A national highway for a faster science: the role of NKN in India

Interview with P.S. Dhekne, BARC and Office of the Principal Scientific Adviser to Indian Government

Mr P.S. Dhekne is currently working as a Raja Ramanna Fellow at BARC. He has made invaluable contributions in the field of High Performance/ Distributed/ Grid Computing and information security systems during his tenure in DAE, spanning more than three decades. He is renowned expert, nationally as well as internationally, and officer of the Principal Scientific Adviser to Indian Government. During the EU-IndiaGrid2 Workshop on Research Applications of High Speed Connectivity Across Europe, India and the Asia-Pacific Area he provided an overview of latest status of NKN, its current applications, various Grid initiatives in India and it's migration to NKN, describing few collaborative applications deployed using NKN through GEANT & TEIN3.

EU-IndiaGrid2: **Can you give an overview of the NKN and its role to the research infrastructure in India**?

P.S. Dhekne: The key ingredients in scientific collaborations are e-infrastructures, consultations, data sharing, and resource sharing, which require facilities to enable researchers to undertake such collaborative efforts albeit at reasonable costs. The Government of India has set up a High-Level Committee for the establishment of a National Knowledge Network (NKN). The National Informatics Centre (NIC) is implementing the NKN. Despite it is a new initiative, NKN will derive strength and benefits from existing initiatives, to ensure faster rollout and cost saving. The NKN is the common network backbone, like a national highway, wherein different categories of users are supported from any part in the country. The low cost connectivity & countrywide reach provided by the NKN would make quality difference in scientific endeavors, as NKN backbone would provide sufficient data transfer capability to any scientists in India to retrieve scientific data, thereby improving their research quality.

EUIG2: **With the Indian Government committed to improving the research infrastructure in India through the NKN, how important has the collaboration with the EC, and in particular EU-IndiaGrid, been in this process?**

P.S.D.: Many Indian researchers have multi-national research collaborations and projects (such as LHC, FAIR, STAR, PHENIX, ITER, Climate/Weather modeling etc.) all of which would require high bandwidth connectivity to Europe & beyond. In India in particular, cost of connectivity is still so high that even well funded organizations have difficulties meeting such costs. Indian scientists are building large detector systems, so that they take part in data analysis and extraction of physics information from huge amount of raw experimental data. Participation in the European Framework Programmes has been very fruitful and has enabled Indian scientists to collaborate in frontier research activities with European colleagues.

EUIG2: **Which collaborative applications are now deployed using the NKN through GEANT and TEIN3?**

P.S.D.: Different applications and research activities are deployed on the NKN, such as grid computing applications ranging from high energy physics to climate modelling and health care, and for collaborative design of advanced complex engineering systems. The four main application areas of EU-IndiaGrid are in the field of High Energy Physics (LHC at CERN), Atmospheric & Earth Sciences, Biology and Material Science. The major part of Garuda Grid network has been transferred to NKN, and the regional WLCG (the Worldwide LHC Computing Grid) network in India also uses NKN backbone.

Many institutions in India are part of EU-IndiaGrid project, which connects European grid infrastructures to Indian Grids. Climate Change modelling & simulation researches are performed between IIT Delhi & ICTP,

Trieste, with a common platform for Climate Change Research provided through the Virtual Research Community (VRC) of the CHAIN project. The Remote experiment for collecting crystal X-ray extraction data at ESRF, Grenoble, France, directly from Mumbai, in India, is another NKN success story in material science across Europe and India.

Other experiments deal with Virtual Classrooms (setting up of virtual classrooms amongst established mentoring IITs and the new mentored IITs) and CollabCAD, an Indigenous CAD / CAM / CAE / PLM solution based on Open Source and Open Standards, is a collaborative framework for CAD, CAE & PLM.

EUIG2: **What are the main benefits of EU-Indian collaboration for Indian research communities?**

P.S.D.: Under the aegis of EU-India Co-operation on ICT, high capacity broadband infrastructure between Europe and India was envisaged. The EU-IndiaGrid project (phase I & II), which has allowed Indian scientists to access major European and Indian Grid infrastructures exposing them to the grid technology, made significant progress in last two years. The agreement with European Commission (EC) proved to be a stepping-stone for further cooperation in the domain of international connectivity by establishing 2.5 Gbps (10 Gbps) link between NKN & GEANT via TEIN3 project. This "bridging" role between European and Indian grid infrastructure has improved overall throughput further, thanks to NKN's low latency, high bandwidth pathways.

The NKN, in combination with developments in TEIN3 connectivity, has enhanced the international co-operation and collaborative innovation, thus boosting scientific and social developments.

EUIG2: **High Energy Physics, through the Large Hadron Collider (LHC) programme, represents one of the unique science and research facilities shared between India and Europe, with the Worldwide LHC Computing Grid (WLCG) project. What are the latest updates in terms of data transferred and results produced?**

P.S.D.: India has established a regional WLCG Grid network in India with two Tier-2 centres, one at the Tata Institute of Fundamental Research (TIFR) in Mumbai for Compact Muon Spectrometer (CMS) and another at VECC/SINP Kolkata for ALICE (A Large Ion Collider Experiment). At CMS T2 at TIFR almost 10 Billion events have been processed since the beginning of this year. Over thousands of terabytes of CMS data retrieved/transferred at T2 within last three months. CMS T2 has been specially chosen to be part of LHCONE, the LHC Open Network Environment, among several sites, to provide high-speed access (PhEDEx Transfers are fine). CMS T2 is one of the Largest T2s within CMS, in terms of storage. Successfully passed LHCONE benchmark testing.

CMS community has reached a count of 100 papers, all in peer-reviewed journals. Out of these 100, 75 papers are from LHC collision data, 24 from cosmic-ray runs and one from CMS detector paper.

P.S. Dhekne, BARC

EUIG2: **Which communities recently benefited from these experiments?**

P.S.D.: High Energy Physics community in India (Government labs & Universities) put up a big effort in setting up the CMS & ALICE detector at LHC, CERN and collected good quality data sets. The results from the experimental runs from both CMS and ALICE have yielded excellent publications in reputed international journals. Also Climate Change research community in India could successfully run complex modeling and weather prediction jobs via Garuda Grid and EU-IndiaGrid.

EUIG2: **Which benefits has the Europe-India cooperation established through EU-IndiaGrid2 brought to these experiments?**

P.S.D.: Large volume of data (multiple of terabytes) generated from LHC experiments could be transported and distributed easily to all Indian participants through low latency, high bandwidth NKN and TEIN3 connectivity. Being part of WLCG, both CMS & ALICE Tier II centres contributed to process power (over 1000 cores) and storage capacity (over 800 Terabytes) and worldwide HEP community could use these resources very effectively. The experience gained in operating & using this e-infrastructure has benefited immensely, allowing faster adoption of Grid technology & implementation of many new applications such as Open source drug discovery, Climate Change modeling, and e-classrooms, Cancer Grid, Health Grid etc. in India.

Source: EU-IndiaGrid2