

EU-IndiaGrid2 - Sustainable e-infrastructures across Europe and India

This the first of a series of EU-IndiaGrid2 newsletters gives an insight into the project objectives and examines the work being done to develop the vision of a worldwide Grid for Research which can provide valuable and cutting-edge computing resources that can maximise research into fields that require data-intensive computing and data access.

The newsletter will also look at recent improvements to the Indian National Knowledge Network (NKN) and the Indian Grid infrastructure GARUDA, as well as highlighting the Gridseed testcase which is an a key and easily deployable training grid infrastructure that can be used almost anywhere in the world.

Finally, the spotlight is turned on upcoming events at which EU-IndiaGrid2 partners will be participating including the EU-IndiaGrid2 supported Worldwide Collaboration on e-Infrastructures Information stand at ICT2010.

Advancing Scientific Frontiers

Climate change and world-wide health threats are two of the grand global challenges which can be effectively addressed only through co-operation worldwide. Investment in e-Infrastructures is enabling collaborative research across national borders. Innovative large-scale science relies on new methods for complex problem solving underpinned by Grid Computing, which provides computing and data resources to researchers all over the world with modest investments in local infrastructures.

Both Europe and India embrace this vision of a worldwide grid for research as it effectively responds to the need for scientific collaboration in a networked world to address grand global challenges. *“EU-IndiaGrid has proven to effectively mobilise actors on both sides for the benefit of the research community”,* says Ms Viviane Reading, European Commissioner, Information Society and Media in recognition of the instrumental role of the EU-funded EU-India Grid initiative in fostering international co-operation with scientific challenges high on the agenda.

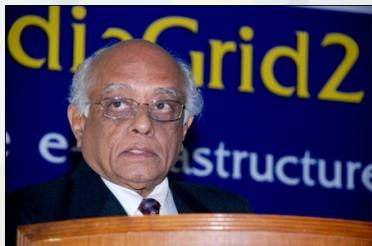
The EC-funded EU-IndiaGrid2 (2010-2012) capitalises on the achievements of EU-IndiaGrid (2007-2009) by acting as a bridge across European and Indian e-Infrastructures to foster evolution in these regions ensuring sustainable scientific, educational and technological collaboration. EU-IndiaGrid2 also collaborates with other international initiatives which are also developing around the world such as EGI in Europe, TEIN3, EUAsiaGrid in Asia, EUMEDGRID-Support in the Meditteranean basin, and SEEGRID-SCI in order to improve global connectivity between regional grids by collaborating with initiatives in Asia and around the globe.

“The EC-funded project EU-IndiaGrid2 (2010-2012) builds on the achievements of the original EU-IndiaGrid initiative by improving the interoperation of e-Infrastructures and Grids between Indian and European Grid initiatives, supporting the development of sustainable e-



Infrastructures across Europe and India.” Alberto Masoni, Director of Research at INFN – the Italian National Institute of Nuclear Physics & EU-IndiaGrid Project Manager.

Supporting User Communities



“I am happy to learn about the second phase EU-IndiaGrid2 project – Sustainable e-Infrastructures across Europe and India. The first phase has been immensely beneficial for a variety of scientific disciplines including Biology, Earth Science and the Indian collaboration for the Large Hadron Collider (LHC).” - Dr R. Chidambaram, Principal scientific advisor to the Government of India

EU-IndiaGrid2 continues to support EU-Indian collaboration by focusing efforts on four specific user communities in the exploitation of grid infrastructure:

Climate change is one of the greatest challenges facing society today and a top priority for governments in Europe and India. Important decisions need to be made on how to protect the planet and research into climate modeling is key to assisting in this process. EU-IndiaGrid2 partners ICTP and IIT Delhi are supporting climate change modelling studies on European and Indian e-Infrastructures by using the Regional Climate Model RegCM, developed by ICTP in Trieste Italy, to produce regional climate change scenarios for the 21st century over the South Asia region, encompassing India and surrounding areas providing a dataset of unprecedented quality to assess the potential of global warming effects on the South Asia region. Additionally, scientists using the GRID system will be able to run different simulations at the same, and thus to complete a relatively large ensemble of experiments.

