (Biomolecular NMR), and structural biology in particular, at both European and international levels. An Integrated Infrastructure Initiative (I3) is operative in the field, which provides access to NMR instrumentation and pursues technical advancement *EU-NMR* (EU-NMR, 2009). In addition, the EC has funded in the past a Coordination action *NMR-Life* (NMR-Life, 2009) aimed at the establishment of common experimental approaches and at the spreading of best experimental practices across Europe. Altogether, these two initiatives provide a reference point for the large majority of European scientists with an interest in biomolecular NMR. In parallel, European developments in the area of e-Infrastructure in the past years resulted in a leading edge high-speed research network covering all Europe and in a overlaying production Grid infrastructure, realized by projects as *EGEE/EGEE-II/EGEE-III*. This integrated network and processing/storage environment provides a platform for new methods of global collaborative research - e-Science.

The main objective of the e-NMR project is to optimise and extend the use of the NMR Research Infrastructures of EU-NMR through the implementation of an e-Infrastructure in order to provide the European biomolecular NMR user community with a platform integrating and streamlining the computational approaches necessary for biomolecular NMR data analysis (e-NMR, 2009). The e-NMR infrastructure is based on the Grid infrastructure.

Access to the e-NMR infrastructure is provided through a portal (e-NMR CI, 2009) integrating commonly NMR software and Grid technology. The e-NMR grid and the portal are already operational. A number of tutorials and use-cases are now available providing examples on how to use the web portals and run calculations on the e-NMR grid (e.g. structure calculations with CNS, Xplor-NIH, CYANA, HADDOCK and CS-Rosetta; NMR data processing with PROSA; automated assignment with MAPPER and MARS; scalar coupling constant determination with INFIT; and processing of non-uniformly sampled data with MDDnmr (e-NMR Tutorials, 2009). Descriptions of some NMR applications are given below. These descriptions have been referenced from web pages pertaining to the NMR Computational Infrastructure (e-NMR CI, 2009):

e-NMR applications	Description	Website
HADDOCK Biomolecular Docking	HADDOCK (High Ambiguity Driven protein-protein DOCKing) is an information-driven flexible docking approach for the modeling of biomolecular complexes. It can deal with a large class of modelling problems including protein-protein, protein-nucleic acids and protein-ligand complexes.	http://haddock.chem.uu.nl/enmr/haddock.php
Xplor-NIH structure calculations	This is the eNMR interface to the Xplor-NIH allowing you to run NMR structure calculations with NOE, dihedral angle and paramagnetic restraints on the eNMR grid infrastructure.	http://haddock.chem.uu.nl/enmr/xplor-nih.html
CYANA structure calculations	This is the eNMR interface to CYANA allowing you to run NMR structure calculations with NOE and dihedral	http://www.enmr.eu/webportal/cyana.html

	angle restraints on the eNMR grid infrastructure.	
CS-ROSETTA structure calculations	This is the eNMR interface to CS-ROSETTA allowing you to run chemical shift-based structure calculations with Rosetta.	http://haddock.chem.uu.nl/enmr/csrosetta.php
TALOS+ Analysis	TALOS+ (the improved TALOS) predicts backbone torsion angles using information derived from chemical shift, amino acid type, and the area of the Ramachandran map where the residue is likely to reside in. This information is compared to a large database of 200 proteins.	http://haddock.chem.uu.nl/enmr/services/TALOS/
MDD NMR Data Processing	MDD NMR allows to process non-uniformly sampled nD spectrum using Multi-Dimensional Decomposition	http://www.enmr.eu/webportal/mdd.html
CcpNmr FormatConverter	The CcpNmr FormatConverted is designed to facilitate conversions between any existing NMR data formats and types.	http://haddock.chem.uu.nl/enmr/format-converter.html

**e-NMR applications that can be accessed from the e-NMR CI web portal
(e-NMR CI, 2009)**

Scientific Publications/Selected Articles:

“CASD-NMR: critical assessment of automated structure determination by NMR”, Nature Methods, Vol.6 No.9 September 2009 625, doi:10.1038/nmeth0909-625

“Biology group issues challenge to computing”, International Science Grid This Week, 9 December 2009, <http://www.isgtw.org/?pid=1002229>

“The HADDOCK web server for data-driven biomolecular docking”, S.J. de Vries, M. van Dijk and A.M.J.J. Bonvin. Nature Protocols, in press (2010).

Quick Facts:

Project acronym	e-NMR
• Start date	01/11/2007
• Duration	36 months
• Total budget	2 766 650 €

Web site	www.e-nmr.eu
• Point of contact	Prof. Harald Schwalbe
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• Telephone	+49 69 79829737
• Fax	+49 69 79829515

Project participants	
Center for Biomolecular Magnetic Resonance (BMRZ), Johann Wolfgang Goethe University	Germany
Magnetic Resonance Center (CERM), University of Florence	Italy
Bijvoet Center for Biomolecular Research (BCBR), NMR Research Group, Utrecht University	The Netherlands
National Institute of Nuclear Physics (INFN)	Italy
European Molecular Biology Laboratory - European Bioinformatics Institute (EMBL-EBI)	UK

Keywords	EU-NMR, Life Sciences, Protein, DNA, RNA
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Collaboration with other EC funded projects	EU-NMR, NMR-Life, EGEE-III
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Quick facts: e-NMR

References:

EU-NMR. (2009). EU-NMR project website. *Available online <http://www.eu-nmr.eu/>*. Last accessed September 2009.

e-NMR. (2009). e-NMR project website. *Available online <http://www.e-nmr.eu/>*. Last accessed February 2010.

e-NMR Tutorials.(2009). e-NMR Tutorials website. *Available online <http://www.e-nmr.eu/eNMR-tutorials>*. Last accessed February 2010.

e-NMR CI. (2009). e-NMR: NMR computational infrastructure. *Available online <http://www.e-nmr.eu/webportal/>*. Last accessed February 2010.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html*. Last accessed August 2009.

NMR-Life. (2009). NMR-Life project website. *Available online <http://www.postgenomicnmr.net/>*. Last accessed September 2009.

1.8 ETSF: A knowledge centre for theoretical spectroscopy

The European Theoretical Spectroscopy Facility (ETSF) is a knowledge centre for theoretical spectroscopy carrying out state-of-the-art research on theoretical and computational methods for studying electronic and optical properties of materials. Theoretical spectroscopy is the powerful combination of quantum-based theories and computer simulation applied to electronic excitations. By employing a wide range of theoretical and computational methods, researchers utilising the ETSF facilities can study electrons inside such materials and explain their interaction with external fields and light. All domains that need knowledge about electronic excitations, transport and spectroscopy will benefit from the ETSF, such as condensed matter physics and chemistry, biology, materials and nano-science. The ETSF gathers the experience and know-how of more than 200 researchers in Europe and the United States, facilitating collaborations and rapid knowledge transfer. The ETSF offers its expertise to researchers, industry, and students in the form of collaborative projects, free scientific software and training. Proposals to benefit from these services can be submitted all round the year and they are evaluated twice a year by an external scientific panel (ETSF, 2009a).

The ETSF is organised within a three-shell structure (core shell, associate shell, user shell), the boundaries between which are intended to become permeable as the ETSF reaches equilibrium. The **core shell** consists of ten prominent European Condensed Matter Theory groups that develop theory and code, and provide services to users. They take responsibility for the management of the ETSF and the development of its user community. The **associate shell** is a broad community of theoretical research groups working on related topics. They develop theory and code, and provide services to users just like members of the core shell. The **user shell** comprises of the users of this facility. They are a large and varied group of researchers from the public or private sector wishing to benefit from developments in the field of electronic excitations by taking advantage of the different services offered by the ETSF (ETSF, 2009a)

The ETSF is divided into seven beamlines, each of which is concerned with a specific scientific topic. The seven beamlines are as follows: Optics, Energy Loss Spectroscopy, Quantum Transport, Time-resolved Spectroscopy, Photo-emission spectroscopy, Vibrational Spectroscopy and X-Rays Spectroscopy. For a description of the beamlines please refer to ETSF (2009a).

The ETSF has made available several *software packages, libraries and tools* for download. These applications have been developed by different partners of the ETSF and they are released under the Free Software Licences. Furthermore, the ETSF has plans to set-up an *e-Library* for the efficient sharing and dissemination of research data. Finally, the ETSF will create a *publication database* to allow its users and any researcher working in the field of spectroscopy a fast access to all the scientific results obtained by the ETSF.

As has been mentioned earlier, every year the ETSF publishes the call for proposal targeted at projects that may benefit from use of the ETSF facilities. These statistics pertaining to four such calls are presented now. In 2007, a total of 54 proposals have

been received from 51 different proposers and 44 different institutions, involving 170 different researchers. Of these 21 projects were selected to be funded or partly funded (ETSF, 2007). In response to the ETSF call for proposals in the Spring of 2008, 40 proposals were submitted (of which two were late submissions). The 38 proposals that were evaluated came from 36 different proposers and institutions, involving 124 researchers. Of these, 25 proposals were fully or partly accepted (ETSF, 2008a). The deadline for submission to the third ETSF call for proposals was 27 October 2008. 28 proposals were submitted and evaluated. They came from 26 different proposers from 24 different institutions, involving 74 researchers. Of these, 17 proposals were fully or partly accepted (ETSF, 2008b). Finally, the most recent call for proposal had a submission deadline of 7th April, 2009. In response to this call 22 proposals were submitted and evaluated. They came from 21 different proposers from 20 different institutions from 8 different countries, involving 68 researchers. 19 proposals were fully or partly accepted, and 3 proposers were invited for discussion with ETSF scientists (ETSF, 2009b). From these statistics it is clear that the number of proposals that are being received by the ETSF has gradually decreased. However, the quality of the proposals have increased substantially in the fourth call for proposal – as evidenced from the fact that 19 of the 22 proposals were fully and partly accepted and the proposers of the remaining three proposals were invited for discussion.

Every year the ETSF organises a high-level conference focusing on the active research areas of the ETSF. The conference has grown into a five day format with more than 100 participants. The ETSF also organises the *Nanoquanta-ETSF series of workshops*. Till date there have been 13 such workshops, and the 14th workshop of this series is slated to be held in September 2009 in Portugal. Every workshop focuses on a particular topics relating with research conducted in the ETSF. Some of the topics covered in the preceding workshops relate to: Electronic Exchange and Correlation in Advanced Materials; Spectroscopy of Electronic Excitations in Materials; Excited states and electronic spectra; Theory and Modeling of Electronic Excitations in Nanoscience; Time Dependent Density Functional Theory: Advances and Prospects; Theoretical Spectroscopy and Quantum Transport.

The ETSF also organises the *Young Researchers Meeting (YRM)*. The attendees of the meetings are usually researchers studying towards their PhDs and Post-Docs. The organization itself is handled by "senior young researchers". At the time of writing, the ETSF has organised six such meetings. The seventh YRM is scheduled to be held in Spring 2010 in Finland.

The ETSF publishes *The ETSF Users' Newsletter* twice every year. It includes the agenda and news of the ETSF and a focus on one of the beamlines (to give users an overview of the ETSF research capabilities) and a user case study (where the work of one of the ETSF users is presented).

Scientific Publications/Selected Articles:

“Absorption Spectra of 4-Nitrophenolate Ions Measured in Vacuo and in Solution”, Kirketerp et al, Chem Phys Chem 10, 1207-1209 (2009).

“The challenge of predicting optical properties of biomolecules: What can we learn from time-dependent density-functional theory?”, Castro et al, *Comptes Rendus Physique* 10, 469-490 (2009).

Quick Facts:

Project acronym	ETSF
• Start date	01/01/2008
• Duration	36 months
• Total budget	4 374 911 €

Web site	www.etsf.eu
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Project participants	
University of York	UK
Freie Universitaet Berlin	Germany
Fritz-Haber-Institut	Germany
Friedrich-Schiller-Univ. of Jena	Germany
Université Catholique de Louvain	Belgium
Lunds Universitet	Sweden
Università Statale di Milano	Italy
University of Roma	Italy
Università di Milano-Bicocca	Italy
Laboratoire des Solides Irradiés, Ecole Polytechnique, CNRS, CEA	France
Department of Materials Science, University of the Basque Country and Centro-Mixto CSIC-UPV/EHU	Spain

Keywords	Spectroscopy, physics, chemistry, biology, material science, nano science
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Collaboration with other EC funded projects	
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Table 1: Quick facts: ETFS

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

ETSF. (2007). First call for projects – Statistics. *Available online* http://www.etsf.eu/system/files/FirstCallReport_v2.pdf. Last accessed September 2009.

ETSF. (2008a). Spring 2008 ETSF Call Statistics. *Available online* <http://www.etsf.eu/system/files/Spring2008CallStatistics.pdf>. Last accessed September 2009.

ETSF. (2008b). Autumn 2008 ETSF Call Statistics. *Available online* <http://www.etsf.eu/system/files/Autumn2008CallStatistics.pdf>. Last accessed September 2009.

ETSF. (2009a). European Theoretical Spectroscopy Facility (ETSF) homepage. *Available online* <http://www.etsf.eu/>. Last accessed September 2009.

ETSF. (2009b). Spring 2009 ETSF Call Statistics. *Available online* <http://www.etsf.eu/system/files/Spring%202009%20call%20statistics.pdf>. Last accessed September 2009.

1.9 EXPReS: Uniting the global radio astronomy community

EXPReS (EXpress Production Real-time e-VLBI Service) was a three-year project to create a distributed astronomical instrument of continental and intercontinental dimensions using e-VLBI. However, before discussing e-VLBI, we provide an overview of Very Long Baseline Interferometry (VLBI). VLBI is a technique in which radio telescopes around the world are combined to form a virtual telescope with a size equal to the maximum separation between the individual telescopes. The resolution such a telescope achieves is unsurpassed by any other astronomical instrument and allows astronomers to observe cosmic sources in great detail. Until recently, each telescope made digital disk-based recordings of a source, interspersed by time signals from an atomic clock. The recordings were then physically shipped to the correlator in The Netherlands and combined to generate the higher resolution image. This process typically took weeks. The high-speed data network developed for the EU-funded EXPReS project enables European VLBI Network to undertake real-time electronic or 'e-VLBI' observation. (ICT Results, 2009).

e-VLBI, or real-time, electronic VLBI, uses fibre optic networks to connect radio telescopes to a central data processor, a purpose-built supercomputer which correlates data from the telescopes in real-time. Transferring data electronically and correlating it in real-time eliminates weeks of waiting from the current VLBI method of storing data on disks and shipping them to the correlator for processing. This allows researchers to take advantage of *Targets of Opportunity* for conducting follow-on observations of transient events such as supernova explosions and gamma-ray bursts. e-VLBI also allows for high precision tracking of space probes (EXPReS, 2009).

The objective of EXPReS were to connect up to 16 of the world's most sensitive radio telescopes on six continents to the central data processor of the European VLBI Network (EVN) at the Joint Institute for VLBI in Europe (JIVE). Specific activities involved securing "last-mile connections" and upgrading existing connections to the telescopes, updating the correlator to process up to 16 data streams at 1Gbps each in real time and research possibilities for distributed computing to replace the centralized data processor (EXPReS, 2009). The project was completed successfully in August 2009.

Success stories associated with this project include the study of *SS433* - *one of the most spectacular and intensely studied locations in the Milky Way*. It comprises two objects orbiting each other. Huge quantities of hydrogen are transferred from one star to its orbiting partner – a black hole or neutron star inside a dense, gas cloud. In November 2008, astronomers noticed flaring activity from SS433. Within days, telescopes of the EVN were turned towards SS433. Its activity was monitored in real time during three sessions and the data were made available within hours of the observations (ICT Results, 2009).

Since e-VLBI has a massive data transfer rate, the EXPReS team has had to pioneer new techniques and technologies in order to get its network to operate effectively. These include the use of light paths, dedicated point-to-point connections between correlator and telescopes. This technology is increasingly being applied to protect "normal" internet users from disruptions caused by demanding applications such as e-

VLBI. Furthermore, the EXPReS Bandwidth-on-demand methods were tested as well, through new developments in light path switching. This could become important in future e-VLBI operations, but is also directly applicable to a vast range of other networking applications where bottlenecks need to be avoided and transfer speed and data integrity must go hand in hand – such as high-bandwidth video and high-fidelity audio transfers. The operational lessons learnt by the EVN on ExPReS can be applied to the *Square Kilometre Array (SKA)* project, due to start construction in 2015. SKA will comprise over 4,000 antennas distributed amongst 200 stations across 3,000km linked via an electronic network. (ICT Results, 2009).

Scientific Publications/Selected Articles:

Tudose, V., Paragi, Z., Soleri, P., Russell, D.M., Maitra, D., Lewis, F., Fender, R.P., Garrett, M.A., Spencer, R.E. and Rushton, A. (2009). e-EVN observations of Aql X-1 in outburst. *The Astronomer's Telegram*. #2000.

Albert, J. et al. (2008). Multi-wavelength (radio, X-ray and gamma-ray) observations of the Gamma ray binary LSI +61 303. *Astrophysics*, 0801.3150.

Okon, M., Stoklosa, D., Oerlemans, R., Langevelde, H.J. van, Kaliszan, D., Lawenda, M., Rajtar, T., Meyer, N. and Stroinski, M. (2008). Grid Integration of Future Arrays of Broadband Radio-Telescopes moving towards e-VLBI. *Grid Enabled Remote Instrumentation*. Springer, pp. 571.

Paragi, Z., Csizmadia, Sz., Borkovits, T., Mosoni, L., Sturmman, L., Abraham, P., Garrett, M. (2008). CHARA and e-VLBI observations of Algol. *PoS(MRU)122*.

Frey, S., Gurvits, L.I., Paragi, Z. and Gabányi, K. (2008). High-resolution double morphology of the most distant known radio quasar at $z=6.12$. *Astronomy & Astrophysics*, Vol 484, pp. L39-L42.

Tudose, V., Paragi, Z., Fender, R., Spencer, R., Garrett, M. and Rushton, A. (2008). e-VLBI Observations of Cyg X-3. *The Astronomer's Telegram*. #1476.

Tudose, V., Paragi, Z., Trushkin, S., Soleri, P., Fender, R., Garrett, M., Spencer, R., Rushton, A., Burgess, P., Kunert-Bajraszewska, E., Pazderski, E., Borkowski, K., Hammargren, R., Lindqvist, M., Maccaferri, G. and the JIVE EXPReS team. (2008). e-VLBI observations of SS 433 in outburst. *The Astronomer's Telegram*. #1836.

Haas, R., Müskens, A., Wagner, J., Dulfer, C., Mujunen, A., Ritakari, J., Bertarini, A. e-VLBI data transfer from Onsala and Metsähovi to the Bonn correlator. *Geowissenschaftliche Mitteilungen, Schriftenreihe der Studienrichtung Vermessung und Geoinformation, Technische Universität Wien*, (79) pp. 27-32. CPL 45297.

Hughes-Jones, R., Strong, M., and Spencer, R. (2007). Very Long Baseline Interferometry. *Grid Network Services Use Cases from the e-Science Community: GFD-I-122*. *Open Grid Forum*, 2007. 42-47.

Molera, G. (2007). Metsähovi, the first radius connected observatory to 10Gbps to the outer world. *DYNA*, Vol. 82, pp. 291-294.

Pandey, M., Paragi, Z., Durouchoux, P., Bignall, H. (2007). High resolution imaging of possible microquasar. *PoS(Dynamic2007)041*.

Paragi, Z., Kouveliotou, C., Garrett, M.A., Ramirez-Ruiz E., Langevelde, H.J. van., Szomoru, A., Argo, M. (2007). e-VLBI detection of SN2007gr. *The Astronomer's Telegram*. #1215.

Paragi, Z., Langevelde, H.J. van, Szomoru, A. (2007). Targeting transient phenomena with e-VLBI. *PoS(Dynamic2007)026*.

Rushton, A., Spencer, R. (2007). Adaptive e-VLBI observations of radio emitting X-ray binaries. *PoS(Dynamic2007)043*.

Rushton, A., Spencer, R.E., Strong, M., Campbell, R.M., Casey, S., Fender, R.P., Garrett, M.A., Miller-Jones, J.C.A., Pooley, G.G., Reynolds, C., Szomoru, A., Tudose, V. and Paragi, Z. (2007). First e-VLBI observations of GRS 1915+105. *Monthly Notices of the Royal Astronomical Society*. 374.1. (January 2007): L47-L50.

Sekido, M., Takiguchi, H., Koyama, Y., Kondo, T., Haas, R., Wagner, J., Ritakari, J. (2007). Ultra-rapid UT1 measurement by e-VLBI. *American Geophysical Union, Fall meeting 2007*.

Tudose, V., Fender, R.P., Garrett, M.A., Miller-Jones, J.C.A., Paragi, Z., Spencer, R.E., Pooley, G.G., Klis, M. van der and Szomoru, A. (2007). First e-VLBI observations of Cygnus X-3. *Monthly Notices of the Royal Astronomical Society*. 375.1. (February 2007): L11-L15.

Sobarzo, Sergio K., Torres., Sergio N., and Hase, H. (2006). eVLBI Development in TIGO. *Progress in Pattern Recognition, Image Analysis and Applications*. Heidelberg: Springer Berlin, 2006. 883-891.

Paragi, Z., Garrett, M.A., Paczynski, B., Kouveliotou, C., Szomoru, A., Reynolds, C., Parsley, S.M., Ghosh, T. (2005). e-VLBI observations of SN2001em - an off-axis GRB candidate". *Memorie della Società Astronomica Italiana*. 76.3. (2005): 570.

Quick Facts:

Project acronym	EXPReS
• Start date	01/03/2006
• Duration	36 months
• Total budget	12454450 €

Web site	http://www.expres-eu.org/
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Project participants	
CORNELL UNIVERSITY	UNITED STATES
COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION	AUSTRALIA
AARNET PTY LTD	AUSTRALIA
SHANGHAI ASTRONOMICAL OBSERVATORY - CHINESE ACADEMY OF SCIENCES	CHINA
ISTITUTO NAZIONALE DI ASTROFISICA	ITALY
UNIVERSIDAD DE CONCEPCION	CHILE
THE UNIVERSITY OF MANCHESTER	UNITED KINGDOM
CENTRO NACIONAL DE INFORMACION GEOGRAFICA	SPAIN
VENTSPILS AUGSTSKOLA	LATVIA
STICHTING ASTRONOMISCH ONDERZOEK IN NEDERLAND (ASTRON)	NETHERLANDS
UNIWERSYTET MIKOLAJA KOPERNIKA	POLAND
TEKNILLINEN KORKEAKOULU	FINLAND
MAX PLANCK GESELLSCHAFT ZUR FOERDERUNG DER WISSENSCHAFTEN E.V.	GERMANY
CHALMERS TEKNISKA HOEGSKOLA AKTIEBOLAG	SWEDEN
INSTYTUT CHEMII BIOORGANICZNEJ PAN	POLAND
DELIVERY OF ADVANCED NETWORK TECHNOLOGY TO EUROPE LIMITED	UNITED KINGDOM
NATIONAL RESEARCH FOUNDATION	SOUTH AFRICA
SURFNET B.V.	NETHERLANDS

Keywords	Information Technology, e-Infrastructure, Astronomy & Astrophysics
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Collaboration with other EC funded projects	GÉANT2, RadioNet, SKADS
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Table 2: Quick facts: EXPReS

References:

European Commission – Information Society and Media. (2002-2006). Framework Programme 6 (2002-2006) Research infrastructures projects. Available online http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed November 2009.

EXPReS. (2009). Express Production Real-time e-VLBI Service (EXPReS) homepage. Available online <http://www.expres-eu.org/index.html>. Last accessed November 2009.

ICT Results. (2009). Network creates virtual super-telescope (Feature). Available online <http://cordis.europa.eu/ictresults/>. Last accessed November, 2009.

2. Towards Sustainability: Bridging the Gap between the World's e-Infrastructures

2.1 e-IRGSP2: Towards maximising the socio-economic impact of e-Infrastructures

The e-Infrastructures Reflection Group Support Programme 2 (e-IRGSP2) project provides a comprehensive support framework for the work of the e-Infrastructures Reflection Group (e-IRG). The e-IRGSP2 builds on the foundation established by the previous support action (e-IRGSP) and expands the support services in order to maximise the socioeconomic impact of the e-IRG activities.

Scientific Publications/Selected Articles:

Karayannis, F. and Lecarpentier, D. (2009). e-IRG White Paper 2008: Join the discussion on the future of e-Infrastructures! *Zero-In Magazine*, Issue 2, April 2009.

Quick Facts:

Project acronym	e-IRGSP2
• Start date	01/01/2008
• Duration	36 months
• Total budget	1 614 083 €

Web site	www.e-irg.eu/support
• Point of contact	Leif Laaksonen
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• Fax	+358 9 4572001

Project participants	
CSC — IT Center for Science	Finland
The Netherlands National Computing Facilities foundation (NCF)	The Netherlands
Emergence Tech Limited (ETL)	UK
The Greek Research and Education network (GRNET)	Greece
Athens University of Economics and Business - Research Center (AUEB-RC)	Greece
Genias Benelux bv	The Netherlands
Poznan Supercomputing and Networking Center (PSNC)	Poland

Keywords	Grid computing, policy support, e-Infrastructure, inter-governmental organisations, analysis, foresight studies
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Collaboration with other EC funded projects	EGI, GridTalk, OGF-Europe, PRACE
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Quick facts: e-IRGSP2

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

2.2 EGI_DS: Redrawing the e-Infrastructure ecosystem in Europe to ensure sustainability

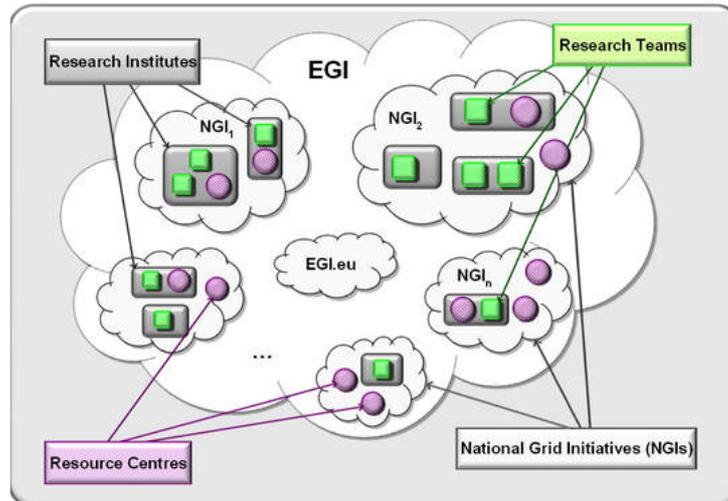
The European Commission (EC) Unit INFSO-F3 "GÉANT & e-Infrastructure" is responsible for funding e-Infrastructure projects as part of the FP7 Capacities Programme. This, together with funding made available to e-Science programmes by the local European Governments, have contributed to what is frequently acknowledged as *Europe's leadership in delivering e-Infrastructures for research and production use*. e-Infrastructures require grid computing technology for secure and co-ordinated access to distributed computing resources. Many member countries have pooled together the available grid computing resources under the National Grid Initiatives (NGI) to establish national grid infrastructures. For example, the National Grid Service (NGS) in the UK pools together resources made available by the four founding members of STFC, University of Oxford, White Rose Grid (University of Leeds), and University of Manchester, plus the national HPCx facilities and a growing number of partner and affiliate sites (NGS, 2009).

