GÉANT2 AS AN ENABLER FOR EUROPEAN GRIDS

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A mature policy statement regarding networking as enabler for eInfrastrucures, is the need to deploy a next generation optical pan-European network platform to support the needs of the Research & Education Community. Specifically, this eInfrastructure should integrate advanced IP based services with lower layer manageable "lambda" and/or Ethernet switched Gigabit provisioning for the support of eScience initiatives (e.g. Grids, collaborative research etc.) This vision reinforces and coincides with NREN and GÉANT2 – NREN PC policy decisions, leading to the pan-European optical infrastructure currently under procurement. GÉANT2 will be based on a wide Dark Fibre (DF) footprint able to provide switched "lambda" services, complemented with leased wavelength and SDH-based provisions for regions where DF solutions are currently not available, or are prohibited from a techno-economic viewpoint.

With the roll-out of GÉANT2 (3Q05) the extended European Research Area (ERA) will be enabled with an abundance of configurable 10 Gigabit/sec connectivity, provided by an end-user controlled combination of national, cross-border and international fibre paths. It is further expected that DF provision will be available in all European regions within the next five years, thus the near-term vision of the NREN community is the deployment of ubiquitous e2e services based on low protocol layers (physical, MAC), complementing layer 3 (IPv6) provisions. This vision includes South-Eastern European countries (SEEREN) and EUMED countries, along with Belarus, the Ukraine and Moldova, in an effort to ease the "digital divide" in Europe.

The trans-European network GÉANT/GÉANT2/GÉANT3 will take advantage of NREN optical facilities and will proceed in dynamic provisioning of production quality seamless connectivity, based on carefully drafted and continuously enforced SLAs among NRENs, optical fibre providers and DANTE (the coordinator of GÉANT). In fact, all players involved have only to gain from this initiative, thus creating a true "win-win" situation. Complemented by distributed computing platforms (e.g. LHC computing & storage, FP6 grid initiatives such as EGEE, DEISA and SEE-GRID, and projects such as LOFAR and ITER), GEANT2 and its successor networks will greatly enhance the human research & development potential of the extended ERA, towards the fulfilment of the Lisbon objectives for a competitive knowledge society.

The networking facilities being developed within the GÉANT2 project and by Europe's NRENs will equip Europe with the networking infrastructure and services to support High Performance Computing - Grids until 2008. Regarding services, GÉANT2 will develop, test and deploy the technologies to provide bandwidth allocation and reservation services, network performance diagnostic and enhancement services (including network monitoring

facilities), and AAA (Authentication, Authorisation & Accounting) services for network access of users. AAA services should extend to moving users, enabling global roaming for accessing digital resources (e.g. HPC - Grid resources, digital libraries, advanced video conference platforms and servers). Multi-gigabit network security and monitoring are major priorities of GÉANT2, both from the operational and from the pre-normative RTD view points. These services will be tested and rolled out to end-users (e.g. eScience projects), offering a distributed advanced platform for the deployment of HPC - Grid technologies. Thus, GÉANT2 and its successors will extend beyond infrastructure provisioning, providing advanced services to NRENs and to end-users alike to enable collaborative scientific and educational activities.

In developing a European Science eInfrastrucure, the ability to provide and control advanced high-performance networking facilities (including the definition of interfaces for the interoperability of grid middleware with the network control and management planes) will be crucial to stable, seamless servicing of eScience user communities. The use of dark fibre acquired from the "new market" implements a new model of "ownership" of the networking resources, as it decouples the provision of the network from bandwidth provision – and the related pricing – by traditional carriers. This opens a completely new and innovative perspective for applications (like Grids), as the cost of bandwidth is no longer a serious bottleneck for network provision. Thus, longer term strategic issues not directly dependent on current practices and cutting edge technologies must drive eInfrastructure planning, including research & education networking. The emerging business model should resolve fundamental questions like ownership of infrastructures, sharing policies, foresight of capital investment, consequences of technology driven choices etc.

It is foreseen that by 2010 all European NRENs will be using dark fibre spans supporting multi-gigabit speeds. Backbone capacities will probably start around 10 Gbps for less developed countries and reach multiple n*10 or n*40 Gbps (or even more) in advanced ones. At the same time, international (global) connectivity requirements will grow towards a Global Terabit Research & Education Network (GTREN), with Europe being a key enabler in the world-wide arena.

GÉANT was as global success story in the IP world, providing ubiquitous advanced connectivity to Research Centers & Universities, also extending to the open Internet community of education, government, health, business and private users. GÉANT2 extends the Internet ubiquitous outreach in the New Generation Networking era by providing hybrid IPv6 routed and lower layer Gigabit switching services via configurable user controlled end-to-end light-paths, enriched by collaborative services and applications aimed at network operators and end-users. This hybrid connectivity should extend its footprint via distributed light-path exchanges, open to the world-wide research and academic community, but also enabling flexible interconnection with other public and commercial users, under appropriate Acceptable User Policies. Pan-European and Global Grid initiatives, such as EGEE, are first expected to benefit from the hybrid multi-gigabit net that will cover all geographical regions and serve all manifestations of the new "knowledge-based digital economy." GÉANT2 is a pre-normative gate, paving the way towards this up-coming reality.