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Deliverable DS2.0.3,2: Report on GÉANT2 Advanced Services - Lambdas and Switched Optical

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Abstract

This document provides a summary of the take-up of GÉANT2 advanced services in Year 3.

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0 Executive Summary

GÉANT2 is a hybrid network, combining the operation of a shared IP infrastructure with the ability to provide additional, switched, circuits reserved strictly for particular user groups. This dual role makes GÉANT2 unique: it is the first hybrid production network operating on an international scale.

Point-to-point circuits are offered between NRENs in Europe where it has been possible to procure at an affordable price the necessary network infrastructure – usually dark (unlit) fibre optic cables on which circuits can be incrementally added as demand requires. The GÉANT2 point-to-point service offers for the first time the opportunity to configure user-designated circuits of between 1Gbps and 10Gbps capacity between many GÉANT2 points of presence (PoPs) across Europe.

Larger projects have requested and use a series of such circuits to form an Optical Private Network (OPN) – effectively a stand-alone internet linking that user group's sites. A total of 27 GÉANT2 point-to-point circuits of this type were delivered between June 2006 and August 2007.

The deliverable reports on the state of the developments at the end of GN2 Year 3 (31 August 2007).

1 Introduction

The GÉANT2 network offers the European research and education community a new range of opportunities for international collaboration. In addition to a shared IP infrastructure, GÉANT2 can provide point-to-point connectivity between the network points of presence (PoPs) which it connects. Additionally, circuits may be provided over the alternative international routes provided by Cross Border Fibre (CBF) operated by GÉANT2 NREN partners. Dedicated point-to-point circuits, either complete 10Gbps wavelengths or sub-divisions thereof, are a new means of delivering high-bandwidth international network connections free from the constraints inherent in a shared, routed infrastructure.

Point-to-point circuits come in two designations:

- An NREN within the dark fibre "cloud"[1] receives, in addition to its IP connection, a GÉANT+ subscription. This service provides the NREN up to 10Gbps of pre-paid point-to-point capacity between the GÉANT2 point-of-presence (PoP) in its own country and the GÉANT2 PoPs connecting similarly-subscribing NRENs. This capacity can be used to provide connections dedicated to individual research and education projects. Because this capacity is pre-provisioned, circuits can be implemented or reconfigured at short notice and without incremental cost to the NREN. These circuits can also be extended across the Atlantic.

- Full 10Gbps wavelengths dedicated to a particular user group can be delivered between the GÉANT2 PoPs (or, indeed, over other routes if CBF is available) in various European NRENs. These international segments will in general be connected to national point-to-point infrastructures to create a dedicated end-to-end connection.

Significant effort has gone into developing processes to coordinate the handling of requests and the management of circuits. Work is also underway to develop the service interface to improve communication and allow tracking of progress by the service requester. For a full description of the services offered, ordering and deployment procedures (technical and administrative, including the End to End Coordination Unit – E2ECU) and further refinements to the delivery process, as well as samples of the service request form, please see deliverable DN3.0.5: Processes and Provision of Point-to-Point Services.

[1] Point-to-point services use dark fibre and therefore are generally only available to NRENs in those countries where dark fibre has been procured for GÉANT2. For more details see section 3.2.

2 Use of Advanced Services on GÉANT2 Footprint

The GÉANT2 IP network is designed to be over-provisioned, allowing small-to-medium sized traffic flows an uncongested path. Unmanaged flows above 1Gbps are considered to run the risk of impacting other IP traffic and suffering congestion. The GÉANT2 point-to-point service offers circuits of between 1Gbps and 10Gbps which avoid congestion and offer un-contended service over the GÉANT2 domain.

Interface Type

GÉANT+

Because the transmission and switching equipment used for GÉANT+ circuits are pre-provisioned, this classification of service allows GÉANT2 to offer NRENs flexible, quickly configurable circuits between GÉANT2 PoPs across Europe. The GÉANT+ subscription cost includes a 10GEth or STM-64 interface on the GÉANT2 equipment, supporting up to 9 GEth circuits, although alternative capacity circuits (e.g. STM-16) are also possible. As described above, capacity granularities below 1Gbps are not offered.

10 Gbps Circuits

10 Gbps circuits can be provided with either 10GEth or STM-64 interfaces, depending on preference. Unless a media converted circuit is specified, interfaces at the A and B ends of the circuit must be of the same type. 10Gbps circuits must be planned several months ahead of the ready-for-service date, due to the long lead times associated with the optical transmission equipment needed to light the wavelength.

Media Conversion

In addition to the full-wavelength 10 GEth and STM-64 services offered by GÉANT2, it is also possible for the network to provide a circuit which transports 10GEth over the SDH network using GFP encapsulation. This brings an important advantage: that the GÉANT2 switches can then be used to allow the technology platform of the circuit to be different at each end of the circuit. Thus a circuit may be provided with mismatched interfaces (STM-64 to 10GEth and vice versa) if this is a requirement. This functionality is known as Media Conversion. Furthermore, a 10Gbps media converted circuit is able to be configured as multiple circuits of lower capacity as with a GÉANT+ subscription.