Driven by the needs and requirements of European research community, the European Grid Initiative (EGI) Design Study represents an effort to establish a sustainable grid infrastructure in Europe. The goal of the EGI Design Study (EGI_DS) is to evaluate use cases for the applicability of a coordinated effort, to identify processes and mechanisms for establishing EGI, to define the structure of a corresponding body, and ultimately to initiate the construction of the EGI organization - EGI.org (EGI, 2009). Some of the other objectives of the future EGI are, to coordinate middleware development; to advise National and European funding agencies; to promote grid interface standards, in consultation with relevant standards organizations; to collaborate closely with industry as technology and service providers, as well as grid users, to promote the rapid and successful uptake of grid technology by European Industry. These objectives are meant to ensure that Europe capitalises fully on its large investment in grid infrastructures, middleware development and applications.

The hardware and the software foundations of the future EGI are discussed next.

Hardware foundations of EGI – the National Grid Initiatives (NGI):

As reported in the EGI blueprint (CERN, 2008), the main foundations of EGI will be the NGIs, which will provide on the national level the services for a seamless, shared and uniform access to a variety of computing resources, ranging from PC clusters to sites operating supercomputers and all sorts of scientific archives (Figure 2). "EGI will be composed of the NGIs and the central, coordinating body - EGI.org. Fundamental for the functioning of EGI, but outside the proposed scope of EGI, will be the developers of the middleware (Middleware Consortia) and the providers of computing resources (Resource Centres – RCs). The *raison d'être* of EGI is its users, the scientists. A scientist is affiliated to a Research Institution (RI). Scientists from various scientific disciplines organize their scientific work in Research Teams. To use the grid, Research Teams establish through the research institutions one or more Virtual Organizations (VOs) according to their needs. VOs will– as in EGEE – often be international and linked to multiple funding agencies and therefore need a suitable representation of their needs in EGI".



Resource providers for EGI (CERN, 2008)

Software foundations of EGI – the Unified Middleware Distribution (UMD):

UMD is the proposed approach of handling middleware maintenance, integration, testing, and deployment within the EGI and NGI infrastructure. It defines components, processes, involved parties etc. in order to guarantee the infrastructure to get reliable middleware in terms of both functionality and quality (EGI UMD, 2009). UMD is proposed as a convergence of three existing middleware solutions presently deployed in Europe, namely, gLite (the EGEE middleware), Advanced Resource Connector (the NorduGrid middleware) and UNICORE, with the objective of offering a unified grid solution for deployment in the EGI and NGI infrastructures of the future. It is expected that UMD will be what the Virtual Data Toolkit (VDT, 2009) in the US is for the Open Science Grid (OSG, 2009). According to CERN (2008), "UMD is a pragmatic way to coordinate at the European level the current independent and parallel developments avoiding duplication of effort. UMD will contain the necessary high-quality middleware components satisfying the strict policies, interoperability standards and quality criteria defined by the EGI.org Middleware Unit and endorsed by the Middleware Coordination Board (MCB). The set of services included in UMD will expand and evolve according to the requirements of European research communities and the operational needs of the resource providers. Components from sources other than ARC, gLite and UNICORE can also be part of UMD if requested by users or NGIs, following the same rules agreed by the MCB. UMD will also deliver stable documented interfaces that will enable the development and the contribution of additional higher-level services by third parties."

Scientific Publications/Selected Articles:

Venton, D. (2009). Europe's Grid infrastructure shifts from EGEE to EGI. *CERN Computer Newsletter*, 29 June 2009.

Venton, D. (2008). We must not be afraid of the future: EGEE to EGI. *iSGTW, 1st October 2008*. Available online <http://www.isgtw.org/?pid=1001407>. Last accessed August 2009.

EGI. (2008). European Grid Initiative: towards a sustainable long-term European grid infrastructure. GridBriefings, issue 3. Available online http://web.eu-egi.eu/fileadmin/public/news/GT-5min-SeptemberOK2__5_.pdf. Last accessed August 2009.

Gater, C. (2008). From Enabling Grids for E-science to European Grid Initiative: The future of grids in Europe. *Innovations report*, 23/09/2008.

Quick Facts:

Project acronym	EGI_DS
• Start date	01/09/2007
• Duration	27 months
• Total budget	3 872 425 €

Web site	www.eu-egi.org
• Point of contact	Dr. Dieter Kranzmuller
• Email	contact@eu-egi.org
• Telephone	+43 732 2468 - 9499
• Fax	+43 732 2468 - 9496

Project participants	
Institut für Graphische und Parallele Datenverarbeitung (GUP)	Austria
Greek Research and Technology Network (GRNET)	Greece
Istituto Nazionale di Fisica Nucleare (INFN)	Italy
Finnish IT center for Science (CSC)	Finland
CESNET,z.s.p.o.	Czech Republic
European Organization for Nuclear Research (CERN)	Switzerland
Deutsche Forschungsnetz (DFN)	Germany
Science and Technology Facilities Council (STFC)	UK
Centre National de la Recherche Scientifique (CNRS)	France

Keywords	Grids, e-Infrastructure, e-Science, National Grid Initiatives
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Collaboration with other EC funded projects	EGEE II, GÉANT 2, DEISA
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Quick facts: EGI_DS

References:

CERN. (2008). EGI_DS: EGI Blueprint (EGI_DS deliverable D5.4). Available online http://web.eu-egi.eu/fileadmin/public/EGI_DS_D5_4_V300b.pdf. Last accessed August 2009.

EGI. (2009). European Grid Initiative – Towards a sustainable production grid infrastructure. Available online <http://web.eu-egi.eu/>. Last accessed August 2009.

EGI UMD. (2009). Unified Middleware Distribution. *Accessed online <http://knowledge.eu-egi.eu/knowledge/index.php/UMD>*. Last accessed August 2009.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html*. Last accessed August 2009.

NGS. (2009). National Grid Service – UK. *Accessed online <http://www.grid-support.ac.uk/>*. Last accessed August 2009.

OSG. (2009). Open Science Grid. *Accessed online <http://www.opensciencegrid.org/>*. Last accessed August 2009.

VDT. (2009). Virtual Data Toolkit. *Accessed online <http://vdt.cs.wisc.edu/>*. Last accessed August 2009.

2.3 OGF-Europe: Mobilising and Integrating Communities on Grid Standards & Best Practices Globally

Open Standards – The key to innovating the European distributed computing landscape

Applied distributed computing is critical to developing new, innovative and scalable applications and infrastructures that advance commerce and science. OGF-Europe has worked in synergy with OGF to champion the adoption and evolution of distributed computing technologies through open standards and has surpassed the general known barriers of widespread adoption by connecting to a diverse set of sectors and communities giving a focused perspective on area-specific standardisation needs.

Industry Expert Group - Building Close links with Enterprise

OGF-Europe's Industry Expert Group (IEG) comprises a distinguished panel of experts working on a voluntary basis to evaluate how the adoption of distributed computing is transforming enterprise IT in Europe. The focus of the IEG is part of a strategic process to make sure specific actions are driven by the need for cost effectiveness, lower environmental impact, on-demand facilities for end-users & the virtualisation of resources.

The IEG has played an extremely active role in investigating the current transition towards cloud computing by: Spearheading the highly successful Cloudscape Workshop series in January 2009 and February 2010 in Brussels, Belgium; Providing primers and user case studies on the value-add of cloud computing for business decision-makers; Ensuring that the OGF-Europe agenda is consistent with business needs and strategies across Europe; Delivering insights that enable policy-makers to wisely drive technology change and business players to innovate through their engagement with standards.

Fostering Interoperability through Open Standards - Europe's Contribution in the e-Infrastructure Landscape

OGF-Europe has connected with a broad range of communities and sectors with workshops, interviews, and detailed surveys in order to identify areas where collaboration can be improved between the standardisation process and the research initiatives or business sectors that would ultimately benefit from improved interoperability. This analysis has fed into a series of Survey and Challenges Reports highlighting what needs to be overcome in areas such as Telecom, Green-IT, early Cloud Computing users and Grid-powered research communities.

Through its student scholarship programme OGF-Europe has reached out to up-and-coming researchers involving them in OGF events, working groups and making them active in the full process of standards development: feedback, implementation and deployment. The end result has helped bring on board research initiatives and end-users, connecting them with expert groups within OGF and other Standards Development Organisations to take forward specification development and implementation.

Supporting Core Technical Work within OGF

Core technical work within OGF is a voluntary process crucial for enabling interoperability through open standards. OGF-Europe has played a key role in both supporting existing groups and spearheading new ones. OGF-Europe has actively participated in the activities of the Grid Interoperation Now – Community Group (GIN-CG), which deals with cross-Grid use case applications from the Fusion, Bio-medicine, eHealth and the Virtual Physiological Human communities that require interoperability. OGF-Europe has also been instrumental in setting up the Production Grid Interoperability Working Group (PIN-WG) which defines a set of profiles to address the needs of production Grid infrastructures based on lessons learned by GIN-CG. With data management a key topic in distributed and Grid computing for many years OGF-Europe has played a leading and timely role in establishing the OGF Digital Repositories Research Group which is taking this topic to the next level exploring commonalities in different architectures and metadata handling and will give a major push to interoperability of digital repositories and ease their exploitation in distributed computing environments.

Community Engagement Outreach & Reports – Groundwork for Best Practices & Standards

European Grid infrastructure communities need to actively participate in and contribute to standardisation efforts so they can adopt the subsequent results for their production Grid infrastructures. To achieve this important goal, OGF-Europe has organised International events and Community Outreach Seminars supported by in-depth tutorials which illustrate mature results obtained within OGF help build consensus on best practices that can be transformed into standards. This, in turn, encourages the adoption of OGF standards and attracts new collaborators towards OGF activities. Best Practices have also been collected and documented to act as an input for the DCI community on national and European level.

OGF-Europe Facts and Figures

3 International OGF conferences: OGF23 Barcelona, Spain, 2008; OGF25 Catania, Italy, 2009; and OGF28 Munich, Germany, 2010 – 3 event reports

2 Cloudscape Workshops delving into the benefits and barriers of cloud computing - 2 position paper documents and 2 post-event reports

6 workshops on Digital Repositories exploring interoperability challenges for architecture and metadata - 1 community report

5 Green IT workshops investigating energy efficiency in large-scale Distributed systems (Data Centres, Clouds, and Grids) - 1 community report.

2 Software Development workshops addressing the challenges of distributed applications and spotlighting best practices for standard adoption - 1 community report

1 Joint ETSI & OGF-Europe workshop on grids, clouds & service infrastructures - 1 community report

1 OGF & Open Geospatial Consortium (OGC) workshop on standards for geospatial & location based services and the role of virtualization - 1 community report

6 In-depth tutorials on OGF standards - 4 tutorial reports

10 Student Scholars supported at OGF23 and OGF25, and 3 Expert scholars supported to attend OGF events - 2 Scholar reports

Maximising Visibility – Outreach & Media Coverage

www.ogf-europe.eu is a dynamic, semantic Web 2.0 Channel that responds to members interests through a personalised approach. Its community-focused information services span tailor-made articles, multimedia content, mini reports and WebTV announcements along with presentations from events. OGF-Europe has also successfully partnered up with a number of leading journals & European initiatives to maximise visibility through diverse formats: in-depth features, blog casts, interviews and high profile opinion pieces.

Scientific Publications/Selected Articles:

Muscella & Gagliardi, Data Confidentiality and Interoperability Challenges in Cloud Computing: Principles, Systems and Applications – Springer Publications, 2010
ISBN: 978-1-84996-240-7

<http://www.springer.com/computer/communication+networks/book/978-1-84996-240-7>

Towards an Interoperable Scientific Cloud for Europe – HPC Wire, 13 January, 2010
- <http://www.hpcwire.com/offthewire/Towards-an-Interoperable-Scientific-Cloud-for-Europe-81331842.html>

Towards an Interoperable Scientific Cloud for Europe – Supercomputing Online, 13 January, 2010
http://supercomputingonline.com/index.php?option=com_content&view=article&id=17877:towards-an-interoperable-scientific-cloud-for-europe&catid=15:latest&Itemid=50

Grid Computing Faces the Future – eStrategies Projects, December 2008

Foreword: Fabrizio Gagliardi on OGF-Europe's Industry Expert Group, eStrategies Projects, March 2009

Cloud Grids? - eStrategies Projects, March 2009

A Workshop Series for Grid/Repository Integration – D-Lib Magazine, January/February 2009 -
<http://www.dlib.org/dlib/january09/aschenbrenner/01aschenbrenner.html>

Transferring Knowledge to consolidate benefits - eStrategies Projects, April 2008

Europe Backs Open Standards to Advance Grid Adoption - eStrategies Projects, February 2008

Quick Facts:

Project acronym	OGF-Europe
• Start date	01/02/2008
• Duration	26 months
• Total budget	1 792 446 €

Web site	www.ogfeurope.eu/
• Point of contact	Merce Calvet , BSC Silvana Muscella, OGF.eeig
• Email	info@ogfeurope.eu
• Telephone	+39 050 28359
• Fax	+39 050 503325

Project participants	
Barcelona Supercomputing Center (BSC)	Spain
OGF.eeig	UK
Telefónica Investigación y Desarrollo Sociedad Anónima Unipersonal (Telefonica I+D)	Spain
INTELLECT	UK
Istituto Nazionale di Fisica Nucleare (INFN)	Italy
Poznan' Supercomputing & Networking Center (PSNC)	Poland
ATOS Origin	Spain
National Institute for Research in Computer Science & Control (INRIA)	France
Ludwig-Maximilians-Universität München (LMU)	Germany
Oxford eResearch Centre	UK

Keywords	Open Standards, Interoperability, Grid Computing, Cloud Computing, Best Practices, Digital Repositories, Software Development, Green IT, Telecommunications
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Collaboration with other EC funded projects	e-IRGSP, GridTalk, EGEE, BEinGRID, EGI, ETICS2, IT-Tude
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Quick facts: OGF-Europe

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

2.4 6CHOICE: Promoting the next generation Internet Protocol IPv6 in research infrastructures

The focus of this project is on the promotion of the Next Generation Internet Protocol: IPv6. The IPv6 technology is ready for deployment, and India has been targeted as being one of the first countries with the potential of adopting political directives to implement this new protocol nationwide. 6CHOICE will promote the use of this technology across Europe and India as a fundamental part of their research infrastructures.

Scientific Publications/Selected Articles:

In development.

Quick Facts:

Project acronym	6CHOICE
• Start date	01/03/2008
• Duration	24 months
• Total budget	766 817 €

Web site	www.6choice.eu
• Point of contact	Dr. Sathya Rao
• Email	Rao@Telscom.ch
• Telephone	+41313762033
• Fax	+41313762031

Project participants	
Telscom Consulting	Switzerland
Education and Research Network (ERNET)	India
Réseau national de télécommunications pour la technologie, l'enseignement et la recherche (RENATER)	France
Indian Institute of Science (IISC)	India
Hewlett Packard Research Labs (HP)	India
SIFY	India
University College London (UCL)	UK
Telefonica Investigacion Y Desarrollo S.A. (Telefonica I+D)	Spain

Keywords	IPv6, Co-operation, Policy, Deployment
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Collaboration with other EC funded projects	6DEPLOY, FEDERICA, GLOBAL, EURO-INDIAGRID
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Quick facts: 6CHOICE

References:

6CHOICE. (2009). 6CHOICE project website. *Available online <http://6choice.eu/>*. Last accessed August, 2009.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html*. Last accessed August 2009.

3. Build the Next Generation of Networks

3.1 GÉANT: The search for the God Particle made possible by GÉANT!

GÉANT (GN3) is the high bandwidth pan-European backbone network that uses innovative hybrid networking technology and offers unrivalled geographical coverage. The GÉANT network interconnects the European National Research and Educational Networks (NRENs) and enables data transfer speeds of up to 10 Gbps across 50,000 km of network infrastructure and over 12,000 km of lit fibre. Together with Europe's NRENs, GÉANT presently connects around 40 million users in over 8000 institutions across 40 countries. GÉANT is co-funded by the European Commission and Europe's NRENs. DANTE (Delivery of Advanced Network Technology to Europe) is responsible for planning, building and managing the GÉANT network. Now in its third term, the GÉANT project is responsible for the network and seeks to develop all aspects of European research and education networking, including shaping the Internet of the future through the network and a portfolio of advanced services for the user community; tackling the digital divide of research and education networking across Europe; and fostering technological research to assure Europe's role at the forefront of networking and e-Science.

GÉANT spans the breadth of the continent from Ireland in the West, to Russia in the East and from Iceland in the North, to Israel in the South. GÉANT directly connects to other high speed networks with links to the Americas (NASA, Abilene, Internet2, ESnet and CA*net4), Japan (SINET), Southern and Eastern Europe (SEEREN), the Mediterranean (EUMEDCONNECT2), Latin America (ALICE), the Asian Pacific (TEIN3) and India (ERNET) and South Africa (TENET). The GÉANT network continues to expand with funding made available by the Commission to create high speed links from GÉANT to the UbuntuNet Alliance in Africa, to link GÉANT to the Ukrainian Research and Academic Network (URAN) and to establish connectivity with countries in the South Caucasus (the Black Sea Interconnection project – refer to section 3.3).

GÉANT links researchers all over the world and is utilised for a wide range of research projects from particle physics and astronomy to archaeology and climate change. One such project is described here- the *Large Hadron Collider (LHC) project* at CERN.

The LHC project is single largest scientific experiment ever undertaken. The LHC itself is the world's largest and the most powerful particle accelerator. Its purpose is to recreate the conditions just after the Big Bang, by colliding the two beams head-on at very high energy. "There are many theories as to what will result from these collisions, but what's for sure is that a brave new world of physics will emerge from the new accelerator, as knowledge in particle physics goes on to describe the workings of the Universe" (CERN, 2008). The Worldwide LHC Computing Grid (WLCG) provides the computation and storage resources for the four LHC particle physics experiments, namely, ALICE, ATLAS, CMS, LHCb. WLCG is a global collaboration of more than 170 computing centres in 34 countries. WLCG aims to

harness the power of 100,000 CPUs to process, analyze and store data produced from the LHC, making it equally available to all partners, regardless of their physical location. GÉANT provides global communications support for WLCG. The experiments at CERN depends on the high speed GÉANT links around the globe for seamless transmission of unprecedented amounts of data (15 million Gigabytes/year) to 5,000 scientists working in 500 institutes worldwide.

Scientific Publications/Selected Articles:

The GÉANT news archive can be accessed through the following link: http://www.geant.net/Media_Centre/News/pages/home.aspx. No scientific publications are reported on the website.

Quick Facts:

Project acronym	GÉANT
• Start date	1/04/2009
• Duration	48 months
• Total budget	182 M €

Web site	http://www.geant.net
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• Fax	+44 1223 371 371

Project Partners	
Delivery of Advanced Network Technology to Europe (DANTE)	
TERENA - The European Association of Research and Education Networking Organisations	
NRENs	
ACOnet	Austria
AMRES	Serbia
ARNES	Slovenia
BELNET	Belgium
BREN	Bulgaria
CARNet	Croatia
CESNET	Czech Republic
CYNET	Cyprus
DFN	Germany
EENet	Estonia
FCCN	Portugal
GARR	Italy
GRNET	Greece
HEAnet	Ireland
IUCC	Israel
JANET	UK

LITNET	Lithuania
MARNet	F.Y.R. Macedonia
MREN	Montenegro
NIIF	Hungary
NORDUnet <i>Note: NORDUnet is a joint collaboration by the 5 Nordic National Research and Education Networks in Denmark (Forskningsnettet), Finland (Funet), Iceland (RHnet), Norway (Uninett) and Sweden (SUNET)</i>	Nordic region
PSNC	Poland
RedIRIS	Spain
RENATER	France
RESTENA	Luxembourg
RoEduNet	Romania
SANET	Slovakia
SigmaNet	Latvia
SURFnet	The Netherlands
SWITCH	Switzerland
ULAKBIM	Turkey
University of Malta	Malta

Keywords	Network Technology, Communication Technology, Information Systems
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Collaboration with other EC funded projects	ALICE, TEIN3, SEEREN2, EUMEDCONNECT2
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Quick facts: GÉANT

References:

BELIEF-II. (2009). *e-Infrastructures Guide*. BELIEF-II Deliverable D2.2.

CERN. (2008). The Large Hadron Collider: Our understanding of the Universe is about to change. *Accessible online* <http://public.web.cern.ch/public/>. Last accessed August 2009.

EC Press Release. (2008). Europe's GÉANT, the world's highest speed computer network, goes global. *Accessible online* <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/354&>. Last accessed August 2009.

GÉANT. (2009). GÉANT website. *Accessible online* <http://www.geant.net>. Last accessed August 2009.

WLCG. (2009). Worldwide LHC Computing Grid. *Accessible online* <http://lcg.web.cern.ch/LCG/>. Last accessed August 2009.

European Commission – Information Society and Media. (2006). Framework Programme 6 (2002-2006) Research infrastructures projects. *Available online*

http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

3.2 FEDERICA: Running disruptive experiments without network disruption

FEDERICA (Federated E-infrastructure Dedicated to European Researchers Innovating in Computing network Architectures) will implement an experimental network infrastructure for trialling new networking technologies. This Europe-wide “technology agnostic” infrastructure will be composed of Gigabit circuits, transmission equipment and computing nodes that will be capable of virtualization, thus permitting disruptive experiments in new Internet architectures and protocols to be conducted over existing networks. The aim is to develop mechanisms that will allow such experiments to be run over existing production networks without an adverse effect. On a more holistic level, the FEDERICA project is dedicated to the research on the “Internet of the future”.

The FEDERICA infrastructure is based on circuit contributions from the participating National Research and Educational Networks (NRENs). The network is composed of Gigabit Ethernet circuits and network nodes and computer systems supporting virtual nodes. The user will be able to request a virtual network composed of (virtual) circuits and (virtual) nodes for experimentation. Each virtual network is a “slice” of the infrastructure and many slides can be active in parallel. The target users of the FEDERICA infrastructure are the researchers who use networks not just as the “tool” but primarily as the “subject’ of their work. User groups will include EC projects, research groups in universities or research centres, equipment manufacturers and telecommunications research labs or even individual researchers. FEDERICA will also conduct research of its own. Mainly this research will be focused on understanding and producing initial solutions for monitoring, management and control of parallel virtual networks.

Since FEDERICA began, on 1 January 2008, the project team has succeeded in defining a network architecture, PoP (point of presence), substrate and topology. The project is now at a stage where it is opening the FEDERICA network to users for experimentation. The core PoPs to be available initially are in the Czech Republic, Germany, Italy and Poland. Nine PoPs in the other participating countries will be gradually connected. This will create a long-distance, multi-domain infrastructure that will provide a real-world environment for end-to-end experiments on the Future Internet.

Scientific Publications/Selected Articles:

Campanella, M. (2008). The FEDERICA project - A federated infrastructure for Future Internet research. EURESCOM mess@ge, issue 2/2008. Available online http://www.eurescom.eu/message/messageJul2008/The_FEDERICA_project_A_federated_infrastructure-%20for_Future_Internet_research.asp. Last accessed August 2009.

Quick Facts:

Project acronym	FEDERICA
• Start date	01/01/2008
• Duration	30 months
• Total budget	5 178 111€

Web site	http://www.fp7-federica.eu/
• Point of contact	Mauro Campanella
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• Telephone	+ 390649622000
• Fax	+390649622044

Project participants	
Consortium GARR	Italy
CESNET	Czech Republic
Deutsche Forschungsnetz Verein (DFN)	Germany
Fundação para a Computação Científica Nacional (FCCN)	Portugal
Greek Research & Technology Network (GRNET)	Greece
National Information Infrastructure Development Institute (NIIF)	Hungary
Poznan Supercomputing and Networking Centre (PSNC)	Poland
Red.es/RedIRIS - Spanish National Research Network	Spain
SWITCH Telematikdienste für Lehre und Forschung Foundation (SWITCH)	Switzerland
Trans-European Research and Education Networking Association (TERENA)	The Netherlands
i2CAT Fundacio	Spain
Kungliga Tekniska Högskolan (KTH)	Sweden
Institute of Communication and Computer Systems (ICCS)	Greece
Universitat Politècnica de Catalunya (UPC)	Spain
Juniper Networks Inc.	IE
Martel Consulting	Switzerland
HEAnet - Ireland's National Education and Research Network	Ireland
Delivery of Advanced Network Technology to Europe (DANTE)	UK
Politecnico di Torino	Italy
NORDUnet - Nordic NREN <i>Note: NORDUnet is a joint collaboration by the 5 Nordic National Research and Education Networks in Denmark (Forskningsnettet), Finland (Funet), Iceland (RHnet), Norway (Uninett) and Sweden (SUNET)</i>	Denmark

Keywords	NREN, virtual networks and systems, infrastructure for new Internet.
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Collaboration with other EC funded projects	GÉANT 2
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Quick facts: FEDERICA

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

FEDERICA. (2009). FEDERICA project website. Available online <http://www.fp7-federica.eu/>. Last accessed August, 2009.

3.3 6DEPLOY: The centre of European expertise in deploying the Next Generation Internet Protocol IPv6

2011 is the year in which it is widely predicted that the last IPv4 address will be issued to a Regional Internet Registry. 6DEPLOY is preparing organisations for the introduction of IPv6, on the basis that a well-planned deployment, in-line with scheduled equipment replacement cycles is more cost-effective than having to react at short notice. Training is an important aspect of this preparation.

Apart from approaching its 20th IPv6 training workshop - focusing on Europe, Latin America and Africa - 6DEPLOY has been particularly active in deploying IPv6 Labs throughout the world. These testbeds - donated by Cisco - all have a similar configuration making it possible for the Lab managers to exploit the available 6DEPLOY training material and other software tools (e.g. the testbed reservation system). These labs become the natural centres of IPv6 training and expertise within the region.