Further work by IISC will also see the creation of a persistent climate modelling service on the trans-continental resources, that can be used by climate scientists to perform long-running climate studies of interest to Europe and India from intraseasonal to decadal scales.

High Energy Physics - The Large Hadron Collider (LHC) program represents both major and unique science and research facilities that are now shared between India and Europe. The role that EU-IndiaGrid played in this development has been widely recognised at the highest level. EU-IndiaGrid2 will continue in this key role by supporting the participation of students and experts at related training events

Biology - Bioinformatics is the formal representation of biological knowledge and is fast emerging as an important discipline for academic research and industrial applications, creating a need for the use of Grid computing techniques for large-scale distributed applications. Systems that support the Biology community sees tasks such as the maintenance of vastly diverse computational tools and databases of ranging sizes; mining of data and the provisioning of databases in derived patterns such as protein motifs, and simulations of molecular dynamics, ligand screening and biochemical pathways.

In EU-IndiaGrid2 the University of Cambridge and NCBS, Bangalore will support closer ties to enable further development research with of software for the grid. Furthermore, the project will support exchange visits the two organizations and training offering the opportunity for experimentalists and computationalists to interact directly, so that the two lines of research can work together.

Material Science - Research into Material Science requires cross-disciplinary research services, computational tools and techniques. EU-IndiaGrid2 is establishing and reinforcing relevant EU-Indian collaborations supported by important EU and Indian Institutions. EU-IndaGrid2 partners ICTP, University of Pune, CEA-Grenoble will work together in order to focus on the testing of applications in order to test already developed parallel paradigms on the GRID; carry out a detailed comparison between EU and Indian GRIDS; and extend material science applications to more complex areas of condensed matter simulation. A number of scientific questions and simulation methods will be focusing on a number of areas on nanoparticles, nano tubes and nanowires.

Sustaining Indian e-Infrastructure

Interoperability and interoperation between major the European and Indian Grid infrastructures EGEE, and GARUDA respectively, is a crucial step towards establishing a cross-continent and even global Grid infrastructure. EU-IndiaGrid2 is paving the way for a



Garuda & NKN in India

global “seamless” integration of different Grid infrastructures. In order to achieve this primary goal, strong efforts are needed bilaterally to evolve towards a common standard. With 14 Garuda sites are currently connected to the National Knowledge Network including two LHC computing sites in Mumbai and Kolkata, it is clear that development in building collaborative research communities is advancing well.

In this section, we look at developments at GARUDA, the Indian Grid network, and the Indian National Knowledge Network and how EU-IndiaGrid2 is working to improve the work of scientific collaborative research communities by creating a merged network, grid and data infrastructure.

NKN – Linking Indian Research

The National Knowledge Network (NKN) announced that it will be linking to an further 550 premier institutions across India by the end of this year. The NKN has been established to interconnect all Indian research, higher education and scientific institutions in the country, over a period of three years in order to encourage sharing of knowledge, specialised collaborative research resources among scientists, researchers and students from diverse spheres across the country to work together for advancing human development in critical and emerging areas with particular emphasis on education, health and agriculture.

The benefit for researchers experts and students alike is massive enabling access to a seamless variety of resources such as specialized applications and allow sharing of high performance computing facilities, e-libraries, virtual classrooms and very large databases. For example, the Indian Space Research Programme will offer 20,000 hours of video material. Connecting to the network is the easy part however, the challenge to institutions states Mr Raghavan, Scientific Secretary, Office of the Principal Scientific Adviser, Government of India “will be to filter the knowledge that is relevant to them. This is the key to the mission going forward”

With an ultra high-speed core supporting a scalable architecture, institutes connecting to the NKN can benefit from speeds of 1 Gbps which will offer a nation-wide ultra high-speed backbone/data-network highway with an international reach. This will offer a variety of users including experts, professors and students computer-based research facilities with speeds that will eventually be scalable up to the order of 10s of gigabits per second coupled with extremely low latencies.