A total of eight projects were served by p2p links on the GÉANT2 footprint at the end of Year 3. The most demanding user by far – requiring 10X10G plus 1X1G capacity - is the CERN Large Hadron Collider (LHC) project[2], followed by DEISA (Distributed European Infrastructure for Supercomputing Applications)[3], requiring a total of 5X10G capacity. Across the whole of the GÉANT2 footprint, 17 10G p2p links and 10 1G links were deployed.

Table 2.1 below provides an overview of the status of the implementation of P2P links on the GÉANT2 footprint at the end of Year 3 (31 August 2007).

LINK	INTERFACE	DELIVERY	PROJECT	EXTENDED TOWARDS
Pure Wavelengths				
Amsterdam-Frankfurt	10GE	11 Dec 2006	DEISA	DFN-SURFNET
Frankfurt-London	10GE	2 Aug 2007	DEISA	DFN-JANET
Copenhagen-Frankfurt	10GE	20 Aug 2007	DEISA	DFN-NORDUNET
Frankfurt-Madrid	10GE	01 Mar 2007	DEISA	DFN-RedIRIS
Frankfurt-Paris	10GE	02 Apr 2007	DEISA	RENATER-DFN
Amsterdam-Geneva	SDH	21 Jun 2006	LHC	CERN-SURFNET
Amsterdam-Geneva	SDH	13 Nov 2006	LHC	CERN-SURFNET
Amsterdam-Geneva	SDH	15 Nov 2006	LHC	CERN-SURFNET
Copenhagen-Geneva	SDH	16 Mar 2007	LHC	CERN-SURFNET
Amsterdam-Prague	SDH	13 Nov 2006	LHC	CESNET-SURFNET
Copenhagen-Geneva	10GE	06 Nov 2006	LHC	CERN-NORDUNET
Frankfurt-Geneva	10GE	01 Jun 2006	LHC	CERN-DFN
Geneva-London	10GE	16 Aug 2006	LHC	CERN-JANET
Geneva-Madrid	10GE	04 May 2007	LHC	CERN-RedIRIS

[2] http://lhc.web.cern.ch/lhc/
[3] http://www.deisa.org/

LINK	INTERFACE	DELIVERY	PROJECT	EXTENDED TOWARDS
Geneva-Milan	10GE	26 Jun 2006	LHC	CERN-GARR
Amsterdam-Paris	10GE	14 Aug 2007	GRID5000	RENATER-SURFNET
Amsterdam-Copenhagen	SDH	30 Mar 2007	Other	SURFNET-NORDUNET
Ethernet circuits				
Amsterdam-London	1GE VLAN	25 May 2007	EXPReS	SURFNET-JANET
Amsterdam-London	1GE VLAN	25 May 2007	EXPReS	SURFNET-JANET
Amsterdam-Milan	1GE VLAN	24 May 2007	EXPReS	SURFNET-GARR
Amsterdam-Poznan	1GE VLAN	27 Feb 2007	EXPReS	SURFNET-PSNC
London-Paris	1GE VLAN	13 Oct 2006	IGTMD	ABILENE/ESNET-RENATER
London-Paris	1GE VLAN	16 Oct 2006	IGTMD	ABILENE/ESNET-RENATER
Frankfurt-Prague	1GE	01 Sep 2006	LHC	DFN-CESNET
Amsterdam-Poznan	1GE VLAN	07 May 2007	PHOSPHORUS	SURFNET-PSNC
New York-Poznan	1 GE VLAN	12 Jun 2007	PHOSPHORUS	CANARIE-PSNC
Amsterdam-Frankfurt	1GE	21 Jun 2007	VIOLA	DFN-SURFNET

Table 2.1: Status of P2P links on the GÉANT2 footprint at end of Year 3[4]

[4] All 10G point to point links – regardless of whether SDH or ETHERNET - are pure wavelength.

3 Conclusions

The GÉANT2 network is the first international production hybrid network. The point-to-point services offered represent a new era in network services which, whilst providing the opportunity to deliver unprecedented levels of service to the research and education community, require significant coordination effort to manage.

This document has described the advanced services taken up by the users by the end of Year 3. A significant number of such circuits are now operational. Building on the experience gained work is well underway to develop and improve the point-to-point and end-to-end procedures to improve the customer service still further.

4 Acronyms

P2P –Point-to-point (a dedicated circuit configured between two points over a single network domain)

E2E –End-to-end (a dedicated path over multiple network domains each segment comprising a P2P circuit)

NREN -National research and education network

OPN –Optical private network

GEth – Gigabit Ethernet

SDH –Synchronous Digital Hierarchy

LHC – Large Hadron Collider