Regular meetings are held between the Lab managers, to discuss new training exercises and ideas for enhancements (e.g. IPv6-based video and audio between the sites). As all of the testbeds have a similar configuration, any of them can be accessed remotely during the 6DEPLOY training workshops as testbeds for use for performing "hands-on" exercises on configuration, routing, etc.

Labs are currently installed in Paris, Sofia, Slovenia, Georgia, Bishkek and Mauritius. Labs under construction are in Nairobi and Bangalore. Discussions are ongoing for Labs in Turkey, Latin America, Spain and Ghana.

Scientific Publications/Selected Articles:

Quick Facts:

Project acronym	6DEPLOY
• Start date	01/03/2008
• Duration	30 months
• Total budget	1 284 776 €

Web site	www.6deploy.eu
• Point of contact	Martin Potts
• Email	martin.potts@martel-consulting.ch
• Telephone	+ 41319942525
• Fax	+ 41319942529

Project participants	
Martel Consulting	Switzerland
Cisco Systems International BV	The Netherlands
Réseau National de Telecommunication pour la Technologie, l'Enseignement et al Recherche (RENATER)	France

Greek Research & Technology Network (GRNET)	Greece
Fundação para a Computação Científica Nacional (FCCN)	Portugal
National Information Infrastructure Development Institute / Hungarian Academic and Research Network (NIIF/HUNGARNET)	Hungary
Consulintel	Spain
University College London	UK
University of Southampton	UK
UNINETT	Norway
AfriNIC Ltd.	Mauritius
LACNIC	Uruguay
Bulgarian Research and Education Network (BREN)	Bulgaria

Keywords	IPv6, deployment, e-infrastructures, training
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Collaboration with other EC funded projects	6CHOICE, GLOBAL, GÉANT
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Quick facts: 6DEPLOY

References:

6DEPLOY. (2009). 6DEPLOY project website. Available online <http://www.6deploy.eu>. Last accessed August, 2009.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

4. Expanding the Reach of GÉANT

4.1 BSI: Black Sea cables to bridge the digital divide between countries in the South Caucasus and Europe

The BSI (Black Sea Interconnection) project intends bridging the digital divide that exists between the South Caucasus countries and Europe by establishing a regional research and education network in the South Caucasus (Armenia, Azerbaijan and Georgia) and connecting it to *GÉANT*. This flagship project is the largest of its kind in the region and will allow Caucasian research communities to participate effectively in joint research and educational activities with the rest of Europe. The BSI represents an invaluable opportunity to realize the objectives of Black Sea Economic Cooperation (BSEC). It will help BSEC to concentrate directions of regional scientific and technological collaboration, sharing best practices, undertaking joint projects of common interest to all member states and stipulating cooperation among the BSEC Member States and with other organizations, in particular with the EU via the advanced GÉANT2 network (BSI Press Release, 2008).

Although National Research and Education Networks (NRENs) already exist in the South Caucasus countries (namely, *GRENA* in Georgia, *AzRENA* in Azerbaijan, *NAS RA* in Armenia), there is need for consolidation of these existing networks and then connecting them to the Pan-European Education and Research Network - GÉANT. The objective of this project, therefore, is to design interconnection strategies, implementing those strategies through networking solutions, and to maintain the established network. Like the *100Mbps GÉANT-ERNET London-Mumbai link* that makes it possible for scientists in India and Europe to collaborate in disciplines like high-energy physics, the BSI project will enable scientists in South Caucasus to join force with their European counterparts to solve challenging problems. Thus, the project will integrate the scientific potential of South Caucasus and Europe. Dissemination activities will encourage scientists in both the geographical regions to exploit BSI for collaborative research.

On the local level, the BSI project will develop a high-speed backbone network among the NRENs of the South Caucasus countries and this will supply the infrastructure needed by the academic and scientific communities in this geographical region. The interconnection will provide an impetus to the Governments in the South Caucasus to implement projects on e-Learning, e-Health, e-Democracy, e-Society. Finally, the BSI project will advance collaboration between scientific communities based in South Caucasus and working in disciplines like earthquake sciences, astronomy, and high-energy physics. It will provide them access to resources like online libraries and experiments results.

The project is successfully meeting its project objectives. It was selected as the project of the month (January 2009) by incrEAST - Information Exchange in Science and Technology between the European Research Area and Eastern European/Central Asian Countries (incrEAST, 2009). The interconnections between the NRENs of

Armenia, Azerbaijan, Georgia and GÉANT2 have been implemented and there is considerable traffic flow (see Figure 3) in the BSI network (BSI, 2009).

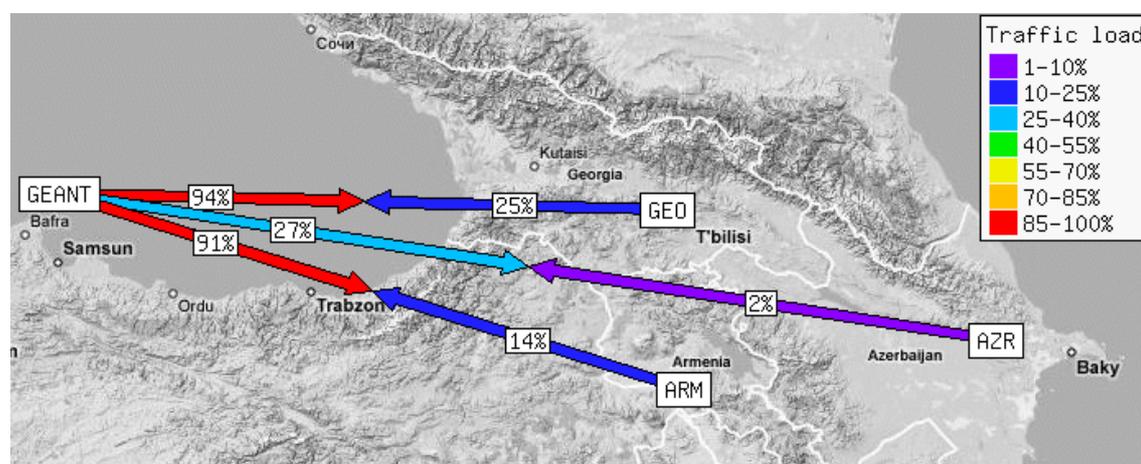


Figure 1: Traffic Flow in the BSI Network (BSI, 2009)

Scientific Publications/Selected Articles:

incrEAST. (2009). Project of the month (January): Black Sea Interconnection Available online <http://www.increast.eu/en/441.php>. Last accessed August, 2009.

Quick Facts:

Project acronym	BSI
• Start date	01/03/2008
• Duration	24 months
• Total budget	1 861 908 €

Web site	www.blacksea-net.org
• Point of contact	Murat SOYSAL
• Email	msoysal@ulakbim.gov.tr
• Telephone	+903122989310
• Fax	+903122989393

Project participants	
Scientific and Technological Research Council of Turkey - Turkish Academic Network and Information Center (TUBITAK)	Turkey
Greek Research & Technology Network (GRNET)	Greece
Central and Eastern European Networking Association (CEENET)	Poland
Delivery of Advanced Network Technology to Europe (DANTE)	UK
Georgian Research and Educational Networking Association (GRENA)	Georgia
Azerbaijan Research Educational Network Association (AZRENA)	Azerbaijan
National Academy of Sciences of RA (NAS RA)	Armenia

Keywords	Black Sea, GEANT, NREN, High speed connection
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Collaboration with other EC funded projects	GEANT2, See-Grid-SCI, SEEREN2, OCCASION
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Quick facts: BSI

References:

BSI Press Release. (2008). RESEARCHERS IN BLACK SEA COUNTRIES TO GET ONLINE: High bandwidth network and link to GÉANT2 will enable faster collaboration for South Caucasian researchers and student. Accessed online <http://www.blacksea-net.eu>. Last accessed August 2009.

BSI. (2009). BSI Traffic Flow – retrieved 24th August 2009. Accessed online http://www.blacksea-net.eu/index.php?option=com_content&task=view&id=45&Itemid=46. Last accessed August 2009.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

incrEAST. (2009). Project of the month (January): Black Sea Interconnection *Available online* <http://www.increast.eu/en/441.php>. Last accessed August, 2009.

4.2 EVALSO: An astronomical observatory with an inter-continental reach

The Enabling Virtual Access to Latin-American Southern Observatories (EVALSO) project aims to create a physical infrastructure, and the tools for its exploitation, to efficiently connect the European Southern Observatory (ESO) Paranal and the Cerro Armazones Observatories in Latin-America to Europe. EVALSO will use the international infrastructures created in the last years with the EC support - RedCLARA (RedCLARA, 2009) and GÉANT (refer to Section 3.1) - to provide European research a competitive edge by enabling faster access to the collected data and use of facilities in an ever more efficient way (EVALSO, 2009).

The main objectives of this project are:

- Link upgrade: The creation of the physical infrastructure, where non existent, or procurement of services in order to upgrade the connectivity to the observing facilities.
- Fast data access: Enabling a drastic improvement in the time needed for making the data available from the moment of the physical observation.
- Virtual presence: Planning and implementing the tools that could be used to make possible the virtual presence of scientists, engineers, and experts at remote facilities and the possibility to perform remote observations. The virtual presence system is described next.

EVALSO aims to build a set of tools to implement a “virtual presence system” (VP system) for the scientists and the experts. The VP system will re-create the observatory environment at a remote site 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 observer to interact with the local staff. A survey of the already available GPL software has been performed in order to choose the tools and the software packages that satisfy the requirements of the VP system architecture (Cirami et al, 2008).

Scientific Publications/Selected Articles/Poster Presentations:

Cirami, R., Coretti, I., Marcantonio, P.D., Pucillo, M. and Santin, P. (2008). EVALSO: Enabling Virtual Access to Latin-America Southern Observatories (Poster presentation). SPIE conference on Astronomical Instrumentation, Marseilles, 23-28 June 2008. Available online http://www.evalso.eu/evalso/wp-content/uploads/2008/08/jra2_spie08_poster.pdf. Last accessed September 2009.

Comerón, F., Filippi, G. and Emerson, J. P. (2008). A fast link with Paranal: new operational opportunities (poster presentation). SPIE conference on Astronomical Instrumentation, Marseilles, 23-28 June 2008. Available online http://www.evalso.eu/evalso/wp-content/uploads/2008/08/jra3_spie08_poster.pdf. Last accessed September 2009.

Pourailly, M.J.L. (2008). Astronomers, be prepare to celebrate the access to data: EVALSO lift off. DeClara, May 2008 - Year 4, N° 16. Available online

http://www.redclara.net/doc/DeCLARA/DeCLARA_en_16.pdf. Last accessed September 2009.

Quick Facts:

Project acronym	EVALSO
• Start date	01/01/2008
• Duration	36 months
• Total budget	4 250 400 €

Web site	http://www.evalso.eu/
• Point of contact	Fernando Liello
• Email	Liello@ts.infn.it
• Telephone	+39 334 6253536
• Fax	+ 39 040 3756268

Project participants	
Università di Trieste	Italy
European Space Organisation	Germany
Osservatorio Astronomico di Trieste (INAF)	Italy
Consortium GARR	Italy
Astronomisches Institut, Ruhr-Universität Bochum	Germany
Nederlandse Onderzoekschool voor de Astronomie	The Netherlands
Queen Mary University of London	UK
Cooperación Latino Americana de Redes Avanzadas (CLARA)	Uruguay
Red Universitaria Nacional	Chile

Keywords	Remote instrumentation, GÉANT, astronomy
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Collaboration with other EC funded projects	GÉANT, ALICE, EGEE
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Quick facts: EVALSO

References:

Cirami, R., Coretti, I., Marcantonio, P.D., Pucillo, M. and Santin, P. (2008). EVALSO: Enabling Virtual Access to Latin-America Southern Observatories (Poster presentation). SPIE conference on Astronomical Instrumentation, Marseilles, 23-28 June 2008. Available online http://www.evalso.eu/evalso/wp-content/uploads/2008/08/jra2_spie08_poster.pdf. Last accessed September 2009.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. Available online http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

EVALSO. (2009). Enabling Virtual Access to Latin-America Southern Observatories (EVALSO) project website. Available online <http://www.evalso.eu/evalso/>. Last accessed September 2009.

RedCLARA. (2009). RedCLARA web site. *Accessible online*
<http://www.redclara.net>. Last accessed September 2009.

4.3 AUGERACCESS: Integrating Auger Observatory and European Research Institutions into a World-wide Grid

AUGERACCESS is a project dedicated to improving the access capabilities of European research groups working on the Pierre Auger Observatory. Located in a remote place in the Pampa Amarilla in Argentina, the Observatory is designed to measure the flux of ultra-high energy cosmic ray particles with unprecedented accuracy and statistical significance. It is the largest existing infrastructure in this research field. The upgrading of the connectivity between the Auger Observatory and European research institutions will allow rapid access to the data collected at the Observatory thus enhancing the potential of the European groups in data processing and analysis.

The AUGERACCESS project has been designed to improve the communications link between the Auger Observatory and the CLARA network in Argentina and hence to international networks. Over 7 Tbytes of data per year are created at the Observatory site and the desired transmission rate greatly exceeds the available transmission capacity between the Observatory and the city of Mendoza, about 400 km to the north. At present some of the data must be put on disk and hand-carried to Mendoza. This makes monitoring of the status of instruments at the Observatory extremely difficult. A link of at least 10 Mbps is required. The plan is to replace the present link with a much faster one (different options are currently being explored as part of the AUGERACCESS activity) so that data can be easily sent to home institutions. Additionally, it will become possible to monitoring and control equipment at the site remotely from the Americas, Australia and Europe (AugerAccess, 2009).

The two research activities of AUGERACCESS are, (a) Design and development of computer codes and procedures with the aim of implementing a system of remote monitoring and control of the data taking of the Auger Observatory, and (b) Development of a dynamic database to store and update information on the status and performance of the detectors.

Scientific Publications/Selected Articles:

Abraham, J. et al. (2007). An Upper Limit to the photon fraction in cosmic rays above 1019 eV from the Pierre Auger Observatory. *Astroparticle Physics*, 27, 155 (astro-ph/0606619).

Abraham, J. et al. (2007). Anisotropy Studies around the Galactic Centre at EeV energies with the Auger Observatory. *Astroparticle Physics*, 27, 244 (astro-ph/0607382).

Abraham, J. et al. (2007). Correlation of the highest energy cosmic rays with nearby extragalactic objects. *Science*, 318, 939, (arxiv :0711.2256v1 [astro-ph]).

Yamamoto, T. (2007). The UHECR spectrum measured at the Pierre Auger Observatory and its astrophysical implications. In *Proceedings of the 30th International Cosmic Ray Conference (ICRC2007)*, Mérida, Yucatan, Mexico (3 – 11 July 2007) (arxiv:0707.2638 [astro-ph]).

Quick Facts:

Project acronym	AUGERACCESS
• Start date	01/11/2005
• Duration	48 months
• Total budget	2050000 €

Web site	www.augeraccess.net
• Point of contact	Prof. Giorgio Matthiae
• Email	matthiae@roma2.infn.it
• Telephone	+39 06 72594591
• Fax	+39 06 2023507

Project participants	
INFN	Italy
CNRS	France
FZK	Germany
University of Leeds	UK
GARR	Italy
RETINA	Argentina

Keywords	Information technology, Interoperable network solutions, Control techniques
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Collaboration with other EC funded projects	GÉANT/GÉANT2
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Quick facts: AugerAccess

References:

AugerAccess. (2009). AugerAccess project website. Available online <http://www.augeraccess.net/menu.htm>. Last accessed November 2009.

European Commission – Information Society and Media. (2002-2006). Framework Programme 6 (2002-2006) Research infrastructures projects. Available online http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed November 2009.

5. Bigger is Better: Linking Super Computing, Cluster Computing and Desktop Computing across the World

5.1 DEISA-2: A pan-European supercomputer of gigantic proportions to solve gargantuan problems.

The Distributed European Infrastructure for Supercomputing Applications (DEISA) is a consortium of leading national Supercomputing centres that aims at fostering the pan-European world-leading computational science research. DEISA-1, and now DEISA-2 (funded by FP7), is paving the way towards the deployment of a cooperative European HPC ecosystem (DEISA, 2009a). In the remainder of this section, we use the acronym DEISA to refer to these projects.

The DEISA infrastructure is based on a tight coupling of eleven national supercomputing centres from seven European countries, using dedicated network 10Gb/s interconnections of GÉANT2 and the National Research and Education Networks (NRENs). The aggregated power of the DEISA supercomputing resources exceeds one PetaFlop/s. DEISA is structured as a layer on top of the national supercomputing services and provides generalised interfaces and services that allow users to access and utilize this pool of computing resources in a consistent and efficient manner. The HPC infrastructure and services offered by DEISA thus combines, for its users and the user communities it serves, the advantage of having access to a variety of supercomputing architectures for different computing purposes with the advantage provided by consistent interfaces to these different resources and services. Accordingly, the profile of using the DEISA HPC infrastructure and services can be regarded as being similar to the usage of a monolithic supercomputing system of single HPC centre (DEISA, 2009). DEISA incorporates several different platforms and operating systems, for example, Cray XT4/5 (Linux), IBM Power5 (AIX), IBM Power6 (AIX, Linux), IBM BlueGene/P (Linux), IBM PowerPC (Linux), SGI ALTIX 4700 (Linux), NEC SX8/9 vector systems (Super UX). The middleware deployed on the DEISA resources enable transparent access to distributed resources, high performance data sharing at European scale, and transparent job migration across similar platforms.

Some of the outputs of this project are discussed next.

(A) Delivery of a turnkey operational solution for a future persistent European HPC ecosystem

The delivery of an operational HPC infrastructure in Europe is one of the primary aims of DEISA. This is consistent with the suggestions of the European Strategy Forum on Research Infrastructures (EFSRI). This aim is being realised by DEISA through the application of a two-fold strategy (DEISA, 2009a):

- Consolidation of the existing DEISA infrastructure by guaranteeing the continuity of those activities and services that currently contributes to the effective support of world-leading computational science in Europe.

- The evolution of this European infrastructure towards a robust and persistent European HPC ecosystem, by enhancing the existing services, by deploying new services including support for European Virtual Communities, and by cooperating and collaborating with new European initiatives, especially PRACE, that will enable shared European PetaFlop/s supercomputer systems. An overview of PRACE is included in the subsequent section of this document (Section 5.2).

(B) DEISA Extreme Computing Initiative:

With its objective of enabling the advancement of computational science in Europe, the DEISA research infrastructure had launched the DEISA Extreme Computing Initiative (DECI) initiative in May 2005. The aim of this initiative is to make possible the execution of challenging supercomputing applications over DEISA resources. These applications are also referred to as “grand challenge” applications. The scale of these “grand challenge” applications, which are usually large and complex simulations, is such that it would not be possible to efficiently execute them over computing resources available in individual member countries, and they would thus require the exceptional computing resources provided by DEISA.

A DECI call for proposal is launched in spring every year. These proposals are evaluated on the basis of innovation potential, scientific excellence and relevance to the DEISA infrastructure first by the National Evaluation Committees and then by the DEISA Executive Committee, with the latter taking the final decision based on the recommendations of the former. The decisions are taken in September every year and the “grand challenge” projects start operation in November and continue usually until October next year. These applications are executed in specific time windows over DEISA resources. It is important to note that DEISA does not intend to maintain a pool of permanent users, and therefore once a big simulation is completed, users are supposed to go back to their national services (DEISA DESI, 2009).

In 2009, **DECI-5 Call for Proposal** was opened on March 1, 2009 (deadline May 4, 2009). The “grand challenge” applications submitted this year were expected to meet one or more the following four application profiles: (a) large, highly scalable parallel applications requiring exceptional computational resources; (b) data intensive applications requiring access to distributed data repositories; (c) workflow simulations managing simulation chains that access more than one computing platform; and (d) distributed applications that need to run on more than one platform (excluding meta-computing).

(C) DEISA Virtual Community Support Initiative:

DEISA had launched a call for Expressions of Interest (EoI) from Global Virtual Research Communities (GVRC) from all science areas for collaborative actions and support through the new DEISA Virtual Community Support Initiative. This EoI was launched on December 10, 2008 (deadline February 12, 2009). The aim of this initiative was to enable various eScience communities to benefit from access to some of the most powerful computing facilities in Europe. Furthermore, since the communities being targeted may not have the expertise of working with the high-end PRACE resources, this has opened up opportunities for HPC consulting from experts based at the participating national HPC centres.

The DEISA Virtual Community Support Initiative encourages EoI from GVRs in areas such as Astrophysics/Cosmology, Climate/Earth System Research, Life Sciences and Materials Sciences that require HPC resources. This initiative is already supporting the European Fusion Community and an EU Life Science project.

(D) DEISA Benchmarking and Benchmark Suite

DEISA provides a suite of benchmarking tools that can be used to quantify the performance of parallel supercomputers with peak performances in the regime of hundreds of teraflops. These benchmarking tools consist of parallel scientific application codes and associated datasets from a wide range of disciplines. These codes have been chosen as being representative for the applications of the scientific projects performed on the DEISA HPC facilities. Along with the benchmarking code and related datasets, DEISA provide the necessary documentation, instructions on the benchmarking framework, rules governing allowable changes to the source and sample results from a range of DEISA platforms. All the codes are packaged into a structured framework allowing compilation, execution and analysis to be configured and carried out via a set of standard XML files (DEISA, 2009b).

DEISA has recently taken on a challenging new role. Under a new European initiative called virtual community support, DEISA is offering its services not just to individual investigators or research groups, but to entire research communities. The aim is not only to provide computational resources to existing communities, but to stimulate the formation of new cooperative communities of researchers. The European Commission hopes that coordinated access to DEISA can help convince competing research groups of the benefits of collaboration. Currently, DEISA is working closely with Europe's best-organised research community, which focuses on nuclear fusion. Fusion theorists are collaborating with DEISA developers to design and run new and more realistic simulations. DEISA is also working closely with an emerging community, spearheaded by the European life science project *VIROLAB*, that focuses on understanding the genetics of infectious diseases and their treatment that network. Above and beyond the research DEISA has empowered and hopes to stimulate, its most important contribution may well be the extent to which it has prepared the ground for the future development of Europe's supercomputing capabilities. Since DEISA started, just four and a half years ago, the aggregated peak computing power it can offer has multiplied by a factor of 300, from 30 teraflops (30 thousand billion floating point operations per second) to over a petaflop (a million billion operations per second) (ICT Results, 2009).

Scientific Publications/Selected Articles (from 2008):

Halling-Brown, M.D., Moss, D.S., Clare E. Sansom, C.E. and Adrian J. Shepherd, A.J. (2009). A computational Grid framework for immunological applications. *Philosophical Transactions of the Royal Society -A*, 367(1898): 2705-2716.

Lederer, H. (2008). DEISA: Supporting and developing a European high-performance computing ecosystem. *Journal of Physics: Conference Series*, 125.

Lederer, H. and Heinzl, S. (2008). DEISA to enhance the European HPC Infrastructure in FP7. *Innovatives Supercomputing in Deutschland (InSiDe)*, 6(1). Hegering, H-G., Lippert, Th. and Resch, M. (eds).

Lederer, H. and Alessandrini, V. (2008). DEISA: Enabling Cooperative Extreme Computing in Europe. *Parallel Computing: Architectures, Algorithms and Applications*, 15: 689-697.

Lederer, H., Tisma, R., Hatzky, R., Bottino, A. and Jenko, F. (2008). Application Enabling in DEISA: Petascaling of Plasma Turbulence Codes. *Parallel Computing: Architectures, Algorithms and Applications*, 15: 713-720.

Lederer, H., Pringle, G.J., Girou, D., Hermanns, M.-A. and Erbacci, G. (2008). DEISA: Extreme Computing in an Advanced Supercomputing Environment. *Parallel Computing: Architectures, Algorithms and Applications*, 15: 687-688.

Robson, D. (2008). Sun, Spain and supercomputing. *Scientific Computing World*, February/March 2008. Available online http://www.scientific-computing.com/features/feature.php?feature_id=187. Last accessed August 2009.

Saksena, R.S., Boghosian, B., Fazendeiro, L., Kenway, O.A., Manos, S., Mazzeo, M.D., Sadiq, S.K., Suter, J.L., Wright, D. and Coveney, P.V. (2009). Real science at the petascale. *Philosophical Transactions of the Royal Society –A*, 367(1897):2557-2571.

Slot, P.M.A, Coveney, P.V., Ertaylan, G., Müller, V., Boucher, C.A. and M. Bubak, M. (2009). HIV decision support: from molecule to man. *Philosophical Transactions of the Royal Society –A*, 367(1898): 2691-2703.

Sterl, A., Severijns, C., van Oldenborgh, G-J., Dijkstra, H., Hazeleger, W., van den Broeke, M., Burgers, G., van der Hurk, B., van Leeuwen, P.J. and van Velthoven, P. (2008). The Essence Project – signal to noise ratio in climate projections. *Geophysical Research Letters*, 2008.

Quick Facts:

Project acronym	DEISA-2
• Start date	01/05/2008
• Duration	36 months
• Total budget	18 731 000 €

Web site	www.deisa.eu
• Point of contact	Stefan Heinzl
• Email	deisa2-coordinator @rzg.mpg.de
• Telephone	+49-89-3299-1340
• Fax	+49-89-3299-1301

Project participants

Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. (MPG-RZG)	Germany
Centro Nacional de Supercomputacion Barcelona (BSC)	Spain
Consorzio Interuniversitario (CINECA)	Italy
Finnish Information Technology Centre for Science (CSC)	Finland
European Centre for Medium-Range Weather Forecasts (ECMWF)	UK
Edinburgh Parallel Computing Centre (EPCC), The University of Edinburgh	UK
Forschungszentrum Jülich (FZJ), Jülich Supercomputing Centre (JSC)	Germany
High Performance Computing Center Stuttgart (HLRS)	Germany
Institut du Développement et des Ressources en Informatique Scientifique (IDRIS)	France
Bayerische Akademie der Wissenschaften (LRZ)	Germany
Stichting Academisch Rekencentrum Amsterdam (SARA)	The Netherlands

Keywords	Supercomputing, Petascale Applications, Integrated European HPC Infrastructure, HPC Ecosystem, Virtual User Communities
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Collaboration with other EC funded projects	PRACE, GÉANT2, EGI, EGEE, etc
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Quick facts: DEISA-2

References:

DEISA. (2009a). Distributed European Infrastructure for Supercomputing Applications. *Accessed online* <http://www.deisa.eu/>. Last accessed August 2009.

DEISA. (2009b). Benchmarking & Benchmark Suite. *Accessed online* <http://www.deisa.eu/science/benchmarking>. Last accessed August 2009.

DEISA DESI. (2009). DEISA Extreme Computing Initiative (DECI). *Accessed online* <http://www.deisa.eu/science/decideisa-extreme-computing-initiative#support>. Last accessed August 2009.