When complete, the NKN will bring together over 1000 institutes from all stakeholders in science, technology, higher education, research and development, grid computing, and e-Governance with speeds scalable up to the order of 10s of gigabits per second coupled with extremely low latencies.



According to Prabhakar Dhekne (left), Scientific Consultant Principal Scientific Adviser to the Govt. of India, Raja Ramanna Fellow at Bhabha Atomic Reserach Centre and EU-IndiaGrid Deputy Project Manager, EU-IndiaGrid2 is playing a major part in developing the international aspect of the NKN by “connecting major European e-infrastructures to the National Knowledge Network (NKN), an all-optic nation-wide core backbone based e-infrastructure in India, which will enable

scientists, researchers and students from different backgrounds and diverse geographies to work closely with any one across the globe for advancing human development in critical and emerging areas”.

GARUDA – Driving Grid Infrastructure in India



GARUDA is a comprising of computational nodes, storage devices and scientific instruments spanning across 17 cities with 45 participating institutions providing the technological advances required to enable data and compute intensive science for the 21st century.

The nationwide grid of science researchers and experimenters otherwise known as GARUDA spans across 17 cities with 45 participating institutions providing the technological advances required to enable data and compute intensive science for the 21st century. The grid is designed with the needs of scientific research at its heart, deploying tools and middleware to enable applications to run seamlessly across the grid and deploying innovation into some of the most complex scientific and engineering endeavours being undertaken by the research community. GARUDA is currently being widely used in a number of fields and work with EU-IndiaGrid2 will see this work intensify in the fields of Bio-Informatics, Material Sciences, Biology and High Energy Physics, all of which require intensive computing and data access, as well as aggregation of geographically distributed.

EU-IndiaGrid2 partner ERNET have been responsible for the establishment of the GARUDA High-Speed network, a Layer 2/3 MPLS Virtual Private Network (VPN), which connects all 45 GARUDA partner institutions across the India. Soon to be part of the National Knowledge Network, the GARUDA network has been boosted by the recent opening of a Teraflop Grid Computing Facility at the Centre of Development of Advanced Computing (C-DAC) in Hyderabad.

Within GARUDA various resources such as high performance computing systems (HPC) and satellite based communication systems have been committed by different centers of C-DAC and GARUDA partners. One of the major challenges of GARUDA is to deploy appropriate tools and middleware to enable applications to run seamlessly across the grid. The same challenge is faced by EU-IndiaGrid2 and the ambitious plans for enhancing cooperation between European and Indian grid infrastructures. The largest challenge in achieving this goal is the interoperability between the middleware used in the European Union and India, with Garuda based on Sigma, and using GT4 for job submission, Europe uses gLite, Unicore and Arc. This challenge will be addressed in the coming two years.

TEIN3 - Linking India to Asia



Thanks to TEIN3, Indian e-Infrastructures are now also interconnected to Europe and to South-East Asia with 2.5 Gb links. The third generation of the Trans-Eurasia Information Network (TEIN3) provides a dedicated high-capacity Internet network for research and education communities across Asia-Pacific. TEIN3 already connects researchers and academics in China, India, Indonesia, Japan, Korea, Laos, Malaysia, Nepal, Pakistan, the Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam and Australia. Bangladesh, Bhutan and Cambodia are in the process of getting connected, bringing the total number of partners involved in TEIN3 to 19.

With direct connectivity to Europe's GÉANT network, TEIN3 offers Asia-Pacific a gateway for global collaboration, enabling over 45 million users at more than 8000 research and academic centres to participate in joint projects with their peers in Europe and other parts of the world.