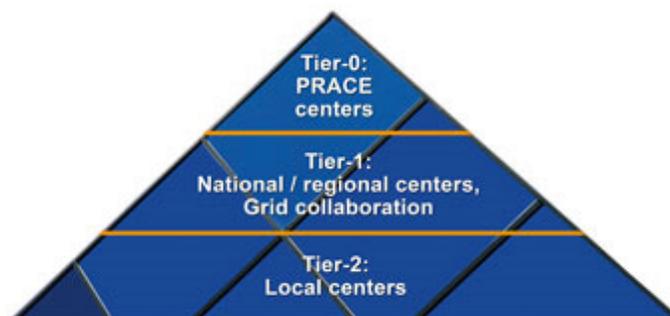
European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

ICT Results. (2009). Supercomputing gets its own superhero (Feature). *Available online* <http://cordis.europa.eu/ictresults/>. Last accessed November, 2009.

5.2 PRACE: Paving the way for a pan-European "leadership" supercomputer for Petaflop computing

PRACE (Partnership for Advanced Computing in Europe) is a European supercomputing infrastructure project that aims to create a coordinated and persistent high performance computing (HPC) service and infrastructure. PRACE will be managed as a single European entity and will provide European scientists access to world-class leadership supercomputers with capabilities equal to or better than those available in the USA and Japan. The stimulus to this project is the increasing awareness of the importance of having a well-structured supercomputing infrastructure in Europe, as well as the need to exchange experiences and know-how pertaining to supercomputing across the member states of the European Union (Valero, 2009). PRACE will complement DEISA (Distributed European Infrastructure for Supercomputing Applications) which is presently responsible for deploying and operating a persistent, production quality, distributed supercomputing environment with a continental scope (DEISA, 2009). An overview of DEISA is included in the previous section of this document (section 4.1).

The PRACE service will include several superior *Tier-0 HPC Centers*, strengthened by *Tier-1 National/Regional Centres* and *Tier-2 Local Centres* (see Figure 4), and is expected to move into the implementation phase by 2010 (PRACE, 2009). Thus, the first two objectives of this project are (a) to prepare for the creation of a persistent, sustainable pan-European HPC service, and (b) to prepare for the deployment of three to six Petaflop/s systems at different European sites. In addition to these, the other three objectives of this project are (c) to define and establish a legal and organisational structure involving HPC centers, national funding agencies, and scientific user communities; (d) to develop funding and usage models and establish a peer review process; (e) to provide training for European scientists and create a permanent education programme.



PRACE architecture (PRACE, 2009)

Within its two-year preparatory phase, PRACE has already achieved some notable goals. With the objective to provide information on which applications should be considered for the PRACE benchmarking suite, PRACE has investigated the current HPC usage in Europe by surveying more than 20 systems representing more than half a Petaflop/s of performance and nearly 70 applications (Simpson, Bull and Hill, 2008). A further objective of this exercise was to map the applications needs to architecture specifications, which were, in-turn, used to select the prototype systems. The six architecture prototypes identified by PRACE are as follows (the sites associated with these prototype systems are mentioned in brackets):

- The IBM BlueGene/P MPP (Massively Parallel Processing) architecture at Forschungszentrum Jülich (**FZJ, Germany**)
- The CRAY XT5 MPP architecture hosted at the IT Centre for Science, Finland (**CSC-CSCS, Finland and Switzerland**)
- The IBM Power6 fat nodes architecture at Computing and Networking Services (**NCF/SARA, The Netherlands**)
- The IBM Cell hybrid architecture at Barcelona Supercomputing Centre (**BSC, Spain**)
- A coupled vector NEC SX-9 and scalar x86 cluster architecture at High Performance Computing Centre Stuttgart (**HLRS, Germany**)
- The BULL systems and the Intel systems thin nodes architecture at French Atomic Energy Commission and Forschungszentrum Jülich (**CEA-FZJ, France and Germany**)

PRACE has also conducted a leading survey among Europe's top HPC users concerning their training needs. The two major outcomes of the survey are as follows:

- Over 90% respondents stated that they needed advanced training in using HPC resources. To address these needs, PRACE was proactive in organising the "PRACE Petascale Summer School" in Stockholm, Sweden (August 26-29, 2008) and the "PRACE Petascale Winter School" in Athens, Greece (February 10-13, 2009) that provided hands-on training on advanced techniques for developing and optimising application codes on the prototype architectures. Furthermore, PRACE organised five code-porting workshops throughout Europe in 2009, whereby students could obtain advanced training and support from world experts in porting application codes to the PRACE prototype architectures. Materials (slides, videos) from these code-porting workshops and the summer and winter School had been made available through a PRACE online training portal.
- The PRACE user survey raised great interest in the USA and Asia where organisations requested to use the PRACE survey as a basis to identify their own training needs.

Scientific Publications/Selected Articles:

PRACE's facilities are used by a huge range of scientific projects. Please see the PRACE website for details of these.

Quick Facts:

Project acronym	PRACE
• Start date	01/01/2008
• Duration	24 months
• Total budget	20 118 000 €

Web site	www.prace-project.eu
• Point of contact	Prof. Achim Bachem
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• Telephone	+49 2461 61 3000

• Fax	+49 2461 61 2525
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Project participants	
Grand Equipement National pour le Calcul Intensif (GENCI)	France
GAUSS Centre for Supercomputing (GCS)	Germany
Netherlands Computing Facilities Foundation (NCF)	The Netherlands
Barcelona Supercomputing Center - Centro Nacional de Supercomputación (BSC)	Spain
Engineering and Physical Sciences Research Council (EPSRC)	UK
Institut für Graphische und Parallele Datenverarbeitung der Johannes Kepler Universität (GUP)	Austria
IT Center for Science (CSC)	Finland
Greek Research and Technology Network (GRNET)	Greece
Consorzio Interuniversitario (CINECA)	Italy
UNINETT Sigma AS	Norway
Poznan Supercomputing and Networking Center (PSNC)	Poland
Universidade de Coimbra – Laboratório de Computação Avançada (LCA-UC)	Portugal
Swedish National Infrastructure for Computing (SNIC)	Sweden
ETH Zurich - Swiss Federal Institute of Technology Zurich, CSCS – Swiss National Supercomputing Centre	Switzerland

Keywords	Supercomputing, HPC ecosystem, petascale, European competitiveness
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Collaboration with other EC funded projects	DEISA, HPC-Europa2, OMII-Europe
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Quick facts: PRACE

References:

DEISA. (2009). Distributed European Infrastructure for Supercomputing Applications. Accessed online <http://www.deisa.eu/>. Last accessed August 2009.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. Available online http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

PRACE. (2009). Partnership for Advanced Computing in Europe. Accessed online <http://www.prace-project.eu>. Last accessed August 2009.

Simpson, A.D., Bull, M. and Hill, J. (2008). Identification and Categorisation of Applications and Initial Benchmarks Suite. Available online http://www.prace-project.eu/documents/Identification_and_Categorisation_of_Applications_and_Initial_Benchmark_Suite_final.pdf. Last accessed August 2009.

Valero, M. (2009). A European Perspective on Supercomputing - Keynote Address. In *Proceedings of the 23rd international conference on Supercomputing*, June 08 - 12, 2009, Yorktown Heights, NY, USA, PP. 1-1. ACM Press, NY, USA.

5.3 EGEEIII: Extending and optimising the world's largest multi-disciplinary production grid infrastructure

During its course EGEE-III expanded and optimised the grid infrastructure that was deployed during the previous EGEE and EGEE-II projects. The EGEE grid infrastructure currently processes hundreds of thousands of jobs per day and supports thousands of researchers from around the world who conduct research in diverse scientific domains. In this section we use the acronym EGEE to refer to EGEE-III and its predecessors - EGEE and EGEE-II.

The achievements of this project are aptly demonstrated by statistics pertaining to the EGEE infrastructure and its users. As of July 2009, 290 sites in over 50 countries are connected to the EGEE infrastructure and they provide approximately 150,000 processing cores to its users. It provides a disk storage capacity and long-term tape storage of approximately 25 petabytes and 38 petabytes respectively. In terms of the users of the EGEE infrastructure, approximately 13,000 researchers belonging to around 120 Virtual Organisations benefit from this resource. The application domains making use of the EGEE infrastructure includes Archaeology, Astronomy & Astrophysics, Civil Protection, Computational Chemistry, Computational Fluid Dynamics, Computer Science/Tools, Condensed Matter Physics, Earth Sciences, Finance (through the Industry Task Force), Fusion, Geophysics, High-Energy Physics, Life Sciences, Multimedia and Material Sciences (EGEE, 2009).

Another success of this project is the creation of the EGEE Business Forum. The Business Forum was started with the objective of communicating effectively the benefits of grid computing to organisations that have the potential to gain advantage from the use of the EGEE infrastructure. These benefits could be with regards to improving business performance through use of grid resources, helping to get products to market faster, supporting companies to innovate, etc. Using a business-friendly open source license has made technology transfer easier by simplifying intellectual property right restrictions. The Business Forum also interacts with the Technology Transfer Offices with the aim of (a) promoting the concept of Knowledge Transfer, whereby knowledge generated by research can be applied to areas of life where it can make a difference, and (b) connecting scientists from EGEE with companies and researchers to foster opportunities for collaborative development and opportunities for Knowledge Transfer.

EGEE's community owes much of its success to its training activities. Through its training programmes, EGEE aims to dispense the knowledge and skills needed to allow the utilisation of the EGEE infrastructure at all levels, by (a) educating developers of applications in order to help enrich the provision of functionalities on the EGEE infrastructure, (b) educating users and developers in the potential of grid architectures to allow the solution of appropriate problems, (c) educating site administrators to allow them to install EGEE middleware and connect to the e-Infrastructure, and (d) collaborating with all the networking activities to enhance and encourage the corporate spirit of EGEE and to promote information sharing within the organisation to help further its goals (EGEE, 2009). Indeed, without provisions of such training it would have been difficult to contemplate the high utilisation of the existing EGEE infrastructure.

EGEE is keenly interested in developing and applying grid standards. Some of the standards and standardisation working groups within EGEE are: OGF Distributed Resource Management Application API Working Group (DRMAA-WG); OGF Education and Training Community Group (ET-CG); OGF Grid Interoperation Now Community Group (GIN-CG); OGF Grid Storage Management Working Group (GSM-WG); OGF Job Submission Description Language Working Group (JSDL-WG); OGF Simple API for Grid Applications Core Working Group (SAGA-CORE-WG). The Open Grid Forum (OGF) has EGEE members in its senior organisational roles.

Another accomplishment of the EGEE project is the grid middleware called gLite, which is integrated, certified and distributed by the project itself. A large fraction of the services included in the gLite distribution are maintained and further enhanced by the EGEE Middleware Engineering Activity (MEA). The goal of MEA is to provide a reference open source implementation of selected grid services satisfying the requirements of both users and administrators, in terms of functionality, performance and manageability (gLite, 2009).

The success of EGEE is paving the way for a sustainable Pan-European grid infrastructure. EGEE has been instrumental in implementing a structure for efficient management of grid resources in member countries. This has been achieved through the EGEE consortium and the National Grid Initiatives (NGIs). The EGEE consortium consists of 42 beneficiaries from academia and industry. However, in real terms, these 42 beneficiaries represent more than 120 partners since the member countries have grouped their academic partners on a national level through the NGIs. These NGIs are an important milestone in the transition of the EGEE infrastructure to a sustainable operational model – the European Grid Infrastructure (EGI). The EGI is a partnership between the NGIs and a coordinating body, the EGI Organisation (EGI.eu). From April 2010 the resources currently coordinated by EGEE will be coordinated through the EGI and each country's grid infrastructure will be run by their respective NGIs (EGEE, 2009) to ensure the long-term health of this resource for researchers. An overview of EGI is included in section 2.3 of this document.

Scientific Publications/Selected Articles (from 2008):

Note that there are a vast number of related articles concerning projects that use the EGEE facilities. Please see the EGEE website.

Quick Facts:

Project acronym	EGEE-III
• Start date	01/05/2008
• Duration	24 months
• Total budget	47 150 000 €

Web site	www.eu-egee.org
• Point of contact	Dr. Robert Jones
• Email	Bob.Jones@cern.ch

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• Fax	+41 22 767 2350

Project participants/Beneficiaries	
European Organization for Nuclear Research	Switzerland
Universitaet Linz	Austria
MTA KFKI Reszecske es Magfizikai Kutatointezet	Hungary
CESNET Zajmove Sdruzeni Pravnickyh Osob	Czech Republic
Ustav Informatiky, Slovenska Akademia Vied	Slovakia
Jozef Stefan Institute	Slovenia
Akademickie Centrum Komputerowe CYFRONET Akademii Gorniczo-Hutniczej im Stanislaw Staszica W	Poland
Sveuciliste u Zagrebu Sveuciliski Racunski Centar	Croatia
Stichting voor Fundamenteel Onderzoek der Materie	The Netherlands
Vrije Universiteit Brussel	Belgium
Forschungszentrum Karlsruhe Gesellschaft mit Beschraenkter Haftung	Germany
SWITCH - Teleinformatikdienste fuer Lehre und Forschung	Switzerland
Centre National de la Recherche Scientifique	France
CGG Services	France
Istituto Nazionale di Fisica Nucleare	Italy
Trust-IT Services Ltd	Italy
Elsag Datamat S.P.A.	Italy
Helsingin Yliopisto	Finland
CSC - Tieteellinen Laskenta Oy	Finland
UNINETT Sigma AS	Norway
Ventenkapsradet	Sweden
Russian Research Centre Kurchatov Institute	Russia
Greek Research and Technology Network SA	Greece
Institute for Parallel Processing of the Bulgarian Academy of Sciences	Bulgaria
University of Cyprus	Cyprus
Tel Aviv University	Israel
Institutul National de Cercetare-Dezvoltare in Informatica Bucuresti	ROMANIA
Institute of Physics Belgrade	Russia
Turkiye Bilimsel ve Teknolojik Arastirma Kurumu	Turkey
Laboratorio de Instrumentacao e Fisica Experimental de Particulas	PT
Institut de Fisica da Altas Energias	Spain
TCD (The Provost, Fellows and Scholars of the Holy and Undivided Trinity of Queen Elizabeth near Dublin)	Ireland
The Science and Technology Facilities Council	UK
Delivery of Advanced Networking Technology to Europe Ltd.	UK
Inter-University Research Institute Corporation, High Energy Accelerator Research Organization	Japan
Academia Sinica	Taiwan
Korea Institute of Science and Technology Information	Korea
Chonnam National University	Korea

The University of Melbourne	Australia
Board of Regents of the University of Wisconsin System	USA
University of North Carolina at Chapel Hill	USA
BT Infrastructures Critiques	France

Keywords	Distributed computing; Virtual organizations; Middleware; Production Grid; Multi-science applications
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Collaboration with other EC funded projects	BalticGrid-II; BEinGRID; EELA-2; EGI_DS; ETICS-2; EUFORIA; GENESI-DR; GridTalk; OGF-EUROPE; SEE-GRID-SCI
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Quick facts: EGEE-III

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

EGEE. (2009). *Accessed online* <http://www.eu-egee.org/>. Last accessed August 2009.

gLite. (2009). Middleware Engineering (EGEE-III JRA1). *Accessed online* <https://twiki.cern.ch/twiki/bin/view/EGEE/Egee3Jra1>. Last accessed August 2009.

5.4 SEE-GRID-SCI: Towards a EGEE-like grid infrastructure for South-East European countries

The SEE-GRID e-Infrastructure for regional e-Science (SEE-GRID-SCI) initiative is committed to ensuring equal participation of the less-resourced countries of South-East Europe in European trends in e-Infrastructure development. SEE-GRID-SCI leverages the South-East European e-Infrastructure to enable new scientific collaborations among user communities. The project stimulates widespread e-Infrastructure uptake by new user groups extending over the region, fostering collaboration and providing advanced capabilities to more researchers, with an emphasis on strategic groups in seismology, meteorology and environmental protection. The initiative thus has a catalytic and structuring effect on target user communities that do not directly benefit from the available infrastructures.

In parallel, the regional e-Infrastructure has been enhanced to meet the demands of communities by increasing the computing and storage resources and involving new partner countries in the region. SEE-GRID-SCI contributes to the stabilisation of the National Grid Initiatives in the region, allowing them to join the new era of longer-term sustainable Grid infrastructure in Europe. In this context, SEE-GRID-SCI has ensured local political support for materializing the e-Infrastructure vision and has successfully joined all countries into EGI.

In the longer term, SEE-GRID-SCI aspires to contribute to the stabilisation and development of South-East Europe, by easing the digital divide and stimulating e-Infrastructure development and adoption by new user communities, thus enabling collaborative high-quality research across target scientific fields.

The project developments include:

- Engaging international user communities and providing application-specific service extensions

The target applications are from the fields most relevant for the region: taking into account local geography – meteorology, seismology and environmental protection are core earth science disciplines in the region.

The Seismology VO has six major applications ranging from Seismic Data Service to Earthquake Location Finding, from Numerical Modeling of Mantle Convection to Seismic Risk Assessment. The Meteorology VO, with two large-scale applications, follows an innovative approach to weather forecasting that uses a multitude of weather models and bases the final forecast on an ensemble of weather model outputs. The Environmental (Protection) VO supports eight applications focusing on environmental protection/response and environment-oriented satellite image processing. These applications typically involve a number of diverse research groups

across the region. Moreover, strong regional collaboration has been encouraged in all the three scientific domains supported by the project via the deployment of specific support mechanisms that facilitate their communications and exchange of expertise. Application-level services and operational tools are being actively developed by the project, currently summing up to 44 different services and 14 tools, which are increasingly used by applications communities.

- Providing infrastructure for new communities

The SEE-GRID-SCI infrastructure has been further expanded, with the inclusion of the Caucasus region in the infrastructure, namely Armenia and Georgia. The project operates the regional Grid infrastructure, maintaining deployed core services for the SEEGRID VO and three discipline VOs, as well as core services for the ops.vo.egee-see.org VO used for the testing of the infrastructure. The geographical distribution of new core services is such that it provides fault tolerance and load balancing for regional users. A set of operational and monitoring tools is maintained and used to manage and assess the status of the e-Infrastructure in terms of reliability, availability and automation. The average availability of Grid sites is above 90%, the number of available CPUs over 3000, while the total available storage around 500 TB.

- Consolidating actions towards long-term sustainability and European Grid Initiative inclusion

SEE-GRID-SCI aims to ensure that all participating countries in the region will be mature enough for inclusion in the next-generation Grid operations model. On the European level, the vision in the long term is that of National Grid Initiatives (NGIs) federated together under the umbrella of the European Grid Initiative or an equivalent, which would coordinate and oversee the operations and general Grid actions. All SEE countries have joined EGI. SEE-GRID-SCI has produced a list of metrics for NGI monitoring, while their relevance for NGI development and EGI international cooperation was underlined. An “NGI cookbook” was produced with detailed NGI guidelines, proving to be a crucial document within and beyond the consortium. Specific support was provided to partner countries not represented in the EGI Policy Board. SEE-GRID-SCI has produced an NGI assessment document, giving detailed country reports, as well as main results of NGI development and future plans.

- Strengthening the regional and national human network

SEE-GRID-SCI has materialized a strong dissemination and training campaign with the aim to further strengthen and widen the regional and national-level Human Network, engaging target national and regional user communities, and establishing and maintaining efficient communication channels and promotional material. SEE-GRID-SCI dissemination-related achievements include the production of brochure and generic and VO-specific posters, as well as numerous scientific posters, scientific

presentations, newsletters, and national and regional dissemination events. Additionally, a wide-ranging training campaign has been carried out in order to raise the national-level and regional-level expertise and end-user adoption. A coherent set of training material has been produced, the training infrastructure is maintained, and a wide trainer community established.

Scientific Publications/Selected Articles:

(ICI) Gorgan, D., Bacu, V., Stefanut, T., Rodila, D., *"Grid based Satellite Image Processing Platform for Earth Observation Applications Development"*. IDAACS'2009 - IEEE Fifth International Workshop on "Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications", 21-23 September 2009, Rende, Cosenza, Italy (2009). Paper accepted for publication in IEEE Computer Press.

(ICI) Gorgan D., Bacu V., Rodila D., Pop Fl., Petcu D., *"Experiments on ESIP - Environment oriented Satellite Data Processing Platform"*. SEE-GRID-SCI User Forum, Bogazici University, Istanbul, Turkey, 2009.

(RBI) D. Davidović, D. Belušić, M. Telišman-Prtenjak: *"Grid implementation of the Weather Research and Forecasting model"* abstract accepted for the SEE-GRID User forum

(IPP) D. Syrakov, M. Prodanova, K. Ganev, N. Miloshev, E. Atanasov, T. Gurov, and A. Karaivanova, *"Grid Computing for Multi-Scale Atmospheric Composition Modeling for the Balkan Region"*, Journal of International Scientific Publication: Ecology&Safety, Vol.3, Part 1, 2009, pp. 4-21, ISSN 1313-2563, Published at <http://www.science-journals.eu>

(UKIM), L. Jordanovski, B. Jakimovski, A. Misev, *"Massively Parallel Seismic Data Wavelet Processing Using Advanced Grid Workflows"*, ICT Innovations Conference 2009, Ohrid 28- 29, September 2009, to be published in Springer Lecture Notes

(UPB) C. Dobre, F. Pop, V. Cristea, *"Simulation Framework for the Evaluation of Dependable Distributed Systems"*. Scalable Computing: Practice and Experience, Scientific International Journal for Parallel and Distributed Computing (SCPE). Volume 10, Number 1, pp. 13–23. <http://www.scpe.org>, 2009, ISSN 1895-1767.

(TUBITAK) Can Ozturan, Bilal Bektas, Mehmet Yilmazer and Cevat Sener, *"Challenges Faced in Building a Virtual Organization for Seismology in South Eastern Europe"*, Full text paper was submitted to e-Challenges-2009 (<http://www.echallenges.org/e2009/>).

(UOB) A. Balaz, I. Vidanovic, A. Bogojevic and A. Pelster: *"Short-time Effective Action Approach for Numerical Studies of Rotating Ideal BECs"*, Conference on Research Frontiers in Ultra-Cold Atoms, 4-8 May 2009 (2009) ICTP, Trieste, Italy

Quick Facts:

Project acronym	SEE-GRID-SCI
• Start date	01/05/2008
• Duration	24 months
• Total budget	3 214 690 €

Web site	www.see-grid-sci.eu
• Point of contact	Dr. Ognjen Prnjat
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Project participants	
Greek Research and Technology Network (GRNET)	Greece
European Organization for Nuclear Research (CERN)	Switzerland
Institute for Parallel Processing (IPP – BAS)	Bulgaria
National Institute for Research & Development in Informatics (ICI)	Romania
The Scientific and Technological Research Council of Turkey (TUBITAK)	Turkey
Computer and Automation Research Institute (SZTAKI)	Hungary
Polytechnic University of Tirana (UPT)	Albania
University of Banja Luka (UoBL)	Bosnia-Herzegovina
SS. Cyril and Methodius University of Skopje (UKIM)	FYR of Macedonia
University of Belgrade (UOB)	Serbia
University of Montenegro (UOM)	Montenegro
Research and Educational Networking Association of Moldova (RENAM)	Moldova
Ruder Boskovic Institute (RBI)	Croatia
Institute for Informatics and Automation Problems, National Academy of Sciences of Armenia (IIAP-NAS-RA)	Armenia
Georgian Research and Educational Networking Association (GRENA)	Georgia

Keywords	eInfrastructure, meteorology, seismology, environmental protection, NGIs.
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Collaboration with other EC funded projects	EGEE-III, EGI_DS, Related regional initiatives, GENESI-DR, BSI, EDGES
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Quick facts: SEE-GRID-SCI

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

SEE-GRID-SCI. (2008). SEE-GRID-SCI Newsletter, Issue no1, November 2008.

SEE-GRID-SCI. (2010). SEE-GRID e-Infrastructure for regional e-Science (SEE-GRID-SCI) project homepage. *Accessible online* www.see-grid-sci.eu. Last accessed September 2009.

SEE-GRID-SCI (2009), SEE-GRID-SCI periodic report, April 2009

SEE-GRID-SCI (2010), SEE-GRID-SCI periodic report, 5th 3M report, July 2009

SEE-GRID-SCI (2010), SEE-GRID-SCI periodic report, 6th 3M report, October 2009

5.5 BalticGrid-II: Europe helps in building and extending e-Infrastructures to the Baltic region

The aim of BalticGrid-II is to increase the impact, adoption and reach, and to further improve the support of services and users of the recently created e-Infrastructure in the Baltic States. This will be achieved by an extension of the BalticGrid infrastructure to Belarus; interoperation of the gLite-based infrastructure with UNICORE and Advanced Resource Connector (ARC – The NorduGrid Middleware [NorduGrid, 2009]) based Grid resources in the region; identifying and addressing the specific needs of new scientific communities such as nano-science and engineering sciences; and by establishing new Grid services for linguistic research, Baltic Sea environmental research, data mining tools for communication modelling and bioinformatics. The e-Infrastructure of 26 clusters built in five countries during the first phase of the BalticGrid is envisaged to grow, both in capacity and capability of its computing resources. With the goal of a sustainable e-Infrastructure in the Baltic Region, the BalticGrid e-Infrastructure will be fully interoperable with the pan-European e-Infrastructures established by EGEE, EGEE associated projects, and the planned EGI. The overall vision is to support and stimulate scientists and services used in the Baltic region to conveniently access critical networked resources both within Europe and beyond, and thereby enable the formation of effective research collaborations (BalticGrid-II, 2009).

BalticGrid-II has created several Special Interest Groups (SIGs). The SIGs bring together people working on the design, evaluation, implementation and study of BalticGrid-II. BalticGrid SIGs provide an international, interdisciplinary forum for the exchange of ideas about the field of BalticGrid. There are SIGs for various fields of physics, astronomy, computer modelling, architecture, graphics, security and so forth, for example, Baltic Sea Eco-System Modelling SIG; Text-to-Speech SIG; Text Annotation SIG; Corpus Laboratory SIG; Atomic and Nuclear SIG; Computer Modelling SIG; Telecommunication modelling and simulation SIG; Biosensors SIG. Members of a SIG cooperate to produce solutions in the corresponding area of research. They arrange regular meetings and discussions particularly during computing conferences. Every SIG is provided with a set of online resources to coordinate their activities. They are as follows (BalticGrid-II SIG, 2009):

- Gridcom - web based tool/interface for SIG members to run and monitor applications on grid directly through a web browser.
- Repository - folder to store and share files and documents for SIG members.
- Forums - discussion board of BalticGrid users for experience and news sharing.
- Audio/video conferences - software for members of SIGs to arrange audio/video conferences online.
- Mailing lists

BalticGrid-II has identified three applications for gridification and execution over the BG-II e-Infrastructure. These applications are listed in the table below (BalticGrid-II, 2009).

Application	Application Description
NWCHEM	NWChem is a computational chemistry package that is designed to run on high-performance parallel supercomputers as well as conventional workstation clusters. It aims to be scalable both in its ability to treat large problems efficiently, and in its usage of available parallel computing resources. NWChem has been developed by the Molecular Sciences Software group of the Environmental Molecular Sciences Laboratory (EMSL) at the Pacific Northwest National Laboratory, USA. NWChem provides many methods to compute the properties of molecular and periodic systems using standard quantum mechanical descriptions of the electronic wave function or density. In addition, NWChem has the capability to perform classical molecular dynamics and free energy simulations. These approaches may be combined to perform mixed quantum-mechanics and molecular-mechanics simulations, like zeolite properties, properties of acids, properties of medications, etc. The software will be used for the development of specific models for quantum-, nano- and mesoscopic level of computing.
CORPLT – Corpus of Academic Lithuanian	The corpus will be designed as a specialized corpus for the study of academic Lithuanian and it will be the first synchronic, corpus of academic written Lithuanian in Lithuania. It will be a major resource of authentic language data for linguistic research of academic discourse, for interdisciplinary studies, lexicographical practice, and terminology studies in theory and practice. The compilation of the corpus will follow the most important criteria: methods, balance, representativeness, sampling, TEI P5 Guidelines, etc. The GRID application will be used for testing algorithms of automatic encoding, annotation and search-analysis steps. Encoding covers recognition of text parts (sections, titles, etc.) and correcting of text flow. Linguistic annotation consists of part of speech tagging, part of sentence tagging, etc. Search-analysis part deals with complexity level of the search, and tries to distribute and effectively deal with the load for corpus services.
ESSM	LatvianGrid system is used for Comparison of Protein Structures (CoPS) using Evolutionary Secondary Structures Matching (ESSM) algorithm. ESSM algorithm can automatically identify different types of protein structure mutations between pair of proteins. For exploration of evolution of protein structures all-against-all comparison have to be done. Grid computing gives the possibility to process the whole protein database like CATH (the number of pairwise comparisons is few billions).

BalticGrid-II Applications

With regard to training activities, BalticGrid-II has organised a five-day long Summer School in June, 2009. It was held at the Molėtai astronomical observatory of VU ITPA, Lithuania. The agenda for the Summer School was packed with lectures and practical work.

BalticGrid-II has also started a subproject aimed at developing cloud computing infrastructure in Baltic States and Belarus. This sub-project project is called BalticCloud. The infrastructure is based on open-source solutions and is available for research and teaching activities within the partner states. As a mid-term goal BalticCloud aims at creating and establishing, on a regular basis, courses on cloud computing for both academia and industry (BalticCloud, 2009).

Scientific Publications/Selected Articles:

I. Dailidienė and P. Zemlys. (2008). Modeling of pollution drifts in the Baltic Sea near Lithuanian seacoast. *In Proc. of the Scientific-practical Conference on Sea and coast research-2008*, Klaipėda, 2008: p. 26-27.

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Quick Facts:

Project acronym	BalticGrid-II
Start date	1/05/2008
Duration	24 months
Total budget	3 344 777 €

Web site	www.balticgrid.eu
Point of contact	Ake Edlund

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Fax	+46 7 0662 1510

Project participants	
Royal Institute of Technology in Stockholm (KTH)	Sweden
Estonian Educational and Research Network (EENET)	Estonia
National Institute of Chemical Physics and Biophysics (NICPB)	Estonia
Institute of Mathematics and Computer Science, University of Latvia (IMCS UL)	Latvia
Henryk Niewodniczanski Institute of Nuclear Physics, Polish Academy of Sciences (IFJPAN)	Poland
Poznan Supercomputing and Networking Center (PSNC)	Poland
Vilnius University (VU)	Lithuania
Riga Technical University (RTU)	Latvia
Institute of Theoretical Physics and Astronomy of Vilnius (ITPA)	Lithuania
European Organization for Nuclear Research (CERN)	Switzerland
Research Division of Belarusian National Technical University (NICH BNTU)	Belarus
United Institute of Informatics Problems of National Academy of Sciences of Belarus (UIIP NASB)	Belarus
Vilnius Gediminas Technical University (VGTU)	Lithuania

Keywords	Information technology; Baltic Region; Grid infrastructure
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Collaboration with other EC funded projects	EGEE III, EGI
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Quick facts: BalticGrid-II

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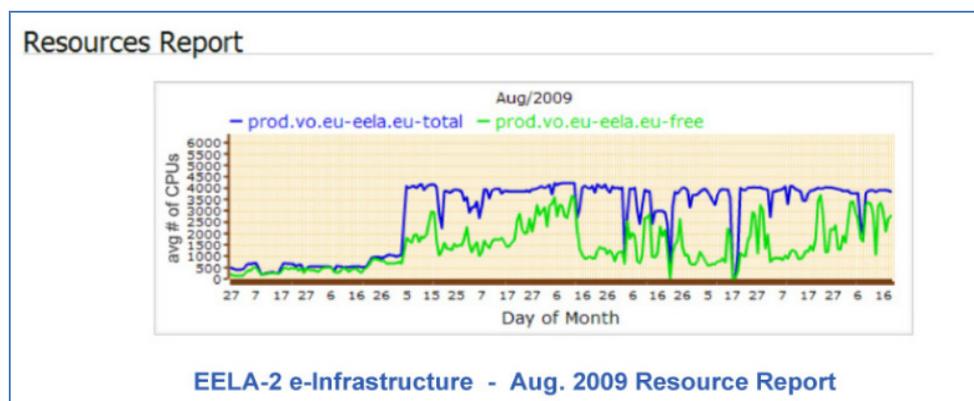
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5.6 EELA-2: Enabling European and Latin American scientific communities to work together!

E-science grid facility for Europe and Latin America, phase 2, (EELA-2) aims at building a high capacity, production-quality, scalable Grid Facility, providing round-the-clock, worldwide access to distributed computing, storage and network resources needed by the wide spectrum of applications from European - Latin American Scientific Collaborations. EELA-2 builds upon the successes of the first EELA project (EELA, 2008) which created a sustainable e-Infrastructure comprising of 16 Resource Centres (RCs) summing up to over 730 CPU cores and 60 Terabytes of storage space. Building upon the successes of the original EELA project, the vision of EELA-2 is two-folds: (a) to consolidate and expand the current EELA e-Infrastructure built on the GÉANT2/European and RedCLARA/LA National Research & Education Networks (NREN), to become an e-Infrastructure Facility, providing a full set of enhanced services to all types of applications from multiple Scientific Areas of European and Latin American Scientific Communities; and (b) to ascertain the conditions of the durability of the e-Infrastructure, beyond the Project duration (EELA-2, 2009).

EELA-2 aims at expanding the current e-Infrastructure to consist of 41 Resource Centres (13 in Europe and 28 in Latin America) mobilising about 3000 computing cores and more than 700 Terabytes of storage space, at start of the project and to further grow by 20 % in computing and 15 % in storage over the duration of the project (EELA-2, 2009). As can be seen from the Screenshot 1 below, EELA-2 has not only achieved this target but it has continued to expand its resources (the screenshot shows that CPU cores available in August 2009 were approximately 4000).



Screenshot 1: EELA-2 Resource Report, August, 2009 (EELA2, 2009).

Screenshot 2 below shows the dissemination activities that have been carried out by the EELA-2 project since its inception. The statistics show that with regards to dissemination activities, EELA-2 has done exceedingly well. One important point to note is the number of EELA-2 press releases in the first year of the project (approx. 20).

Event/Activity	Done 1st year	Committed 1st Year	Committed in 2 years	Planned
Tutorials				
Users and Administrators	7	—	≥6	
Tutorial for Trainers	1	1	2	
Grid Schools	1	1	2	
On-line tutorials	1	—	—	
Gridification weeks	3	—	—	≈13
Participant - day	810	≥300	≥600	
Conferences	1	1	2	
Workshops	4	—	—	
User Forum	—	—	—	1
Decision Makers Days	6	≥2	≥6	
e-Science Virtual Days	1	—	≥4	
Posters	3	2	3	
Brochures-Flyers	5	—	3	
Bulletins	3	3	6	
Press releases	≥20	—	—	
Legend				
≈: about				
—: not defined				
≥: at least				
Summary of Dissemination activities as planned and achieved at M12				

Screenshot 2: EELA-2 Summary of Dissemination Activities (EELA2, 2009)

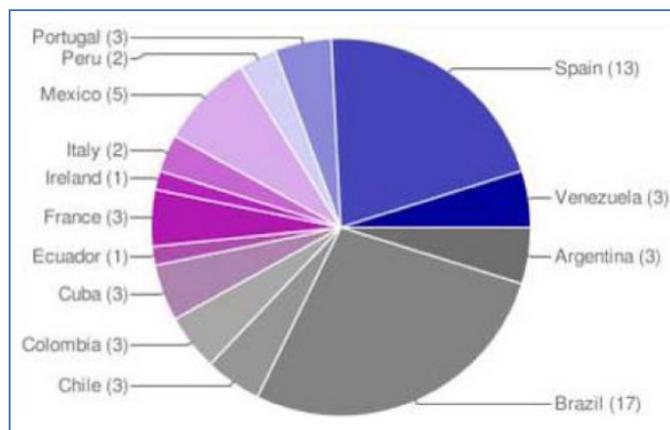
Presently EELA-2 supports a total of 57 applications. A few of these applications, their descriptions and the target domains are listed in the table below. This information has been collated from EELA-2AS (2009).

Application	Application Doman	Application Description
AERMOD	Environmental Sciences	AERMOD is a model for the assessment of local dispersion of atmospheric pollutants (less than 50 km from emission sources).
AeroVANT	Engineering	This application allows the simulation of nonlinear and unsteady behavior of joined wings, high altitude, long endurance unmanned aerial vehicles.
Aiuri	AI / Optimization	The objective of Aïuri Project is the development of a framework that includes a user interface, data and text mining tasks, database access and a visualization tool. T
ALICE	High Energy Physics	The ALICE Collaboration is building a dedicated heavy-ion detector to exploit the unique physics potential of nucleus-nucleus interactions at LHC energies. The aim is to study the physics of strongly interacting matter at extreme energy densities, where the formation of a new phase of matter, the quark-gluon plasma, is expected.
BiG - Blast in Grids	Biomedicine	One of the most important efforts on the analysis of the genome is the study of the functionality of the different genes and regions. Sequence alignments provide a powerful way to compare novel sequences with previously characterized genes. Both functional and evolutionary information can be inferred from well designed queries and alignments. The Basic Local Alignment Search Tool (BLAST) finds regions of local similarity between sequences. The program compares nucleotide or protein sequences to sequence databases and calculates the statistical significance of matches.
CAM	Earth Sciences	Weather and climate simulation/prediction is one of the most computationally expensive scientific activities with strong social and economical implications (for instance, El Niño phenomenon is a key factor in Latin-America). The basis for this activity is the use of global and regional circulation models, which solve numerically the physical

		equations of atmosphere/ocean dynamics. Global models simulate the dynamics of the circulation in a coarse resolution grid over the world (with an approximate resolution of 100 km) whereas the regional models focus on the area of interest (e.g. South America) simulating high-resolution details (5-10 km) with boundary conditions given by a global model. Therefore, regional weather and climate simulation requires a sequence of global + regional coupled models.
CROSS-Fire	Civil Protection	Civil Protection (CP) activities involve different and autonomous actors, from public bodies to research centres. CP applications require a strict integration of human and physical resources that must be shared in a coordinated and effective way, and available for the whole emergency procedure. Developments in information and communication science and technology enabled such integration, namely through Virtual Organizations (VO) in the emerging grid technologies: a VO should efficiently coordinate the sharing of these interconnected resources (computing, storage, communication, sensors and actuators) geographically scattered across national borders.
Gknowledge	e-Learning	Gknowledge is a LMS (Learning Management System) based on standards, and designed in agreement with the new GRID architecture philosophy, in order to cover the education needs via Internet.

Table 3: Examples of applications supported by EELA-2

The applications that are supported by EELA-2 belong to different scientific domains and to different member counties involved in this project. As can be seen from Screenshot 3, there is a good distribution of these applications among the EELA-2 project participants that belong to different countries.



Screenshot 3: Distribution of EELA-2 Applications by Member Countries (EELA2, 2009)

Similarly, there is a good distribution of EELA-2 applications per scientific domain: Bioinformatics (22 applications supported by EELA-2), Earth/Environmental Science (8), High Energy Physics (7), Artificial Intelligence (5), Engineering (2), Physics (1), Civil Protection (1), e-Learning (1), Others (1).

EELA-2 has also been involved with middleware development. EELA-2 researchers have added new features to *gLITE* that allows it to be used by scientists performing many different kinds of research. In addition, they have adapted a version of *gLITE* that runs on computers using Windows operating systems, rather than Linux. Even with those modifications, researchers working in small groups with limited IT support needed something simpler. EELA-2 chose to implement *OurGrid*, a system designed to communicate with a large number of computers and use them when they would otherwise be idle. Besides being easier to use than *gLITE*, *OurGrid* allows each

computer to work on its part of the calculation independently. This eliminates the need for high-speed connections linking the participating computers. EELA-2 has found a potential ally in CLARA (in English, Latin American Advanced Networks Cooperation), an international organisation with a strong interest in advancing academic computing in Latin America (ICT Results, 2009).

Scientific Publications/Selected Articles:

Note: Proceedings of the EELA-2 Conference are not included in this list.

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Isea R., Montes, E., Rubio-Montero, A.J. and Mayo R. (2009). Computational challenges on Grid Computing for workflows applied to Phylogeny. *In: Lecture Notes on Computer Sciences*, v 5518, p.1130-1138.

Ciuffo, L.N. (2009). Using Grids to Support Recommender Systems: A Case Study of Generating Movie Recommendations on the EELA-2 Infrastructure. *In: International Conference on High Performance Computing & Simulation, 2009, Leipzig, Germany. Proceedings of the HPCS 2009.* New Jersey: IEEE.

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Ciuffo, L.N., Mayo, R. et al. (2009). Biomedical applications in the EELA-2 Project. *In: Ninth Annual Workshop Network Tools and Applications in Biology, 2009, Catania, Italy. NETTAB 2009 Proceedings. Genova: Liberodiscrivere edizioni*, v.1. p.35-38.

Pina, A., Oliveira, B., Puga, J., Marques, R. and Proenca, A. (2009). An OGC-WS framework to run FireStation on the Grid. *In: 3rd Iberian Grid Infrastructure Conference, 2009, Valencia. IBERGRID Proceedings. Santa Cristina: NETBIBLO S.L.*, v.3.

Esteves, A. and Pina, A. (2009). A Prototype to Integrate a Wireless Sensor Network with Civil Protection Grid Applications. *In: 3rd Iberian Grid Infrastructure Conference, 2009, Valencia. IBERGRID Proceedings. Santa Cristina: NETBIBLO S.L.*, v.3.

Ciuffo, L.N. (2009). Using Grids to Support Recommender Systems: Generating movie recommendations on the EELA-2 infrastructure. *In: 3rd Iberian Grid Infrastructure Conference, 2009, Valencia. IBERGRID Proceedings. Santa Cristina: NETBIBLO S.L.*, v.3. p.432-443.

Acero, A. et al. (2009). Grid and Supercomputing activities at the ICT Division of CIEMAT. *In: 3rd Iberian Grid Infrastructure Conference, 2009, Valencia. IBERGRID Proceedings. Santa Cristina: NETBIBLO S.L., v.3. p.126-136.*

Castejon, F. et al. (2009). Grid Computing for Fusion Research. *In: 3rd Iberian Grid Infrastructure Conference, 2009, Valencia. IBERGRID Proceedings. Santa Cristina: NETBIBLO S.L., v.3. p.291-302.*

Lopez, J., Cordero, D., Fernandez, C., Gutierrez, E., Valin, R., Rodriguez, A., Garcia-Loureiro, A., Aldegunde, M., Seoane, N., Pena, T., Cabaleiro, J. and Rivera F. (2009). FORMIGA/G-FLUXO: Adding Computer Labs to the Grid. *In: 3rd Iberian Grid Infrastructure Conference, 2009, Valencia. IBERGRID Proceedings. Santa Cristina: NETBIBLO S.L., v.3. p.237-246.*

Valin, R., Garcia-Loureiro, A., Aldegunde, M., Seoane, N., Pena, T., Cabaleiro, J., Rivera, F., Cordero, D., Fernandez, C. and LOPEZ, J. (2009). Gridification of a Nanodevice Monte Carlo Simulator for the FORMIGA Project. *In: 3rd Iberian Grid Infrastructure Conference, 2009, Valencia. IBERGRID Proceedings. Santa Cristina: NETBIBLO S.L., v.3. p.109-116.*

Simon, A., Fernandez, C., Freire, E., Lopez, J., Diez, R. and Diaz, S. (2009). Too many grids? How to share resources between different Grid infrastructures. *In: 3rd Iberian Grid Infrastructure Conference, 2009, Valencia. IBERGRID Proceedings. Santa Cristina: NETBIBLO S.L., v.3.*

Castro, H., Marechal, B., Carvalho, D., Ciuffo, L.N., Dutra, I., Gavillet, P., Mayo, R., Nunex, L., Hoeger, H., Hamar, V. and Lopez, M.J. (2009). EELA: una infraestructura para e-ciencia en Latinoamérica. *In: Revista de Ingeniera de la Universidad de los Andes, May 2009.*

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Marechal, B., Carvalho, C., Ciuffo, L.N., Dutra, I., Gavillet, P. and Mayo, R. (2008). Creating and Operating a Grid Infrastructure: Use Case from Latin America. *In: IST-Africa 2008 Conference, 2008, Windhoek, Namibia. IST-Africa 2008 Conference Proceedings. Dublin: IIMC International Information Management Corporation Ltd, 2009.*

Brasileiro, F., Duarte, A.N., Carvalho, D., Barbera, R. and Scardaci, D. (2008). An Approach for the Co-existence of Service and Opportunistic Grids: The EELA-2 Case In: *Latin-American Grid Workshop, 2008, Campo Grande, Brazil. Proceedings of the Second Latin-American Grid Workshop*. Petrópolis: LNCC, 2008.

Montes, E., Isea, R. and MAYO, R. (2008). PhyloGrid: a development for a workflow in Phylogeny. In: *2nd Iberian Grid Infrastructure Conference, 2008, Porto, Portugal. IBERGRID Proceedinfs, v.2, p.378-387*.

Quick Facts:

Project acronym	EELA-2
• Start date	01/04/2008
• Duration	24 months
• Total budget	5 106 702 €

Web site	www.eu-eela.org
• Point of contact	Prof. Bernard Marechal
• Email	marechal@if.ufrj.br
• Telephone	+34 669 49 14 06
• Fax	+34 91 346 66 45

Project participants	
<i>A total of 78 Member Institutions participate in EELA-2. The following 18 members act either as single Partner or Partner Coordinator of a Joint research Unit (JRU), if there is more than one EELA-2 Member in the country.</i>	
Centro de Investigaciones Energéticas Medioambientales y Tecnológicas (CIEMAT)	Spain
Centro de Gestión de la Información y Desarrollo de la Energía (CUBAENERGIA)	Cuba
Cooperación Latino-Americana de Redes Avanzadas (CLARA)	International
University College Cork - Costal and Marine Resources Centre (UCC-CMRC)	Ireland
HLP Développement (HLP)	France
Centre National de la Recherche Scientifique (CNRS)	France
Istituto Nazionale di Fisica Nucleare (INFN)	Italy
Laboratorio de Investigación en Nuevas Tecnologías Informáticas (LINTI - UNLP)	Argentina
Red Universitaria Nacional (REUNA)	Chile
Servicio Nacional de Meteorología y Hidrología (SENAMHI)	Peru
Universidad de Los Andes (ULA)	Venezuela
Universidad de Los Andes (UNIANDES)	Colombia
Universidad Nacional Autónoma de México (UNAM)	Mexico
Universidade do Porto (UPORTO)	Portugal
Universidade Federal do Rio de Janeiro (UFRJ)	Brazil
Universidad Técnica Particular de Loja (UTPL)	Ecuador
Universidad Tecnológica de Panamá (UTP)	Panama
Universidad de la República (UdelaR)	Uruguay

Keywords	Grid Facility, e-Science, e-Infrastructure, Latin America
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Collaboration with other EC funded projects	BELIEF, EGEE-III, EGI_DS, EU-IndiaGrid, GRIDTALK, SEE-GRID 2
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Table 4: Quick facts: EELA-2

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ICT Results. (2009). How do you say grid computing in Spanish? (Feature). *Available online* <http://cordis.europa.eu/ictresults/>. Last accessed November, 2009.

5.7 EDGeS: Desktop grids and production grids join-up forces to answer the call of e-Science!

EDGeS - enabling Desktop Grids for e-Science - is a European project with the aim of creating an integrated Grid infrastructure across Europe that seamlessly integrates a variety of Desktop Grids with EGEE type of service grids. This integration is made possible using the EDGeS Bridge. The EDGeS Bridge works in two directions: (a) work can be sent from Desktop Grids to EGEE type of service grids; and (b) work can also be sent from EGEE type of service grids to Desktop Grids. Presently, there are several projects that utilise BOINC (BOINC, 2009) and XTREMWEB (INRIA/IN2P3, 2008) Desktop Grids middleware to achieve (a), i.e., send jobs from the Desktop Grids to Service Grid (DG->SG). These projects are listed below (EDGeS Monitoring, 2009).

Project (DG->SG)	Project Description
Blender: 3D Video Rendering	The main purpose of the Rendering Application is to create images and videos from models that were designed in Blender, one of the most popular Open Source 3D graphics applications in the World. The rendering process is computationally very expensive; a more complex animation can be rendered for weeks or months in a single processor. This time can be reduced seriously by porting the application to a Desktop Grid.
PR: Patient Readmission Application	Frequent patient readmissions have a significant organisational consequence. This has enabled healthcare commissioners in England to use emergency readmission as an indicator in the performance rating framework, where hospitals are rated based on their levels of readmission. The Patient Readmission Application is a statistical model developed in R, where individual hospitals propensities for first readmission, second readmission, third (and so on) are considered to be measures of performance.
DSP: Defining the class of optimal periodic non-uniform sampling sequences	Digital alias-free signal processing (DASP) is an approach that offers effective solutions to processing signals with conservatively estimated spectral support. Designing periodic nonuniform sampling (PNS) sequences for digital alias free signal processing is a computationally extensive problem where sequential single computer based solutions could easily run for days or even weeks. The Desktop Grid based implementation significantly reduces the computation time, and thus makes research more efficient.
laserac: CALD - Cellular Automata-based Laser Dynamics	This application simulates the dynamics of laser devices using a Cellular Automata-based discrete model. Individual-based models like Cellular Automata are very effective to carry out detailed simulations of complex systems in a broad range of fields of science and technology. This kind of models has been recently applied by the proponent to simulate one of the most paradigmatic complex systems of particular technological importance: laser systems. Our application uses this model to carry out simulations intended to understand the emergence of macroscopic behaviours in lasers, arising from the interaction of simple microscopic components, and to simulate specific optoelectronic devices of arbitrary shape.
Protein: Protein Molecule Simulation using AutoDock	AutoDock is a suite of automated docking tools. It is designed to predict how small molecules, such as substrates or drug candidates, bind to a receptor of known 3D structure. Although one run of Autodock finishes on a single machine in a reasonable time, thousands of scenarios have to be simulated and analyzed to receive stable and meaningful results. Deploying the application on a Grid computing infrastructure, utilising hundreds of machines at the same time, allows harnessing sufficient computational power to undertake the simulations on a larger scale and in a much shorter timeframe.

Table 5: DG->SG Projects

The EDGeS project also provides “Application Support” to existing and future grid users and application developers during the application gridification and porting process. In this regard EDGeS has established two application support centres - *Grid Application Support Centre (GASuC)* and *Westminster Grid Application Support Service (W-GRASS)*. GASuC provides assistance to current and future grid users and application developers during the application gridification process. GASuC helps identify and apply best patterns, practices, tools and infrastructures in order to get the grid-enabled code running on production grids as soon as possible (GASuC, 2009). W-GRASS aims to support users in the migration of their existing applications onto the grid, and in the creation of brand new grid applications. Towards this aim, W-GRASS has the following four objectives (W-GRASS, 2009): (a) to identify and approach those users who have compute and data intensive applications but do not yet use the grid; (b) to analyse these applications in collaboration with their users and identify the applications that can be grid-enabled; (c) to grid-enable the selected applications, i.e., to run these applications on production grids, such as the EDGeS Grid and Desktop Grids; and (d) to train users how to run these applications on the Grid.

One measure of gauging the success of this project is the deployment base of the Desktop Grid. The current size of the Desktop Grids connected to the EDGeS Bridges is about **80,000 processors** - about equal to the EGEE number. Connected Desktop Grids include *SZTAKE Desktop Grid*, *AlmereGrid* and the *University of Westminster Desktop Grid* (EDGeS, 2009).

EDGeS have organised three “*User and Industry Forums*” with the goal of bringing together grid application users, developers and companies and discuss the possibilities of using grid technology to get more computing power at reduced costs to universities and companies. The first EDGeS - User and Industry Forum was held in Paris (France) in May 2008. The second and third EDGeS forums were held in Debrecen (Hungary) and Hamburg (Germany) in September 2008 and June 2009 respectively.

The EDGeS project has signed four Memorandum of Understanding (MoU) with grid operators to connect their grid through the EDGeS Bridge. EDGeS has signed a MoU with the EGEE-III project (refer to Section 5.3) at the EGEE'08 conference in Istanbul (September 2008). This MoU marks the start of a collaboration between the two projects on technical, application and dissemination levels. Another MoU has been signed between EDGeS and the SEE-GRID-SCI project (refer to Section 5.4) to connect the SEE-GRID infrastructure to other Grids using the EDGeS Bridge technology. Under the agreement, SEE-GRID-SCI and EDGeS will further collaborate on application porting and dissemination and training activities. A further two MoUs have been signed with Ibercivis - the Spanish Desktop Grid operator that hosts several scientific projects (under the MoU with EDGeS, the Ibercivis Grid will be connected to other grids using the EDGeS Bridge) and EELA-2 (see Section 5.6).