"The successful working of the initial phase of the multi-gigabit National Knowledge Network (NKN), Indian Certification Authority, and participation in Trans-Eurasia Information Network (TEIN3) phase 3 are some of the important building blocks for supporting virtual research communities in India and their collaboration work with other countries." - Dr R. Chidambaram, Principal scientific advisor to the Government of India

**The GRIDSEED Testcase -
Interoperability among gLite and
ARC middleware in training grid
infrastructures**



The GRIDSEED tool is a key training resource for EU-IndiaGrid2 which will hold advanced hands-on training events for system administrators, application developers and both novices and potential users of Grid infrastructure. GRIDSEED was developed during EU-IndiaGrid and provides a simple tool to setup up a portable fully fledged gLite grid infrastructure based on virtual machines. It exploits the concept of “grid in a box” providing a self-containing grid that could be easily deployed in any existing infrastructure for training and dissemination purposes.

GRIDSEED is the only grid virtual training infrastructure that provides an easy configurable environment where end users can experiment with interoperability issues on tightly integrated middleware. The training environment is formed by a virtual infrastructure where different grid middleware are inter-operating. High-level tools are also installed to help users in porting, deploying and accessing their application across the different available middleware allowing users to learn how to use ARC and GLite middleware and examine multi-level interoperability.



Recent improvements to GRIDSEED has seen the inclusion of ARC middleware in the original GRIDSEED infrastructure which incorporates GLite. This provides a unique training facility where users can learn how two similar grid middleware can interact in order to exploit of

the commonalities of both infrastructures with an emphasis on functional interoperability.

On top of the middleware components, GRIDSEED provides high level tools like GANGA and DIANE and other demo applications developed within **EUIndiaGrid** project.

GRIDSEED’s development will eventually see the establishment of a training facility that will provide to end users the possibility of facing grid interoperability features and issues when using quite widely deployed European grid middleware solutions. While using GRIDSEED, users are able to experience different levels of interoperability: Middleware level, scientific gateways level, application access level. GRIDSEED will be expanded to include support for other grid middleware like GARUDA used in the Indian Grid infrastructure, as well as other high level tools like web-based portals or workflow engines

URL: <http://gridseed.escience-lab.org/>

EU-IndiaGrid2 – On the road

Looking Forward

EU-IndiaGrid2 showcasing Worldwide Cooperation on e-Infrastructures – ICT2010, 27-29 September 2010, Brussels Belgium



EU-IndiaGrid2 in collaboration with EGI-Inspire, EUMEDGRID-Support and e-ScienceTalk (previously known as GridTalk) will present an exhibition stand in the International Village at ICT2010). The stand entitled “*Worldwide Cooperation on e-Infrastructures Supporting Collaborative Research on Climate Change and Large Scale Challenges*” will look at the powerful resource of shared distributed computing in helping scientists worldwide to deliver the latest

cutting-edge research and to meet some of the grand challenges being faced by society at-large today. International collaborative research is dependent on the successful development of e-Infrastructures that can connect scientists around the world and lead to far-reaching developments having a huge impact on citizens globally. The stand will showcase work from the EGI-Inspire, EU-IndiaGrid2, EUMEDGRID-Support and e-ScienceTalk projects highlighting the global e-Infrastructure landscape as well as major achievements, success stories and future perspectives from around the world. This includes activities of past and future projects such as EELA, EUAsiaGrid, SEE-GRID-SCI, GISELA, CHAIN with emphasis on the synergy among network, grids, high performance computing and data repositories, and their impact on large scale applications and collaborative research.