Yet another achievement of this project is that, EDGeS has made possible the streaming and analysis of real time video over the desktop grid environment as well as the cluster-based EGEE grid. *Video Stream Analysis in a Grid Environment (ViSAGE)* is a real-time video analysis tool that is able to identify specific objects and behaviours within a video stream based on a filter such as motion detection. The real time aspect is made possible by using the grid to run the analysis. ViSAGE uses

EDGeS bridges in order to connect between BOINC desktop grid platform to EGEE high performance grid network providing automatic communication between those two different grid networks. The aim is utilizing this ability to create an international centre for processing television, Internet, CCTV video streams.

Scientific Publications/Selected Articles:

Cardenas-Montes, M., Emmen, A., Marosi, A.C., Araujo, F., Gombas, G., Terstyanszky, G., Fedak, G., Kelley, I., Taylor, I., Lodygensky, O., Kacsuk, P., Lovas, R., Kiss, T., Balaton, Z. and Farkas, Z. (2008). EDGeS: bridging Desktop and Service Grids. *In Proceedings of the 2nd IberIAN Grid Infrastructure Conference*, 12-14 May 2008, Portugal.

Farkas, Z., Kacsuk, P. and del Solar, M.R. (2008). Utilizing the EGEE Infrastructure for Desktop Grids. (2008). *Distributed and Parallel Systems*, Springer, pp. 27-35.

Kacsuk, P., Farkas, Z. and Fedak, G. (2008). Towards Making BOINC and EGEE Interoperable. *In Proceedings of the IEEE Fourth International Conference on eScience, 2008*. 7-12 Dec. 2008, Indianapolis, Indiana, USA.

Quick Facts:

Project acronym	EDGeS
• Start date	01/01/2008
• Duration	24 months
• Total budget	2 871 480 €

Web site	www.edges-grid.eu
• Point of contact	Prof. Peter Kacsuk
• Email	Kacsuk@sztaki.hu
• Telephone	+36 1 329 7864
• Fax	+36 1 329 7864

Project participants	
MTA SZTAKI- Laboratory of Parallel and Distributed Systems	Hungary
Centro de Investigaciones Energéticas Medio Ambientales y Tecnológicas (CIEMAT)	Spain
Foundation for the Development of Science and Technology in Extremadura (Fundecyt)	Spain
Institut national de recherche en informatique et automatique (INRIA)	France
University of Westminster	UK
Cardiff University	UK
University of Coimbra	Portugal
AlmereGrid	The Netherlands
Centre National de la Recherche Scientifique (CNRS)/IN2P3	France

Keywords	Grid, service grid, desktop grid, volunteer grid, internet public computing
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Collaboration with other EC funded projects	EGEE, CancerGrid, ETICS, SEE-GRID
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Table 6: Quick facts: EDGeS

References:

BOINC. (2009). BOINC - Open Source Software for Volunteer Computing and Grid Computing. *Accessible online <http://boinc.berkeley.edu/>*. Last accessed September 2009.

EDGeS. (2009). EDGeS project website. *Available online www.edges-grid.eu*. Last accessed August 2009.

EDGeS Monitoring. (2009). Enabling Desktop Grids for e-Science (EDGeS) Monitoring. *Accessible online <http://edges.dei.uc.pt/EDGeSMonitoring/>*. Last accessed September 2009.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html*. Last accessed August 2009.

GASuC. (2009). Grid Application Support Centre (GASuC). *Available online <http://www.lpds.sztaki.hu/gasuc/>*. Last accessed August 2009.

INRIA/IN2P3. (2008). XtremWeb - The Open Source Platform for Desktop Grids. *Accessible online <http://www.xtremweb.net/>*. Last accessed September 2009.

W-GRASS. (2009). Westminster Grid Application Support Service (W-GRASS) homepage. *Available online <http://wgrass.wmin.ac.uk/>*. Last accessed August 2009.

6. Facing the Challenges of the Data Deluge

6.1 DRIVERII: A pan-European knowledge repository for posterity

The project DRIVERII (“Digital Repository Infrastructure Vision for European Research – Phase II”)¹ is a multi-phase effort whose main objective is twofold: (i) setting-up a European *Confederation* for advocating and promoting EC Open Access mandates across European researchers and institutions, and (ii) enabling a *technical infrastructure* of European Institutional Repositories aggregating and making accessible Open Access content throughout Europe.

DRIVER Confederation. The DRIVER confederation is an organization of people working to achieve a formal establishment of an (European) digital repository community. The Confederation mirrors strategic alliances that move towards a global, interoperable, trusted, long-term repository infrastructure for which DRIVER has built the nucleus in Europe. It aims to encourage a combined effort of repository development between federations within a network of content providers. The Confederation partners represent European and international repository communities, subject based communities, repository system providers, service providers, as well as political, research, and funding organisations who share the DRIVER vision to allow all research institutions in Europe and worldwide to make all their research publications openly accessible through institutional repositories. DRIVER liaises with institutions and initiatives from the majority of European countries, the U.S., Canada, Latin America, China, Japan, India and Africa.

Closely related to the theme of interoperability and specifically in relation to this project, are the DRIVER Guidelines, as they create a common ground by achieving interoperability on two layers: (i) syntactical (use of OAI-PMH and OAI_DC), and (ii) semantic (use of vocabularies). The data in the technical infrastructure is based on locally hosted resources that are collected in digital repositories and harvested and aggregated by DRIVER. In order to ensure a high quality of aggregation, the DRIVER Guidelines have been developed to make it possible to harmonise and validate the data. DRIVER makes its aggregated data available for re-use via OAI-PMH to all partners in the DRIVER network of content providers whilst respecting the provenance of resources by “branding” them with information of the local repository. The DRIVER Guidelines provide orientation for managers of new repositories to define their local data-management policies, for managers of existing repositories to take steps towards improved services and for developers of repository platforms to add supportive functionalities in future versions. By following the Guidelines repositories can become part of the DRIVER network and can re-use DRIVER data for the development of local services. In essence then, the DRIVER Guidelines assist repository managers to make their material more widely available. Interoperability in the sense of the DRIVER Guidelines means standardised metadata of the harvested records, based on the use of standards.

¹ www.driver-community.eu

Technical Infrastructure. An important outcome of the DRIVER project is *D-Net*,² a software toolkit capable of enabling a running environment where data and service providers can (i) find the tools to aggregate heterogeneous OAI-PMH compliant Institutional Repositories into uniform shared Information Spaces, and (ii) dynamically build, modify and customize their Digital Library (DL) applications to operate over such Spaces. The technology supports a Service-oriented e-infrastructure, where distributed and shared resources are implemented as standard Web Services and applications consist of sets of interacting services. The current implementation of D-Net offers functionality services required to build distributed aggregation systems and DL end-user applications. Aggregation systems enable the construction of uniform Information Spaces of metadata records to be harvested from possibly heterogeneous Institutional Repositories. Important in this context are Store Services, Index Services and Aggregation Services, which offer advanced tools for OAI-PMH harvesting, cleaning and integrating metadata records according to target metadata record formats. The resulting Information Spaces can then be accessed via an arbitrary number of DL applications built by service providers by combining D-Net services such as Recommendation, Collection, Browsing, User Interfaces and others.

Key features of D-Net are the *scalability* and the *openness* of its infrastructure instances. Specifically, an instance of the DRIVER infrastructure can scale up to arbitrary numbers of service instances, applications and organizations while the underlying application framework is open to the introduction of services providing new functionality so as to extend the D-Net toolkit.

Since July 2008, the DRIVER project maintains a running instance of D-Net which hosts one main aggregation system, integrating Open Access metadata records from a growing number of European Institutional Repositories. At present, the infrastructure runs 36 services distributed over 9 partner sites; as a result of the Confederation efforts, the resulting Information Space numbers 1,000,000+ records out of 200+ repositories across 27 countries, and the number of repositories willing to join is still growing. Currently, the space is accessed by three DL applications: the Belgium national repository portal, offering search over the Belgium Repository Federation subset; Recolecta national repository portal, offering search on the Spanish Repository Federation subset; and the main DRIVER portal, providing access and advanced functionality over the whole space.

Scientific Publications/Selected Articles/DRIVER Studies:

Lossau, N. and Peters, D. (2008). DRIVER: Building a Sustainable Infrastructure of European Scientific Repositories. *Liber Quarterly*, 18(3/4): 437-448.

Foulonneau, M., Badolato, A., Horstmann, W., van Godtsenhoven, K., Robinson, M., Jones, S., Feijen, M. and Weenink, K. (2008). Rseaux d'archives institutionnelles en Europe: logiques developpement et convergences, *aMETIST, Vol.2, Partie 2: Capitalisation/ Mutualisation*, 2008, pp. 109-11.

² http://www.driver-repository.eu/D-NET_release: developed at Istituto di Scienza e Tecnologie dell'Informazione, CNR (Pisa, IT), ICM (Warsaw, PL), Department of Informatics and Telecommunications of the University of Athens (Athens, GR) and University of Bielefeld Library (Bielefeld, DE).

Feijen et al. (2007). DRIVER: Building the Network for Accessing Digital Repositories across Europe. *Ariadne*, Issue 53, October 2007.

Graaf, M. and Eijndhoven, K. (2007). The European Repository Landscape: Inventory study into present type and level of OAI compliant Digital Repository activities in the EU. *Amsterdam University Press*. ISBN 9789053564103. Available online <http://dare.uva.nl/document/93725>. Last accessed August 2009. **Driver Study**.

Weenink, K., Waaijers, L. and Godtsenhoven, K. (2007). A DRIVER's Guide to European Repositories : Five studies of important Digital Repository related issues and good Practices. *Amsterdam University Press*. ISBN 9789053564110. Available online <http://dare.uva.nl/document/93898>. Last accessed August 2009. **Driver Study**.

Foulonneau, M. and Andrè, F. (2007). The Investigative Study of Standards for Digital Repositories and Related Services. *Amsterdam University Press*. ISBN 9789053564127. Available online <http://dare.uva.nl/document/93727>. Last accessed August 2009. **Driver Study**.

Quick Facts:

Project acronym	DRIVER-II
• Start date	01/12/2007
• Duration	24 months
• Total budget	3 057 172 €

Web site	www.driver-repository.eu
• Point of contact	Michael Hatzopoulos
• Email	mike@di.uoa.gr
• Telephone	+210 727 5203
• Fax	+210 727 5214

Project participants	
University of Athens	Greece
University of Bielefeld	Germany
Consiglio Nazionale Delle Ricerche (CNR)	Italy
SURF Foundation	The Netherlands
University of Nottingham	UK
Centre National de la Recherche Scientifique (CNRS)	France
University of Bath	UK
University of Warsaw	Poland
University of Gent	Belgium
Goettingen State and University Library	Germany
Danmarks Tekniske Universitet	Denmark
Universidade do Minho	Portugal
Narodna in univerzitetna knjiznica	Slovenia

Keywords	Digital repository, infrastructure
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Collaboration with other EC funded projects	
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Quick facts: DRIVERII

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

6.2 EuroVO-AIDA: A Galactic-scale information repository for astronomical data and knowledge

The European Virtual Observatory - Astronomical Infrastructure for Data Access (EuroVO-AIDA) aims at unifying the digital data collections of European astronomy, integrating their access mechanisms with evolving e-technologies, and enhancing the science extracted from these datasets. Together with the VOTECH project and the Euro-VO Data Centre Alliance (EuroVO-DCA) project, EuroVO-AIDA is a sister project of the main European Virtual Observatory (Euro-VO) project. The EURO-VO project aims at deploying an operational European Virtual Observatory (VO). The VO will allow global electronic access to the available astronomical data archives of space and ground-based observatories, and sky survey databases. The objectives of Euro-VO are technology take-up and VO compliant resource provision, building the technical infrastructure and to support its utilization by the scientific community (Euro-VO, 2009). The EuroVO-AIDA project is proposed to lead the transition of Euro-VO into an operational phase.

EuroVO-AIDA will integrate the technology, networking and service activities of Euro-VO into a fully functioning structure. It will establish a Registry of VObs-compliant resources; support the network of Data Centres in deploying the VObs e-Infrastructure; co-ordinate the development of user tools for science extraction; and disseminate results to the astronomical community and identify their needs. The VObs interoperability standards will be updated taking into account feedback from implementation by data centres and from science usage. Specific emphasis will be placed on data access and data models, and on assessing innovative use of emerging technologies such as web 2.0 by data centres for continuous improvement of the e-Infrastructure (EuroVO-AIDA, 2009).

Some of the success stories of this project are now highlighted. EuroVO-AIDA organised the *EuroVO-AIDA School* on 30 March - 2 April 2009 at the European Space Organisation, Garching, Germany. The goals of the School were to expose European astronomers to the variety of VO tools and services available for their use. The workshop included several hands-on exercises that allowed the participants to become familiar with the various VO functionalities (data discovery and data mining, catalogue and table handling, image and spectra handling, etc.) and the tools used for these purposes.

At the time of writing, the project had already organised three *Euro-VO Technology Forums*, with the fourth forum being scheduled for 22-24 September, 2009 at Trieste. The technology forums intend to provide joint planning, sharing of best practice, dissemination of results, and technology exchange for all Euro-VO partners.

Euro-VO AIDA has organised an international workshop on “multi-wavelength astronomy and virtual observatory” at the European Space Astronomy Centre (ESAC) On 1-3 December, 2008. The goals of the workshop was to pinpoint the challenges that multi-wavelength astronomy will be facing in the coming years and to identify how the unique capabilities intrinsic to the VO concept, such as simultaneous access to different archives, metadata describing the content and quality of the data packages or tools to e.g. cross-correlate the various datasets, can meet them (ESAC, 2008).

The Euro-VO registry of resources (EURO-VO Registry, 2009) has been released on 13th March 2009. The IVOA Registry allows an astronomer to be able to locate, get details of, and make use of, any resource located anywhere in the IVO space, i.e. in any Virtual Observatory (IVOA.Net, 2009). There are utilities that have been designed to handle the Registry data online. They allow the user to search different resource types in the Registry, insert resources and update existing resources in the Registry.

Scientific Publications/Selected Articles (from 2008):

Please note that this list includes all EURO-VO publications (including EuroVO-AIDA, EuroVO-DCA, VOTECH)

Ball M. and Brunner R.J. (2009). Data Mining and Machine Learning in Astronomy. *International Journal of Modern Physics D*.

Budavari et al. (2009). GALEX-SDSS Catalogs for Statistical Studies. *The Astrophysical Journal*, 694(2):1281-1292.

Caballero J.A. et al. (2009). X-Ray Variability of sigma Orionis Young Stars as Observed with ROSAT. *The Astronomical Journal*, 137(6):5012-5021.

D'Abrusco, R., Longo, G. and Walton, N. (2009). Quasar candidates selection in the Virtual Observatory era. *Monthly Notices of the Royal Astronomical Society*, 396(1):223-262.

Deleuil et al. (2009). Exo-Dat: An Information System in Support of the CoRoT/Exoplanet Science. *The Astronomical Journal*, 138(2):649-663.

Fossati et al. (2009). The chemical abundance analysis of normal early A- and late B-type stars. *Astronomy & Astrophysics*.

Ganesh et al. (2009). Stellar populations in a standard ISOGAL field in the Galactic disc G. *Astronomy and Astrophysics*, 493(2):785-807.

Solano et al. (2009). The LAEX and NASA portals for CoRoT public data. *Astronomy & Astrophysics*.

Souchay J. et al. (2009). The construction of the large quasar astrometric catalogue (LQAC). *Astronomy and Astrophysics*, 494(2):799-815.

Valdivielso L. et al. (2009). An IPHAS-based search for accreting very low-mass objects using VO tools. *Astronomy and Astrophysics*, 497(3):973-981.

Bayo A. et al. (2008). VOSA: Virtual Observatory SED Analyzer. An application to the Collinder 69 open cluster. *Astronomy and Astrophysics*, 492(1):277-287.

Caballero J.A. (2008). Stars and brown dwarfs in the σ Orionis cluster: the Mayrit catalogue. *Astronomy and Astrophysics*, 478(2):667-674.

Caballero J.A. and Solano E. (2008). Young stars and brown dwarfs surrounding Alnilam (eps Ori) and Mintaka (del Ori). *Astronomy and Astrophysics*, 485(3):931-949.

Chilingarian I.V. and Mamon G.A. (2008). SDSSJ124155.33+114003.7 -- a Missing Link Between Compact Elliptical and Ultracompact Dwarf Galaxies. *Monthly Notices of the Royal Astronomical Society: Letters*, 385(1):L83-L87.

Costa A. et al. (2008). The TVO Archive for Cosmological Simulations: Web Services and Architecture. *The Publications of the Astronomical Society of the Pacific (PASP)*, 120(870):933-944.

Dalla S., Fletcher L. and Walton, N.A. (2008). Invisible sunspots and rate of solar magnetic flux emergence. *Astronomy and Astrophysics*, 479(1):L1-L4.

Freudling W. et al.(2008). The Hubble Legacy Archive NICMOS grism data. *Astronomy and Astrophysics*, 490(3):1165-1179.

Gonzalez-Solares E. et al. (2008). Initial data release from the INT Photometric H α Survey of the Northern Galactic Plane (IPHAS). *Monthly Notices of the Royal Astronomical Society*, 388(1):89-104.

Kennefick, J. and Bursick, S. (2008). Infrared Imaging of Sloan Digital Sky Survey Quasars: Implications for the Quasar K Correction. *The Astronomical Journal*, 136(5):1799-1809.

Quick Facts:

Project acronym	EuroVO-AIDA
• Start date	01/02/2008
• Duration	30 months
• Total budget	3 500 000 €

Web site	http://www.euro-vo.org/pub/ (Euro-VO project) http://cds.u-strasbg.fr/twikiAIDA/bin/view/EuroVOAIDA/WebHome (EuroVO-AIDA project)
• Point of contact	Francoise GENOVA
• Email	genova@astro.u-strasbg.fr
• Telephone	+33 3 90 24 24 32
• Fax	+33 3 90 24 24 32

Project participants	
Centre National de la Recherche Scientifique-Institut National des Sciences de l'Univers (CNRS-INSU)	France
European Space Agency	International
European Southern Observatory	International
Istituto Nazionale di Astrofisica (INAF)	Italy

Instituto Nacional de Técnica Aeroespacial (INTA)	Spain
Nederlandse Onderzoekschool voor Astronomie	The Netherlands
University of Leicester	UK
Max Planck Gesellschaft	Germany

Keywords	Scientific Digital repositories, Astronomy, Virtual Observatory, Interoperability
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Collaboration with other EC funded projects	EuroVO-DCA, VO-TECH
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Quick facts: EuroVO-AIDA

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

ESAC. (2008). EURO-VO AIDA workshop at ESAC (homepage). *Available online* <http://esavo.esa.int/MultiwavelengthVOWorkshopDec2008/>. Last accessed September 2009.

EURO-VO Registry. (2009). EURO-VO Full Harvestable VO Resource Registry. *Available online* <http://registry.euro-vo.org/>. Last accessed September 2009.

EURO-VO. (2009). The European Virtual Observatory (EURO-VO) project webpage. *Accessible online* <http://www.euro-vo.org/pub/>. Last accessed September 2009.

EuroVO-AIDA. (2009). The European Virtual Observatory - Astronomical Infrastructure for Data Access (EuroVO-AIDA) project homepage. *Accessible online* <http://cds.u-strasbg.fr/twikiAIDA/bin/view/EuroVOAIDA/WebHome>. Last accessed September 2009.

IVOA.Net. (2009). IVOA Resource Registry Working Group Home. *Available online* <http://www.ivoa.net/cgi-bin/twiki/bin/view/IVOA/IvoaResReg>. Last accessed September 2009.

6.3 GENESI-DR: European scientists conduct collaborative studies on the state of the Earth.

GENESI-DR (Ground European Network for Earth Science Interoperations - Digital Repositories) has the challenge of establishing open Earth Science Digital Repository access for European and world-wide science users. GENESI-DR shall operate, validate and optimise the integrated access and use available digital data repositories to demonstrate how Europe can best respond to the emerging global needs relating to the state of the Earth, a demand that is unsatisfied so far.

Scientific Publications/Selected Articles:

Fusco, L. (2009). GENESI-DR Paving the way for access to all Earth Science Data. Zero-In (first edition). Available online http://www.genesi-dr.eu/documents/GENESI-DR_Paving_the_way_for_access_to_all_Earth_Science_Data.pdf. Last accessed August 2009.

GENESI-DR. (2008). ESA leads endeavour to save Earth Science data. Available online http://www.esa.int/esaEO/SEMDFQK26DF_index_0.html. Last accessed August 2009.

Quick Facts:

Project acronym	GENESI-DR
• Start date	01/01/2008
• Duration	24 months
• Total budget	5 407 150 €

Web site	www.genesi-dr.eu
• Point of contact	Luigi Fusco
• Email	luigi.fusco@esa.int
• Telephone	+39 06 941 80 530
• Fax	+39 06 941 80 532

Project participants	
European Space Agency	France
ElsagDatamat	Italy
Deutsches Zentrum für Luft - und Raumfahrt e.V. (DLR)	Germany
Centre National d'Etudes Spatiales (CNES)	France
Kongsberg Satellite Services (KSAT)	Norway
InfoTerra	UK
Italian Space Agency (ASI)	Italy
Norsk institutt for luftforskning (NILU)	Norway
European Commission Joint Research Centre (JRC)	International
University of Reading	UK
Ente per le Nuove Tecnologie l'Energia e l'Ambiente (ENEA)	Italy

Terradue	Italy
CS Systèmes d'Information Space Unit	France

Keywords	digital repositories, data access, research infrastructure, Earth science, e-Infrastructure
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Collaboration with other EC funded projects	D4SCIENCE, DEGREE, GÉANT2, SEADATANET
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Quick facts: GENESI-DR

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

6.4 METAFOR: Europe in the forefront of climate change research

The main objective of METAFOR is to develop a Common Information Model (CIM) to describe climate data and the models that produce it in a standard way, and to ensure the wide adoption of the CIM. METAFOR will provide an essential asset for the numerous stakeholders actively engaged in climate change issues (policy, research, impacts, mitigation, private sector).

Scientific Publications/Selected Articles:

“Metafor: managing metadata for climate models” Sarah Callaghan, Reinhard Budich, Gerry Devine, Eric Guilyardi, Bryan Lawrence and Sophie Valcke, Zero-In magazine, Issue 3: Successful case studies of eScience/eResearch projects in Europe and globally <http://www.beliefproject.org/zero-in/zero-in-third-edition/metafor-managing-metadata-for-climate-models>

Quick Facts:

Project acronym	METAFOR
• Start date	01/03/2008
• Duration	36 months
• Total budget	2 890 000 €

Web site	http://metaforclimate.eu/
• Point of contact	Dr Eric Guilyardi
• Email	E.D.A.Guilyardi@reading.ac.uk
• Telephone	+44 118 378 8315
• Fax	+44 118 378 8316

Project participants	
University of Reading	UK
Science and Technology Facilities Council/British Atmospheric Data Centre (BADC)	UK
Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique (CERFACS)	France
Max-Planck Gesellschaft zur Foerderung der Wissenschaften, Max-Planck Institute for Meteorology/Model and data (MPI-M/M&D)	Germany
Centre National de la Recherche Scientifique /Institut Pierre Simon Laplace (CNRS/IPSL)	France
University of Manchester	UK
UK Met Office	UK
Administratia Nationala de Meteorologie (ANM)	Romania
Meteo France/CNRM	France
CL!MPACT	France
Princeton University	US
European Centre for Medium-Range Weather Forecasts (ECMWF)	EU

Keywords	Metadata, climate modelling, data management, information model standards, numerical simulation, IPCC
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Collaboration with other EC funded projects	ENSEMBLES, CCMVAL, EC-EARTH, GENESIDR
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Quick facts: METAFOR

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

6.5 NMDB: Finding answers to the effect of space weather on humans, technological systems, and the environment

The worldwide network of standardized neutron monitors is, after 50 years, still the state-of-the-art instrumentation to measure variations of the primary cosmic rays. These measurements are an ideal complement to space based cosmic ray measurements. Unlike data from satellite experiments neutron monitor data has never been available in high resolution from many stations in real-time. The data is often only available from the individual stations website, in varying formats, and not in real-time. To overcome this deficit, the European Commission is supporting the Neutron Monitor DataBase (NMDB) as an e-Infrastructures project in the Seventh Framework Programme in the Capacities section. Stations that do not have 1-minute resolution will be supported by the development of an affordable standard registration system that will submit the measurements to the database via the internet in real-time. This resolves the problem of different data formats and for the first time allows to use real-time cosmic ray measurements for space weather predictions (NMDB, 2009a).

NMDB will provide a real-time database of cosmic ray measurement which will help to answer questions like the effects of space weather on humans, technological systems, and the environment. All neutron monitors operated in Europe and some neighbouring countries will pool their data to make them available in real time and provide easy-to-use data products to scientists and others. In addition to the database, the NMDB project will provide different data products, for example, data pertaining to the near real-time determination of ionisation and radiation dose rates induced by cosmic rays in the Earth's atmosphere. Besides creating a database and developing applications working with this data, a part of the project is dedicated to create a public outreach website to inform about cosmic rays and possible effects on humans, technological systems, and the environment (NMDB, 2009a).

Some of the achievements of this project are now outlined. Most of this information is collected from NMDB (2009b). Real time NMDB data is now being made available and updated regularly by several neutron monitor stations with high resolution (one minute). The NMDB Event Search Tool (NEST) has been developed that can be used to plot and retrieve NMDB data. This tool also allows the user to generate quick snapshots of recent data and also detailed plots of individual events (including solar cosmic rays and Forbush decreases). Furthermore, an alert system for *solar energetic particle events* is presently under experimentation on the NMDB website. This alert system is intended to provide real-time alerts of imminent and major solar particle events, using the rapid arrival of the few, but fast energetic particles that are detected by neutron monitors.

Finally, the NMDB project has created several tools that allow users to interact with the NMDB database. These tools can be categorised under the following three categories (example of tools are included in the parenthesis). More information on these tools can be found in the NMDB website (NMDB, 2009a).

- **User tools to send the data to/ retrieve from NMDB** (C interface to NMDB; ASEC data deployment script; IDL and Python scripts for Kerg_ori and Tera_ori; software for feeding 1-Min and 1-Hour Almaty Data, etc.)

- **User tools for data processing**
- **User tools for data visualization** (NEST, NMDB Event Search Tool; NMDB visualization and retrieval tool)

Scientific Publications/Selected Articles:

In development.

Quick Facts:

Project acronym	NMDB
• Start date	01/01/2008
• Duration	24 months
• Total budget	500 000 €

Web site	http://www.nmdb.eu
• Point of contact	Dr. Christian Steigies
• Email	steigies @ physik.uni-kiel.de
• Telephone	+ 49 431 880 1763
• Fax	+ 49 431 880 3968

Project participants	
Christian-Albrechts-Universität zu Kiel	Germany
Institute of Experimental Physics, Slovak Academy of Sciences	Slovakia
University of Oulu	Finland
University of Bern	Switzerland
Institute of Earth magnetism, ionosphere and radiowaves propagation (IZMIRAN)	Russia
l'observatoire de Paris	France
National and Kapodistrian University of Athens	Greece
Yerevan Physics Institute	Armenia
University Roma Tre	Italy
Institute of Ionosphere	Ukraine
Tel Aviv University	Israel
University of Alcalá	Spain

Keywords	Cosmic rays, Sun, Sun-Earth system, Database
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Collaboration with other EC funded projects	COST 724, SWEETS, EURADOS
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Quick facts: NMDB

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

NMDB. (2009a). Neutron Monitor DataBase (NMDB) project website. Available *online* www.nmdb.eu. Last accessed September 2009.

NMDB. (2009b). NMDB: First Results. Available *online* http://cosmicrays.oulu.fi/nmdbinfo/sites/default/files/NMDB_Brochure_3_4.pdf. Last accessed September 2009.

6.6 PARSE.Insight: Enabling permanent access to the records of science in Europe

PARSE.Insight is an initiative aimed at the preservation of digital information in science, from primary data through analysis to the final publications resulting from the research. Its aim is to develop a roadmap and recommendations for developing the e-Infrastructure in order to maintain the long-term accessibility and usability of scientific digital information in Europe.

Scientific Publications/Selected Articles:

In development.

Quick Facts:

Project acronym	PARSE.Insight
• Start date	01/03/2008
• Duration	24 months
• Total budget	1 250 000 €

Web site	www.parse-insight.eu
• Point of contact	David Giaretta
• Email	d.l.giaretta@rl.ac.uk
• Telephone	+447770326304
• Fax	+441235446362

Project participants	
Science and Technology Facilities Council (STFC)	UK
Koninklijke Bibliotheek	The Netherlands
Deutsche Nationalbibliothek	Germany
Max Planck Gesellschaft (MPG)	Germany
International Association of Scientific, Technical and Medical Publishers (STM)	The Netherlands
European Space Agency ESRIN (ESA)	France
FernUniversität in Hagen	Germany
European Organization for Nuclear Research (CERN)	Switzerland
Georg-August-Universität Göttingen Stiftung Öffentlichen Rechts (UGOE)	Germany

Keywords	digital preservation, e-infrastructure
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Collaboration with other EC funded projects	CASPAR, DILIGENT, GENESI-DR
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Quick facts: PARSE.Insight

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

6.7 PESI: A shot in the arm for management of biodiversity in Europe

PESI – The Pan-European Species directories Infrastructure - is the next step in integrating and securing taxonomically authoritative species names directories in Europe. Species names are critical data for biodiversity management and for most branches of biodiversity related applied and fundamental research. Correct species names are likewise important for pest and disease control, agriculture, aquaculture, forestry, fisheries, habitat protection, environmental control, and nature conservation. Therefore the availability of high quality taxonomic name services, including valid species names and names relationships, functioning as authoritative taxonomic reference system, is essential for biological data management (PESI, 2009b).

PESI is addressing weaknesses in taxonomic databases, including the standardisation of taxonomic data and database systems; completion of high quality taxonomic data sets; improving integration and accessibility of taxonomic reference systems (PESI, 2009b). It is a standards-based, quality-controlled, expert-validated, open-access infrastructure for research, education and data & resource management (de Jong et al., 2008). PESI brings together the three largest species databases in Europe – Fauna Europaea (FAEU, 2004), European Register of Marine Species (ERMS, 2008) and Euro+Med PlantBase (Euro+Med, 2006) – together with European-based Global Species Databases, e.g. World Register of Marine Species (WoRMS, 2009), and their associated expertise networks, e.g., PESI unites the two major European experts networks on marine and animal taxonomy integrated in the Society for the Management of Electronic Biodiversity Data (SMEBD, 2009).

PESI brings together the national and regional representatives - referred to as Focus Points. These Focal Points work with the database experts in building the quantity and quality of information in the databases. According to PESI (2009b), “PESI is working towards the geographic expansion of the European networks of experts to cover the entire Palaearctic bio-geographic region, beginning with Turkey, Georgia, Ukraine and Russia. This network is crucial for the exchange of information between the pan-European infrastructure and the knowledge resources at the local level, which are the primary sources of species information at the national level. PESI is engaging with end-users so the databases will benefit their needs, and with scientific publishers to link the databases with online publications so as to benefit the wider scientific and user communities. PESI will raise all three regional databases to a common standard of accessibility over the internet, through the PESI Portal. This will include interlinked regional and national checklists, species distributions, legal status, vernacular names, and socio-economic importance.”

PESI has recently entered into collaboration with the European Topic Centre on Biological Diversity (ETC/BD) (Eionet, 2009). ETC/BD supports the EU Nature Directives develops biodiversity-related indicators. ETC/BD will provide PESI the most up-to-date versions of species lists of the annexes of the Nature Directives. PESI will use these for cross-validation against the pan-European checklists of Fauna Europaea (FAEU, 2004), ERMS (ERMS, 2008) and E+M PlantBase (Euro+Med, 2006) and provide a first review of the taxon names figuring in the Annexes of the Birds and Habitats Directives. PESI will also provide ETC/BD with downloads of the pan-European checklists as soon as new versions of these become available. For

Fauna Europaea (FAEU, 2004) this is expected to be in June or July of this year (PESI, 2009).

PESI has featured in the MarBEF newsletter. MarBEF is one of the Networks of Excellence funded by the EU. The reference to the PESI article in MarBEF is de Jong et al. (2008).

Yet another success of this project is the European Science Foundation (ESF, 2009) networking proposal: “*Citizens Monitoring Biodiversity (CMD)*”, a combined EDIT/PESI/LifeWatch initiative, was recommended for funding by the ESF Standing Committee for Life, Earth and Environmental Sciences (LESC). Out of 112 eligible proposals in all scientific fields, 20 were recommended for submission for funding to ESF Member Organisations in the course of 2009. The aim of the project is to involve organisations of naturalists, such as bird watchers and botanists, in Europe-wide monitoring of biodiversity. As a first important step, the various groups should agree as much as possible in standards regarding the names of organisms, as well as on observation metadata and monitoring schemes. PESI would play an important role in providing taxonomic standards. The results will be beneficial for both the naturalist community and for scientists and researchers making use of data collected by volunteers (PESI, 2009).

Scientific Publications/Selected Articles:

de Jong, Y., Costello, M., Appeltans, W. and Nash, R. (2008). PESI: Pan-European Species-directories Infrastructure. *MarBEF Newsletter*, 8:33-34. Available online <http://www.vliz.be/imisdocs/publications/141373.pdf>. Last accessed September 2009.

Quick Facts:

Project acronym	PESI
• Start date	01/05/2008
• Duration	36 months
• Total budget	4 057 628 €

Web site	www.eu-nomen.eu/pesi
• Point of contact	Dr Yde de Jong
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• Telephone	+31.20.5257191
• Fax	+31.20.5255402

Project participants	
Cab International	UK
Comitato Scientifico per la Fauna d'Italia (CSFI)	Italy
Consejo Superior de Investigaciones Científicas (CSIC)	Spain
Comenius University in Bratislava	Slovakia
Ecological Consultancy Services Ltd	Ireland
University of Helsinki; Finnish Museum of Natural History	Finland
Free University of Berlin; Botanischer Garten und Botanisches Museum Berlin-	Germany

Dahlem	
Hellenic Centre for Marine Research (HMCR)	Greece
Slovak Academy of Sciences; Institute of Botany	Slovakia
National Academy of Sciences of Ukraine; Institute of Biology of the Southern Seas	Ukraine
International Commission for Zoological Nomenclature	UK
Ilia Chavchavadze State University	Georgia
Israel Oceanographic and Limnological Research Ltd.	Israel
Polish Academy of Sciences; Institute of Oceanology	Poland
University of Latvia	Latvia
Marine Biological Association of the UK	UK
National Natural History Museum Paris	Paris
Asociatia Mynature	Romania
National Museum of Natural History - Naturalis	The Netherlands
Natural History Museum	UK
National Institute of Biology	Slovenia
National and Kapodistrian University of Athens	Greece
National Museum of Natural History	Bulgaria
Swedish Museum of Natural History	Sweden
Norwegian University of Science and Technology	Norway
National University of Ireland	Ireland
Polish Academy of Sciences; Museum and Institute of Zoology	Poland
Royal Botanic Gardens, Kew	UK
Society for the Management of Electronic Biodiversity Data	Ireland
National Academy of Sciences of Ukraine; State Museum of Natural History	Ukraine
Swiss Systematics Society	Switzerland
Trakya University	Turkey
Università degli studi di Palermo	Italy
Université des Sciences et Technologies de Lille	France
University of Sevilla	Spain
Universiteit van Amsterdam; Faculteit der Natuurwetenschappen, Wiskunde en Informatica; Zoologisch Museum Amsterdam	The Netherlands
Vlaams Instituut voor de Zee	Belgium
Institute of Ecology of Vilnius University	Lithuania
Russian Academy of Sciences; Zoological Institute	Russia
University of Copenhagen; Zoological Museum	Denmark

Keywords	Taxonomy, biodiversity informatics, taxonomic meta-data standards
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Collaboration with other EC funded projects	EDIT, MarBEF, Life Watch, SYNTHESYS, CATE
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Quick facts: PESI

References:

- de Jong, Y., Costello, M., Appeltans, W. and Nash, R. (2008). PESI: Pan-European Species-directories Infrastructure. *MarBEF Newsletter*, 8:33-34. Available online <http://www.vliz.be/imisdocs/publications/141373.pdf>. Last accessed September 2009.
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- FAEU. (2004). Fauna Europaea – A database of the scientific names and distribution of all living multicellular European land and fresh-water animals. Available online <http://www.faunaeur.org/>. Last accessed September 2009.
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- PESI. (2009b). PESI brochure. Available online http://www.eu-nomen.eu/pesi/index.php?option=com_remository&Itemid=56&func=fileinfo&id=377. Last accessed September 2009.
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- WoRMS. (2009). World Register of Marine Species (WoRMS) homepage. Available online <http://www.marinespecies.org/>. Last accessed September 2009.

7. Infrastructures for Remote Instrumentation

7.1 DORII: e-Infrastructures make possible the fusion of scientific instruments across the world!

The DORII project aims to integrate scientific instruments into e-Infrastructures to make them available for broader scientific communities. These communities are characterised by the fact that although such advanced ICT technology is still not available at the appropriate level at present, it is in high demand because of its potential to make enormous improvements in their day-to-day working. DORII paves the way for new applications of e-Infrastructures targeted at these scientific communities (e.g., Grid-enabled remote instruments such as autonomous underwater vehicles for oceanographic measurements, or earthquake sensors or cameras), through integration of scientific instrumentation in complex workflows and providing the ability to interact with them from the desktop (DORII, 2008). The project objectives are as follows (Meyer, 2009):

- Adopt e-Infrastructure functionality across selected areas of science and engineering. Presently DORII is focusing on the following selected scientific areas: earthquake community (with various sensor networks), environmental science community, and experimental science community (with synchrotron and free electron lasers).
- Deploy and operate persistent production quality distributed instrumentation, integrated with e-Infrastructure
- Adapt a framework environment that can be used for fast prototyping

DORII works closely with the end-users and provides solutions that build upon the success of past and ongoing projects in such areas as remote instrumentation (GRIDCC, RINGrid), interactivity (int.eu.grid), software frameworks for application developers (g-Eclipse) and advanced networking technologies (GN2) with EGEE based middleware. Regular interaction with the end-users ensures that risks associated with delivering new e-Infrastructure solutions to the target communities can be mitigated. Furthermore, building upon past successes makes it possible deliver solutions based on proven methodologies and technology.

DORII applications require the integration of scientific instruments with computational and storage resources to facilitate data acquisition, storage and processing. Coordinated and secure access to instruments, data and computational resources is an important requirement for the effective remote usage of these instruments by the application and their users. To fulfil the above requirements the DORII project utilizes the capabilities of existing grid infrastructures in Europe, adding the necessary components and services to facilitate remote instrumentation. The DORII e-Infrastructure is mainly based on the EGEE (Enabling Grids for E-scienceE) infrastructure and its middleware of choice gLite. The middleware service dealing with the management of remote instrumentation is the **Instrument Element (IE)** that is being built by the DORII project. To deal with the interactivity

requirements of the applications the DORII e-Infrastructure deploys a selection of services built by the Interactive European Grid Project - int.eu.grid (DORII, 2009).

DORII was among the top 10 projects (out of a total of 198 projects) in the exhibition award at the EU conference on information and communication technologies (ICT2008) in Lyon, France (25 – 27 November 2008). At this event DORII showcased an interactive robot demo which showed the steering of intelligent instruments over the Grid using web services technology (DORII, 2008). On this regard, the DORII project is also focused on dissemination of its outcomes and in raising awareness of the technology adopted among the targeted communities.

Scientific Publications/Selected Articles:

Author	Conference/Journal	Title
Adami et al.	Tridentcom09	The DORII Project Test Bed: Distributed e-Science Applications at Work
Cheptsov et al.	CMST	Porting the OPATM-BFM Application to a Grid e-Infrastructure – Optimization of Communication and I/O Patterns
Salon et al.	CMST	Remote Oceanographic Instrumentation Integrated in a GRID Environment
Prica, Del Linz, Pugliese, Curri	INGRID'08	ADAPTING THE INSTRUMENT ELEMENT TO SUPPORT A REMOTE INSTRUMENTATION INFRASTRUCTURE
Adami, D., Barceló, Á. D. G., Coz, I. C., Davoli, F., Gamba, P., Keller, R., Kranzlmüller, D., Labotis, I., Meyer, N., Monteoliva, A., Plóciennik, M., Prica, M., Pugliese, R., Salon, S., Schiffers, M., Watzl, J., Zafeiropoulos, A., de Lucas, J. M.	<i>Proceedings, Cracow Grid Workshop October 2008</i>	DORII – Deployment of Remote Instrumentation Infrastructure
Kourousias, Prica, Del Linz, Pugliese, Curri	CMST	Integrating Instruments in the Grid for on-line and off-line processing in a synchrotron radiation facility

Quick Facts:

Project acronym	DORII
Start date	01/02/2007
Duration	30 months
Total budget	3 601 690 €

Web site	www.dorii.eu
Point of contact	Norbert Meyer
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Project participants

Instytut Chemii Bioorganicznej PAN Poznan Supercomputing and Networking Center (PSNC)	Poland
Consejo Superior de Investigaciones Cientificas (CSIC)	Spain
Consejo Superior de Investigaciones Cientificas (CNIT)	Italy
ELETTRA Sincrotrone Trieste SCpA	Italy
European Centre for Training and Research in Earthquake Engineering (EUCENTRE)	Italy
Ludwig-Maximilians-Universität München	Germany
High Performance Computing Center of the University of Stuttgart (USTUTT)	Germany
National Institute of Oceanography and Experimental Geophysics (OGS)	Italy
Ecohydros SL	Spain
Greek Research and Technology Network S.A. (GRNET)	Greece
Universidad de Cantabria	Spain

Keywords	Remote Instrumentation, Grid, Experimental Equipment, Remote Sensors, Remote Visualisation
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Collaboration with other EC funded projects	int.eu.grid (FP6), RINGrid (FP6), g-Eclipse (FP6), EGEE -II (FP6), GRIDCC (FP6), EUFORIA
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Quick facts: DORII

References:

DORII. (2008). Remote Instrumentation on the Grid: DORII gets going (Press Release). Available online <http://www.dorii.eu/press>. Last Accessed August 2009.

DORII. (2009). The DORII Infrastructure. Available online <http://www.dorii.eu/infrastructure>. Last Accessed August 2009.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. Available online http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

Meyer, N. (2009). Integrating e-Infrastructure and scientific instrumentation. Projects (February 2009 issue), pp. 20-21. British Publishers. Available online <http://viewer.zmags.com/publication/116913e6#/116913e6/22>. Last accessed 9th August 2009.

8. Keeping the World in Touch

8.1 BELIEF-II: A one-stop-shop for e-Infrastructure dissemination activities

BELIEF-II (Bringing Europe's eElectronic Infrastructures to Expanding Frontiers) built on the successes of the its first phase, aims at coordinating the efficient & effective communication of results, networking and knowledge between e-Infrastructure projects and their users to promote worldwide development and exploitation of e-Infrastructures. The objectives of this project are further described below, together with the actions carried out by its consortium to achieve them.

With the dual objectives of establishing synergies between the e-Infrastructure projects and to realise effective dissemination of results and best practices, BELIEF-II, supported the EC in the organisation and delivery of three **Concertation Meetings**. The 5th *Concertation meeting* with a central theme on *standards* (held on 6th June in Barcelona, Spain), the 6th *Concertation meeting* which focussed on *sustainable e-Infrastructures* (held on 24th November in Lyon, France) and finally the last eConcertation Meeting which was held in Brussels on the 24th-25th November 2009 - with the central theme of *e-Infrastructure for e-Science*. The BELIEF consortium also successfully delivered two **Brainstorming Events** and three **International Symposia** respectively in India, Brazil and South Africa. The aforementioned networking events have effectively engaged the European and the international e-Infrastructure communities and have provided valuable inputs to the European Commission on various aspects pertaining to the European and global e-Infrastructures, such as, the current challenges in terms of standardisation and governance models, relevant issues to be addressed, and the future course of actions.

BELIEF-II Concertation Meetings: These events are of particular importance as they represent a bottom-up process to identify commonalities and synergies between projects, the various national actions and research initiatives, standardisation activities, etc. The success of the aforementioned concertation events were achieved also thanks to a new and effective approach suggested by the BELIEF-II consortium: the use of the eConcertation Forum.

BELIEF-II eConcertation Forum: The primary objective of the eConcertation Forum, accessible at <http://www.beliefproject.org/forum/>, is to provide an online platform for those involved in the various FP7 e-Infrastructure projects to discuss and debate key matters pertaining to e-Infrastructures both prior and after the Concertation meetings. The EC encouraged contributions to these online discussions considering them valuable for the success of the eConcertation activity itself.

BELIEF-II Brainstorming Event: The purpose of these events is to identify and discuss big-picture opportunities for e-Infrastructure applications and to propose solutions for problems identified during the Concertation Meetings. In the wave of its first-phase successful workshops, the 5th brainstorming event was jointly organised with the CASPAR consortium and it took place in Athens on 6-7 April, 2009. Discussions revolve around the theme of "Sustainable e-Infrastructures: Challenges in

Data Provenance and Authenticity” –which had emerged from the discussions that took place during the 6th *Concertation meeting* (24th November in Lyon, France). The 6th of the series, was held in Brussels on the 24th & 25th of February and focused on Global Research Communities: success criteria for future impact. The event, organised back to back with the eResearch2020 workshop, brought together participants from several disciplines and with different background/roles. The output of the workshop will be a report/position statement intending to contribute to the drafting of the EU research agenda on the related issues.

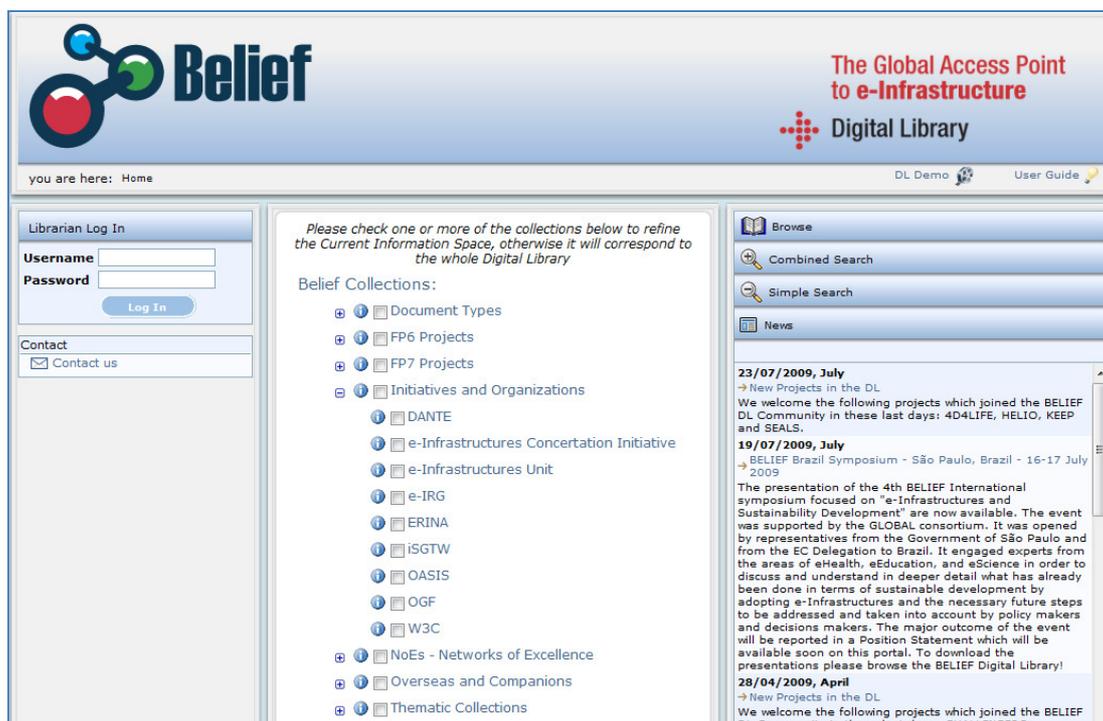
BELIEF-II International Symposia: The consortium organised three international symposia.

The BELIEF Indian Symposium, jointly organised with the 6CHOICE consortium, focused on “*Distance Learning as an e-Infrastructures application: innovation and future trends*” – It was organised in New Delhi, India - 28 & 29 January 2009. The second international symposia with the central theme of “*Future trends and e-Infrastructures application: towards sustainable development*” - was organised in São Paulo, Brazil - 16 & 17 July 2009 and finally the third one was held in Johannesburg, South Africa and it was jointly organised with the CHPC. The aforementioned meetings were aimed at facilitating knowledge exchange and strengthening the links between Europe and the hosting countries with regards to the deployment and exploitation of e-Infrastructures. They provided an opportunity to reinforce the global relevance and impact of EU e-Infrastructure. Furthermore, the international symposia were successful in fostering the dialogue between the local policy and decision makers and key actors in these emerging economies and their EU counterparts. Major outcomes and future actions have been illustrated in the public event reports available on the [BELIEF portal](#) and in the project Digital Library. Both these on-line dissemination tools are further described in the paragraph below

BELIEF Digital Library (DL): The BELIEF-II DL is a customisation of OpenDLib, a Digital Library Management System comprising of a federation of services that can be customised to meet the requirements for a target user community. This federation can be expanded at any time by adding other community specific services. The entire set of services can be managed and hosted either by a single or by a multitude of organisations collaborating on the maintenance of the shared digital library, each according to their own computational and human resources (BELIEF-II DL, 2009b).

The DL is an important channel through which BELIEF-II disseminates the results of the e-Infrastructure projects. This powerful repository service hosts, preserves and manages e-Infrastructure material pertaining to the various FP6 and FP7 e-Infrastructure projects. The DL is constantly been expanded and now includes resources from the overseas partners that are associated with these projects (e.g., UbuntuNet Alliance). The collection in the DL is categorised in several ways so as to aid easy navigation (Screenshot 4). For example, it is possible to browse the DL using document types (e.g., case studies, deliverables, dissemination and training, technical documents, wikis, etc), using particular FP6 and FP7 projects, through thematic collections (AAI, bioinformatics, IPv6, QoS, Sustainability, VO, etc.), by Network of Excellence, etc. The DL provides features that allow the user to perform both simple and combined (advance) search. The DL has an online users’ guide (BELIEF-II DL, 2009b) that is targeted towards the end-user of the DL and it focuses on the

functionalities that provide access to the DL's capabilities for content management and collection search/browsing.



Screenshot 4: BELIEF-II Digital Library

BELIEF-II Portal: The BELIEF-II portal is the one-stop-shop of the global e-Infrastructure community. It is a sort of “MySpace” for the e-Infrastructure projects. To join this e-Infrastructure community, the users need to register themselves through the portal. The portal then allows them to submit events in the e-Infrastructures event calendar, to publish e-Infrastructures news, to browse the BELIEF-II community and contact other members, to create and manage their profile, and to submit documents to the BELIEF-II DL (through an interface to the DL).

With the objective of disseminating the results of the European e-Infrastructure projects in a clear, coherent and efficient way, BELIEF-II created a suite of joint communications products such as a video, two editions of an e-Infrastructure guide, e-Infrastructure news magazine **Zero-In** and two EC publications. At the time of writing this document (which incidentally is also an EC publication), most of these communication products were developed. This section will mainly focus on the video, the two e-Infrastructures Guide and Zero-In magazine since four issues of this magazine have already been released.

Zero-In Magazine: aims to showcase and widely disseminate the results of research and development activities that are currently taking place in the world of e-Infrastructures. The title is inspired by the concept of the Zero distance neighbourhood of global research. The targeted audiences of this magazine include national and international policy makers as well as key individuals involved in using or developing e-Infrastructures across the world. Each issue of Zero-In has a thematic section and features articles on “hot” topics with global relevance. At the time of writing, four issues of Zero-In were released both in electronic and paper format and widely disseminated through media channels and during international conferences.

Paper copies were distributed, thanks to the valuable support of the international partners, to policy makers and stakeholders, including Embassies, in India, Brazil and South Africa. The four issues of Zero-In are available on line and downloadable in pdf. format at <http://www.beliefproject.org/media-corner/e-magazine>

EGI video: This three-minute animated video will contribute to spread the word on this new European reality: EGI and to support its dissemination particularly during its start-up phase.. This video will be useful for projects worldwide that would link with EGI, as well as to let new MEPs and new commissioners know about this new direction that Europe is taking.

Two e-Infrastructures Guides: They aim at providing detailed *take away* information for researchers on what e-Infrastructures are, which projects exist and how to use them. In this light and in the international spirit of the BELIEF project, the first edition of the Guide focused on the international most relevant projects with a specific focus on initiatives like GEANT, CLARA, TEIN, etc. The second edition , which is on-going, will provide an overview of the hot topic of Scientific Data in the e-Infrastructures in the European Capacities Programme. There has been a growing concern in the past five years both on policy and technical issues related with managing scientific information and relevant investments have been made by the EC in order to response to the so called 'data flood' challenge. The BELIEF publication will offer an overview of the major EU fund projects on data and highlight the challenges which still need to be addressed and sorted out.

Scientific Publications/Selected Articles:

None reported.