ICT2010 is Europe's most visible forum for ICT research and innovation. The biennial event has become a unique gathering point for researchers, business people, investors, and high level policy makers in the field of digital innovation,



High Performance Computing, Grid and Clouds – 21-25 June 2010, Cetraro, Italy



EU-IndiaGrid2 Project coordinator Alberto Masoni and Deputy Project Manager Prabhakar Dhekne will offer insight into e-Infrastructures in India at this high-level event which sees grid and cloud experts from around the world descend on the Italian town on Cetraro. The event, 21-25 June 2010, will examine the future developments in the HPC technologies, and to contribute to assess the main aspects of Grids and Clouds, with special emphasis on solutions to grid and cloud computing deployment. The HPC Advanced Workshops in Cetraro have brought together international leaders from academia, government, and industry continuously on a biennial basis since 1992, with two of the initial workshops sponsored by NATO.

Looking Back

The India-EU Workshop on Research Infrastructures & EU-IndiaGrid2 Launch event – 11-12 January 2010, New Delhi India

Co-sponsored by the Indian Department of Science and Technology and the European Commission the Workshop was led a number of important Indian and European dignitaries including Dr P. Chidambaram, Principal Scientific Advisor to the Government of India; Dr T. Ramasami, Secretary, Indian Department of Science and Technology; Prof Carlo Rizzuto, Chair, European Strategy Forum for Research Infrastructures; Mr Hervé Péro, Head, Research Infrastructures, DG RTD; and Mr Kostas Glinos, Head, GEANT & e-Infrastructures at the European Commission.

This workshop brought together about 20 European & 40 Indian researchers and administrators and was opened by Dr.R.Chidambaram who reflected on the Indian roadmap for research infrastructures (RI) and e-Infrastructures emphasising the importance for India of leveraging international partnerships to promote outward orientation that makes use of existing experience and maturity; the central role of altruistic collaborative innovation such as Partner Centres to International Research Infrastructures such as CERN having Tier 2 Centres at TIFR Mumbai & VECC

Kolkata; and the Launch of EUIndiaGrid2 which he referred to as an excellent example of EU-India collaboration underpinning all areas of science.

Possible collaboration between several European infrastructures and their counterpart activities in India were discussed. Discussions showed that existing collaboration was strong and that most initially started with scientist-to-scientist contacts that have matured over a period of time. Areas of future cooperation were also identified including arctic sciences, biomedical sciences, material sciences and astronomy and the appropriate e-infrastructures in these fields as well as those related to computations for synchrotron and NMR (Nuclear Magnetic Resonance) facilities, CERN, and ITER.

On the e-Infrastructures side, policy orientations were presented and specific projects such as the research networks GEANT and TEIN3 (Trans-Eurasia Information Network) in Europe, the National Knowledge Network in India; the supercomputing infrastructures Partnership for advanced Computing in Europe (PRACE) and Distributed European Infrastructure for Supercomputing Applications (DEISA) and corresponding activities in India were presented. The EU-IndiaGrid2 project was also presented and his bridging role between European and Indian e-Infrastructures was highlighted. The EU-IndiaGrid2 Launch event and kick-off meeting on the same week with the participation of Dr Chidambaram and the Workshop delegates was a further opportunity to exploit and highlight collaboration opportunities. EU-IndiaGrid2 Indian partners actively contributed to the Workshop. In addition the EU-IndiaGrid2 project manager participated in a meeting, dedicated to EU-India connectivity, between the EC delegation and the DIT Joint Secretary, which was particularly relevant for the development of EU-India connectivity in view of the new TEIN3 2.5 Gb link from Europe to India.



partnership.

Following the workshop, delegates were invited to the EU-IndiaGrid2 Launch cocktail and dinner at the Indian Institute of Technology (IIT), New Delhi. Dame Sandra Dawson, Cambridge-India project leader and Cambridge University Deputy vice-Chancellor, also attended the EU-IndiaGrid2 launch event which offering further opportunities to prepare common activities in this

Finally, European e-Infrastructure delegates including, EC Officials, representatives of e-IRG, EGEE, GEANT, DANTE, PRACE, made significant contributions during the EU-IndiaGrid2 Kick-off meeting held 14-15 January also at IIT New Delhi.