Quick Facts:

Project acronym	BELIEF-II
• Start date	01/04/2008
• Duration	25 months
• Total budget	1 242 845 €

Web site	www.beliefproject.org
• Point of contact	Stephen Benians
• Email	s.benians@metaware.it
• Telephone	+39 050 3871400
• Fax	+39 050 3871401

Project participants	
Metaware SPA	Italy
Institute of Information Science and Technologies (CNR-ISTI)	Italy
Meraka Institute, Council for Science and Industrial Research	South Africa
Education and Research NETwork (ERNET)	India
National Kapodistrian University of Athens (NKUA)	Greece
EPUSP - Escola Politécnica da Universidade de Sao Paolo	Brazil

Brunel University	UK
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Keywords	e-Infrastructures, Coordination, eConcertation
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Collaboration with other EC funded projects	GLOBAL, GridTalk
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Quick facts: BELIEF-II

References:

BELIEF. (2007). BELIEF project homepage. *Accessible online* <http://belief1.metaware.it/>. Last accessed September 2009.

BELIEF-II. (2009). BELIEF-II project homepage. *Accessible online* <http://www.beliefproject.org/>. Last accessed September 2009.

BELIEF-II DL. (2009a). *Accessible online* <http://belief-dl.research-infrastructures.eu/>. Last accessed September 2009.

BELIEF-II DL. (2009b). BELIEF Digital Library User's Guide. *Accessible online* https://userguide.wiki.belief.research-infrastructures.eu/index.php/Main_Page. Last accessed September 2009.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

8.2 GLOBAL: Reducing the environmental impact of collaboration

GLOBAL's (Global Linkage Over Broadband Links) suite of advanced communication technologies promote an environment-friendly (lower travel carbon emissions) approach to communicate and share ideas. GLOBAL provides virtual conference centre using advanced communication technologies and concepts to support the promotion of e-Infrastructure topics in Europe and around the world. This enables research projects to organise training events, participate in conferences and workshops and to disseminate the results of their projects remotely. The use of GLOBAL's teleconferencing suite reduces the carbon footprint that would otherwise be associated if the participants were to meet at a physical location. e-Infrastructures promote Global Virtual Research Communities and GLOBAL plays a very important part in realising this vision, since it focuses on virtual communication of results, dissemination, training, etc. Furthermore, access to teleconference facilities over broadband links will enable GLOBAL to support the promotion of e-Infrastructures to audiences that are located in various geographical location.

GLOBAL's Virtual Conference Centre (VCC, 2009) provides three main functions focused on usability: *a virtual auditorium* (for planning, coordination and management of the virtual events), *an event repository* (to store the recordings and outcomes of the events), and *a virtual corridor* (which will support networking and partnership building amongst the participants). Through its Virtual Conference Centre GLOBAL has supported several virtual conference events. A list of GLOBAL-supported virtual conference events (from May 2008) is given below (IPW, 2009).

Event	Event Date	Description
EULAKS Summer School	17-30 August, 2009	The central aim of the Summer School is the creation of a face-to-face linkage between young European and Latin American researchers and senior scholars in the social sciences and humanities with a focus on the design and implementation of public science, technology and innovation (STI) policies (EULAKS, 2009).
4th BELIEF International Symposium 2009 in Brazil	16- 17 July, 2009	Refer to Section 8.1.
GLOBAL e-Infrastructure Networking Event II (Middle East, Africa, Asia, Pacific)	1st July, 2009	The purpose of this event is to introduce the "e-Infrastructures" area in FP7 with a focus on the seventh call for proposals.
GLOBAL e-Infrastructure Networking Event I (Caribbean, Latin & North America)	23rd June, 2009	The purpose of this event is to introduce the "e-Infrastructures" area in FP7 with a focus on the seventh call for proposals.
TERENA Networking Conference 2009	9th June, 2009	http://tnc2009.terena.org/ (last accessed September, 2009)
BELIEF-6CHOICE India Symposium	28-29 January, 2009	Refer to section 8.1.
Telecom I+D 2008	29-31 October, 2008	http://www.telecom-id.com/ (last accessed

		September, 2009)
EGEE'08 Conference	22-26 September, 2008	http://egee08.eu-egee.org/ (last accessed September, 2009)
Internet Next Generation (NG) Conference 2008	16th October, 2008	http://internetng.dit.upm.es/english/workshops-internet-next-generation/ (last accessed September, 2009)
TERENA Networking Conference 2008	19-22 May, 2008	http://tnc2008.terena.org/ (last accessed September, 2009)

Table 7: Virtual conference events supported by GLOBAL

Scientific Publications/Selected Articles:

None reported.

Quick Facts:

Project acronym	GLOBAL
• Start date	01/05/2008
• Duration	30 months
• Total budget	1 251 651 €

Web site	www.global-project.eu
• Point of contact	Dr. Margit Hofer
• Email	hofer@zsi.at
• Telephone	+43/(1) 495 0442 63
• Fax	+43/(1) 4950442 40

Project participants	
Zentrum für Soziale Innovation	Austria
U. Politécnica de Madrid	Spain
Agora Systems S.A.	Spain
Cooperación Latino Americana de Redes Avanzadas (CLARA)	Uruguay
University College London	UK
Jozef Stefan Institute	Slovenia
Ubuntunet	Malawi

Keywords	Networking; Dissemination; Promotion
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Collaboration with other EC funded projects	6DISS, BELIEF-II, CEENet, CERNet, DANTE, eDeissa, EGEE, GÉANT2, GridTalk, PHIME
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Quick facts: GLOBAL

References:

EULAKS. (2009). EULAKS Summer School. Available online <http://www.eulaks.eu/summerschool.html>. Last accessed September 2009.

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

GLOBAL. (2009). Global Linkage Over Broadband Links website. *Available online* <http://www.global-project.eu/>. Last accessed September 2009.

IPW. (2009). Isabel Plaza Wiki: Community Portal. *Available online* http://isabel.dit.upm.es/mediawiki/index.php/Main_Page. Last accessed September 2009.

VCC. (2009). GLOBAL Virtual Conference Centre. *Available online* <http://vcc.dit.upm.es/>. Last accessed September 2009.

8.3 GridTalk: Disseminating the success stories of European e-Infrastructures

The European Commission (EC), through the EC Unit INFSO-F3 "GÉANT & e-Infrastructure", funds various projects on Research Infrastructures. The results achieved by these projects need to be disseminated in proper channels with the aim of realising the full potential of the Research & Development activities, networking and standardisation activities, capacity building exercises, etc. being carried out through funds made available by the Commission. It is therefore not surprising that the projects are expected to take active part in disseminating the project aims and objectives, the results achieved and the success stories. In addition to this project-level dissemination, the Commission has funded an e-Infrastructure project called GridTalk which has the specific objective of disseminating the success stories of Europe's e-Infrastructure by targeting three main audiences: policymakers working in government, science and industry; scientists with an interest in grid computing; and the general public. Through its coordinated reporting and dissemination activities GridTalk has been very successful in portraying the achievement of Europe's e-Infrastructure to a wider audience.

GridTalk has utilised the following six mechanisms for dissemination, (a) GridBriefings; (b) GridCafé; (c) GridCast; (d) GridGuide; (e) International Science Grid This Week (ISGTW). These are discussed below.

(a) GridBriefings

GridTalk works with various European e-Infrastructure projects to produce GridBriefings. These briefings strive to provide timely summaries of policy-oriented reports and key issues. The GridBriefings are mainly targeted at the policy makers in government and the industry, scientists (to inform them of the potential of e-Infrastructures to conduct their own research) and the general public (to create a general awareness). These briefings have a very appropriate caption line "Grid computing in five minutes" which informs the non-technical reader that the GridBriefing has been written in jargon-free language, are concise and the content can be easily understood. The GridBriefings, and the topics they have been associated with are summarised below (GridTalk, 2009):

Issue	Topic	Description of content
June 2008 – Issue 1	Grids and standardization	What are grid standards? How is the grid community meeting the standards challenge? Examining the standards debate and the need (or otherwise) for grid standards.
August 2008 – Issue 2	What is grid?	How do grids work? Why are they useful? Introducing grid computing with case studies of its application to high energy physics, fusion energy, malaria control and more.
September 2008 – Issue 3	European Grid Initiative	What is the European Grid Initiative? What does it hope to achieve? Summarizing the blueprint for EGI: towards a sustainable long-term European grid infrastructure.
January 2009 – Issue 4	Grid and clouds	What's the difference between a grid and a cloud? How can these technologies interact? Investigating the role of grids and clouds in

		providing the extra computing power needed for European innovation.
March 2009 – Issue 5	Facing the skills shortage: attracting more women to ICT	How can we encourage more women into Information and Communication Technologies? Analyzing the situation of women in ICT and ways in which we can increase their number.
April 2009 – Issue 6	The future of innovation: developing Europe's ICT e-Infrastructures	What do Europe's ICT infrastructures look like now? What needs to happen over the next ten years to ensure we remain competitive? Summarizing the achievements and challenges of European e-Infrastructures for e-science.
July 2009 – Issue 7	A Greener Way? Grids and Green Computing	Climate change is one of the biggest challenges facing us in the 21st century and, across Europe, efforts are being made to cut down on energy usage and carbon emissions. How grid computing and green ICT can help us reach the EU's green targets by 2012.

Table 8: GridBriefings and the various topics they cover

(b) GridCafé

The GridCafé website (GridCafé, 2009) is publicised as “the place for everybody to learn about grid computing” and it is devoted to explaining the complex grid concepts in a simple and simulating manner. Originally the website was created by CERN and it is presently maintained, updated and improved by GridTalk. The GridCafé website can be accessed in five languages (English, Spanish, French, Chinese and Hungarian) and enables the users to learn about grid computing using multimedia. The website provides a wealth of information on grid computing such as a discussion on grid architecture and the key grid concepts; a historical reflection on grids in the overall context of computer history; a listing of projects that are utilising grid computing and a listing of key people involved; current debates on grid computing, for example, how can we ensure the future of e-Science, etc.

(c) GridCast

GridCast – the faces & places behind the grid – is essentially a blogging website that is used by participants in a grid event to blog about their experiences. By visiting the GridCast website (GridCast, 2009) the users can get to know the latest happenings in various grid computing events taking place across the world. They can listen to podcasts and webcasts uploaded in the GridCast website, view pictures and read articles and thereby virtually share some of the excitement at these grid events. Some of the events that have been covered by GridCast include:

- SuperComputing 06 (13-17 November 2006; Tampa, Florida, USA)
- EGEE User Forum (9-11 May 2007; Manchester, UK)
- 23rd Open Grid Forum (2-6 June 2008; Barcelona, Spain)
- International Summer School on Grid Computing 2008 (6-18 July 2008; Balatonfüred, Hungary)
- EGEE'08 Conference (22-26 September 2008; Istanbul, Turkey)
- SuperComputing 08 (15-21 November, 2008; Austin, Texas, USA)
- HealthGrid 2009 (29 June-1 July, 2009; Berlin, Germany)
- 4th BELIEF International Symposium (16-17 July 2009; São Paulo, Brazil)

(d) GridGuide

With the aim of projecting “the human face of grid computing,” the GridGuide was developed to demonstrate the global reach and variety of grid computing, in terms of the countries and organisations involved, and the scientists and engineers who work to make it happen (GridGuide, 2009). The website has an interactive world map and the users can become aware of the different organisations working on various grid projects through a click of the mouse. Some of the organisations features in the website include:

- Queen Mary (University of London), UK
- Institute of Physics of Cantabria (IFCA), Spain
- European Organization for Nuclear Research (CERN), Switzerland
- University of Naples - Parthenope, Italy
- Nordic Data Grid Facility, Norway
- National Institute of Physics and Nuclear Engineering (NIPNE), Romania
- Fermilab, USA
- Academia Sinica Grid Computing (ASGC), Taiwan

(e) International Science Grid This Week (ISGTW)

ISGTW is a successful weekly electronic newsletter that informs over three thousand readers in one hundred countries about scientific grid computing. ISGTW was formed as a joint project between Open Science Grid in the U.S. and EGEE. GridTalk will allow ISGTW to cover more European grid projects and to expand the ISGTW resources section, providing information and support for scientists working with grids or considering becoming involved. iSGTW is a weekly newsletter, presently read by more than 15,000 people every week and having more than 5,000 subscribers in more 100 countries, that promotes grid computing by highlighting stories of grid-empowered research, scientific discoveries, and grid technology from around the world (iSGTW, 2009). iSGTW was launched on 16 November 2006 as a jointly funded by the U.S. Department of Energy’s Office of Science and the National Science Foundation, through the Open Science Grid, and by the European Commission’s Information Society and Media Directorate-General, through GridTalk (iSGTW, 2009).

GridTalk will allow iSGTW to cover more European grid projects and to expand the iSGTW resources section, providing information and support for scientists working with grids or considering becoming involved (GridTalk, 2009). The other projects that are involved in iSGTW through the provision of contributing editors include EGEE, TeraGrid, OSG and GridPP.

iSGTW has an extensive website. It has archives dating back to 2006 and makes available material published by its precursor – Science Grid This Week (first published in April 2005. It was funded by the National Science Foundation and U.S. Department of Energy’s Office of Science). The website allows users to subscribe to the iSGTW electronic newsletter. As mentioned previously, iSGTW is presently subscribed by approximately 5,000 users. Presently iSGTW is in issue 137. The articles published in this newsletter appear under one of the following four categories (a) Feature, (b) Opinion/Editorial/Technology, (c) Link/Acronym/Statistic/Post, and

(d) Announcement. The newsletter encourages contributions from its readers and has submission guidelines listed in its website.

Scientific Publications/Selected Articles:

None reported.

Quick Facts:

Project acronym	GridTalk
• Start date	01/05/2008
• Duration	24 months
• Total budget	726 447 €

Web site	www.gridtalk.org
• Point of contact	Dr Sarah Pearce
• Email	s.pearce@qmul.ac.uk
• Telephone	+61 35261 6840
• Fax	+44 20 8981 9465

Project participants	
Queen Mary, University of London	UK
Mr. Andre-Pierre Olivier (GridCafé)	France
European Organization for Nuclear Research (CERN)	Switzerland

Keywords	Grid, e-infrastructure, science, dissemination, policy, impact
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Collaboration with other EC funded projects	GridTalk aims to collaborate with all EC funded e-infrastructure projects
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Table 9: Quick facts: GridTalk

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

GridTalk. (2009). GridTalk website. *Accessed online* <http://www.gridtalk-project.eu/index.php>. Last accessed August 2009.

GridCafé (2009). GridCafé website. *Accessed online* <http://www.gridcafe.org/>. Last accessed August 2009.

GridCast. (2009). GridCast website. *Accessed online* <http://gridcast.web.cern.ch/Gridcast/>. Last accessed August 2009.

GridGuide (2009). GridGuide website. *Accessed online <http://www.gridguide.org/>.*
Last accessed August 2009.

iSGTW. (2009). International Science Grid This Week (iSGTW) website. *Accessed
online <http://www.isgtw.org/>.* Last accessed August 2009.

8.4 EUAsiaGrid: Building an EuroAsian e-Infrastructure community

The EUAsiaGrid project promotes awareness in the Asian countries of the *EGEE* e-Infrastructure and related European e-Infrastructure projects and supports capacity building in the region. To this end, it: (a) supports scientific communities through help with application porting and deployment; (b) provides training to further increase grid technology know-how; (c) monitors the results and gives feedback for the definition of policies. The consortium behind the project comprises 17 partners – fourteen in the Asia-Pacific region - in twelve countries.

In order to develop a deeper understanding of the computing, storage, application support and training requirements, EUAsiaGrid has conducted a *Requirements Survey* in five different languages (English, Mandarin, Thai, Vietnamese, Malaysian). Based on the evidence collected and on the local expertise of the partner institutions in the region, the project has developed coordination and support activities to help foster the establishment of certified resources in the partner countries and to increase human capacity for local support. It has provided support for applications in areas such as high energy physics, computational chemistry, mitigation of natural disasters, bioinformatics and biomedical science and social sciences. The establishment of the EUAsia VO as a catch-all VO for the Asia-Pacific region has enabled researchers throughout the region to gain access to grid resources through a simplified process in order to increase uptake of the infrastructure.

The project has produced a number of successful instances of scientific work conducted on the infrastructure. For example, the *EUAsiaGrid DC2 (Data Challenge 2) Refined Activity* has focused on screening of 20,000 potential ligands for Avian Flu target proteins. EUAsiaGrid has delivered an intuitive and user-friendly productive system that enables biologists to run the simulations and to manage the results on the grid as easily as with a desktop application (GAP 2009a). In March 2009, virtual screening jobs were run consuming a total of 1,111 CPU-days under the EUAsia VO and more than 160,000 output files with a data volume of 12.8 Gigabytes were created and stored in a relational database (GAP, 2009b). With the success of the *Avian Flu DC2 Refine drug discovery*, the EUAsiaGrid project has also launched the *EUAsiaGrid Dengue Fever Activity*. Similar activities are being prepared in other application areas such as disaster mitigation.

As many of today's scientific challenges require long-term international collaboration, it is paramount that researchers have access to a persistent, sustainable infrastructure that they can access as needed. Such an infrastructure needs to be supported so that researchers can take its operation for granted and focus on their substantive research work. In order to foster the long-term sustainability of the infrastructure the EUAsiaGrid has supported, the project has developed a roadmap (EUAsiaGrid 2010) that outlines the collaboration and governance structures for an Asia-Pacific Grid Initiative that will build on and expand on the work done by EUAsiaGrid and work e-Infrastructures in other regions such as the European Grid Initiative and the Latin-American Grid Initiative.

The activities of EUAsiaGrid and the project participants have been widely reported in the International Science Grid This Week (iSGTW) publication this year, e.g., ASGC (2009) and Grey (2009a, 2009b, 2009c).

Project Outputs:

ASGC. (2009). Academia Sinica watches global carbon. International Science Grid This Week (iSGTW), 12 August 2009. <http://www.isgtw.org/?pid=1001915>. Last accessed September 2009.

GAP (2009a). EUAsiaGRID DC2 Refined Activity: Grid-enabled Virtual Screening Service. GAP - Grid Application Platform website. Available online at: http://gap.grid.sinica.edu.tw/index.php?option=com_content&task=view&id=17&Itemid=59. Available online September 2009.

GAP (2009b). Dengue Fever Activity in EUAsiaGrid: GAP Virtual Screening Service. GAP - Grid Application Platform website. Accessible online at: http://gap.grid.sinica.edu.tw/index.php?option=com_content&task=view&id=18&Itemid=59. Last accessed September 2009.

Grey, F. (2009a). Food for thought at EUAsiaGrid. International Science Grid This Week (iSGTW), 18 March 2009. Available online <http://www.isgtw.org/?pid=1001787>. Last accessed September 2009.

Grey, F. (2009b). Volunteer computing goes East. International Science Grid This Week (iSGTW), 6 May 2009. Available online <http://www.isgtw.org/?pid=1001689>. Last accessed September 2009.

Grey, F. (2009c). Asian computers join forces against avian flu. International Science Grid This Week (iSGTW), 26 August 2009. Available online <http://www.isgtw.org/?pid=1001965>. Last accessed September 2009.

EUAsiaGrid (2008). EUAsiaGrid project website. Available at <http://www.euasiagrid.org/>. Last accessed February 2010.

EUAsiaGrid (2010). EUAsiaGrid Roadmap: A vision for an Asia-Pacific e-Infrastructure for Research and Education. Available at: <http://www.euasiagrid.eu/roadmap>

Quick Facts:

Project acronym	EUAsiaGrid
• Start date	01/04/2008
• Duration	24 months
• Total budget	1 454 150 €

Web site	www.EUAsiaGrid.org
• Point of contact	Prof. Marco Paganoni
• Email	marco.paganoni@mib.infn.it

• Telephone	+390264482409
• Fax	+390264482463

Project participants	
Istituto Nazionale di Fisica Nucleare (INFN)	Italy
CESNET – Czech NREN operator	Czech Republic
National Centre for e-Social Science (University of Manchester)	UK
HealthGrid	France
Ateneo de Manila University	Philippines
Australia National University	Australia
Academia Sinica Grid Computing Centre (ASGC)	Taiwan
Advanced Science and Technology Institute (ASTI)	Philippines
Hydro and Agro Informatics Institute (HAI)	Thailand
Infocomm Development Authority	Singapore
Institute of Information Technology	Vietnam
Institut Teknologi Bandung	Indonesia
National Electronics and computer Technology Center (NECTEC)	Thailand
University Putra Malaysia	Malaysia
MIMOS	Malaysia

Keywords	Grid, e-Science, EGEE, training, dissemination, Grid application, e-infrastructure use
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Collaboration with other EC funded projects	EGEE III, EGI_DS, EUChinaGRID, EUIndiaGRID
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Quick facts: EUAsiaGrid

8.5 LinkSCEEM: Narrowing the digital divide between the Eastern Mediterranean and the Western World

The acronym LinkSCEEM stands for *Linking Scientific Computing in Europe and the Eastern Mediterranean*. This support action aimed to ensure that the High Performance Computing (HPC) facility at CaSToRC (Computation-based Science and Technology Research Centre), which is being built by the Cyprus Institute in Nicosia, develops strong anchors in both the European ICT infrastructure and the Eastern Mediterranean scientific community, thereby helping to build scientific and technological bridges between Europe and the Middle East and to narrow the digital gap between the Eastern Mediterranean and the Western World. CaSToRC will be a regional HPC centre of significant size designed primarily to serve the needs of Cyprus and the Eastern Mediterranean region, with an associated research and educational centre devoted to supercomputing applications in science and technology.

The actions of this project included (a) the assessment of needs for computational resources within the scientific community of Cyprus and the Eastern Mediterranean (LinkSCEEM, 2009b); (b) the coordination of HPC resources in the region and the planning of user access to HPC resources both in the region and EU-wide (LinkSCEEM, 2009d); (c) to conduct prospective study of the improvement of the network connectivity in the region (LinkSCEEM, 2009c); (d) the development of research and educational programmes in computational science (LinkSCEEM, 2009e); (e) dissemination and outreach through the organisation of an International Conference, user workshops and various other actions (LinkSCEEM, 2009a, 2009f).

The project conducted some 15 Users Meetings and created a database of over 600 users from the region throughout its lifetime. It also conducted pilot training activities in HPC, notably at the University of Jordan, and favoured the incubation of active research partnerships within the Eastern Mediterranean region. The project has thus laid the foundations of a user community that will be built upon with research and education projects relevant to the region in the future.

The LinkSCEEM High Performance Computing (HPC) conference was held from the 6th to the 8th of October, 2009. Its aim was to create a platform for the coordination of the regional HPC collaboration. It was attended by internationally recognised computational scientists and leading experts of the European and US HPC scene. They met with HPC users and prominent personalities of the regional scientific community. The conference highlighted the achievements of the LinkSCEEM project, favoured interactions between regional and global actors in the field, and highlighted to civil society the benefits of computational approaches to science. Renowned speakers of the HPC community presented at the conference. The conference also held tutorial tracks on HPC clusters, HPC applications and software development.

Scientific Publications/Selected Articles/Project Reports:

LinkSCEEM. (2009b). LinkSCEEM - Assessment of Needs. Available online http://www.linksceem.eu/LinkSCEEM_Reports/D3%20Final%20report%20WP2.pdf . Last accessed February 2010.

LinkSCEEM. (2009c). LinkSCEEM - Network Study. *Available online* http://www.linksceem.eu/LinkSCEEM_Reports/D11%20Final%20report%20WP5.pdf . Last accessed February 2010.

LinkSCEEM. (2009d). LinkSCEEM - Coordination of Resources and Access of Users. *Available online* http://www.linksceem.eu/LinkSCEEM_Reports/D9%20Final%20report%20WP3.pdf . Last accessed February 2010.

LinkSCEEM. (2009e). LinkSCEEM - Computational Science Research and Training Perspective. *Available online* http://www.linksceem.eu/LinkSCEEM_Reports/D10%20Final%20report%20WP4.pdf . Last accessed February 2010.

LinkSCEEM. (2009f). LinkSCEEM - Dissemination and Outreach. *Available online* http://www.linksceem.eu/LinkSCEEM_Reports/D12%20Final%20report%20WP7.pdf . Last accessed February 2010.

Quick Facts:

Project acronym	LinkSCEEM
• Start date	01/04/2008
• Duration	22 months
• Total budget	747 164 €

Web site	www.linksceem.eu
• Point of contact	Dr. Alan O’Cais
• Email	a.ocais@cyi.ac.cy
• Telephone	+357 22208633
• Fax	+357 22208625

Project participants	
The Cyprus Institute	Cyprus
CSCS, Swiss National Supercomputing Centre in Manno	Switzerland
GRNET, the Greek national academic networking authority	Greece
IUCC, the Israeli national consortium coordinating scientific computing activities	Israel
Illinois / National Center for Supercomputing Applications	US
John von Neumann Institute for Computing (NIC) in Jülich	Germany
SARA, the Dutch national HPC and networking center	The Netherlands
SESAME, the UNESCO-sponsored synchrotron facility in Jordan	Jordon

Keywords	HPC, Middle East, e-infrastructures, EUMed
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Collaboration with other EC funded projects	EUMedconnect, PRACE, EGEE 2, DEISA
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Quick facts: LinkSCEEM

References:

European Commission – Information Society and Media. (2008-2009). Framework Programme 7 (2007-2013) Research infrastructures projects. *Available online* http://cordis.europa.eu/fp7/ict/e-infrastructure/home_en.html. Last accessed August 2009.

LinkSCEEM. (2009a). LinkSCEEM project website. *Available online* <http://www.linksceem.eu/joomla/>. Last accessed September 2009.

LinkSCEEM. (2009b). LinkSCEEM - Assessment of Needs. *Available online* http://www.linksceem.eu/LinkSCEEM_Reports/D3%20Final%20report%20WP2.pdf . Last accessed February 2010.

LinkSCEEM. (2009c). LinkSCEEM - Network Study. *Available online* http://www.linksceem.eu/LinkSCEEM_Reports/D11%20Final%20report%20WP5.pdf . Last accessed February 2010.

LinkSCEEM. (2009d). LinkSCEEM - Coordination of Resources and Access of Users. *Available online* http://www.linksceem.eu/LinkSCEEM_Reports/D9%20Final%20report%20WP3.pdf . Last accessed February 2010.

LinkSCEEM. (2009e). LinkSCEEM - Computational Science Research and Training Perspective. *Available online* http://www.linksceem.eu/LinkSCEEM_Reports/D10%20Final%20report%20WP4.pdf . Last accessed February 2010.

LinkSCEEM. (2009f). LinkSCEEM - Dissemination and Outreach. *Available online* http://www.linksceem.eu/LinkSCEEM_Reports/D12%20Final%20report%20WP7.pdf . Last accessed February 2010.