

WP2: Enhancements to the GMPLS Control Plane for Grid Network Services (GNS)

WP2 is the Phosphorus work package responsible for the Network Control Plane issues. The main goal is to bring to an innovation in the field of co-allocation of Grid and network resources, overcoming the current limitation of Grids that operate as stand-alone overlaid infrastructures upon “always-on”. This is mainly driven by the European NRENs requirement to support advanced and demanding research activities in Grids. In particular, WP2 developed the Grid-aware GMPLS Control Plane (G²MPLS), capable of implementing new GNS scenarios on top of a first class pan-European optical and multi-domain field-trial deploying the most innovative optical transport technologies interconnected through GÉANT2.

G²MPLS is an enhancement of the ASON/GMPLS Control Plane architecture that implements the provisioning of network and Grid resources in a single-step, through a set of seamlessly integrated procedures.

Objectives

- To implement the single-step provisioning of Grid and network resources, enhancing the GMPLS Control Plane both in terms of routing protocols and of signalling protocols;
- To enable a real node-to-node deployment of on-demand Grid services, exposing a uniform interface for the Grid-user (Grid-Optical User Network Interface, G.OUNI) and support any kind of end-user applications;
- To guarantee the interworking and coexistence (in inter-domain scenarios) with legacy GMPLS Control Plane and different Network Resource Provisioning Systems;
- To provide the integration of the Grid AAA functionality and create an interoperable multi-domain AAA infrastructure;
- To implement innovative anycasting network transport services (i.e. dynamic selection of the optimal transmission sink by Control Plane);
- To support advance reservations of Grid and network resources on network transport services.

Developments

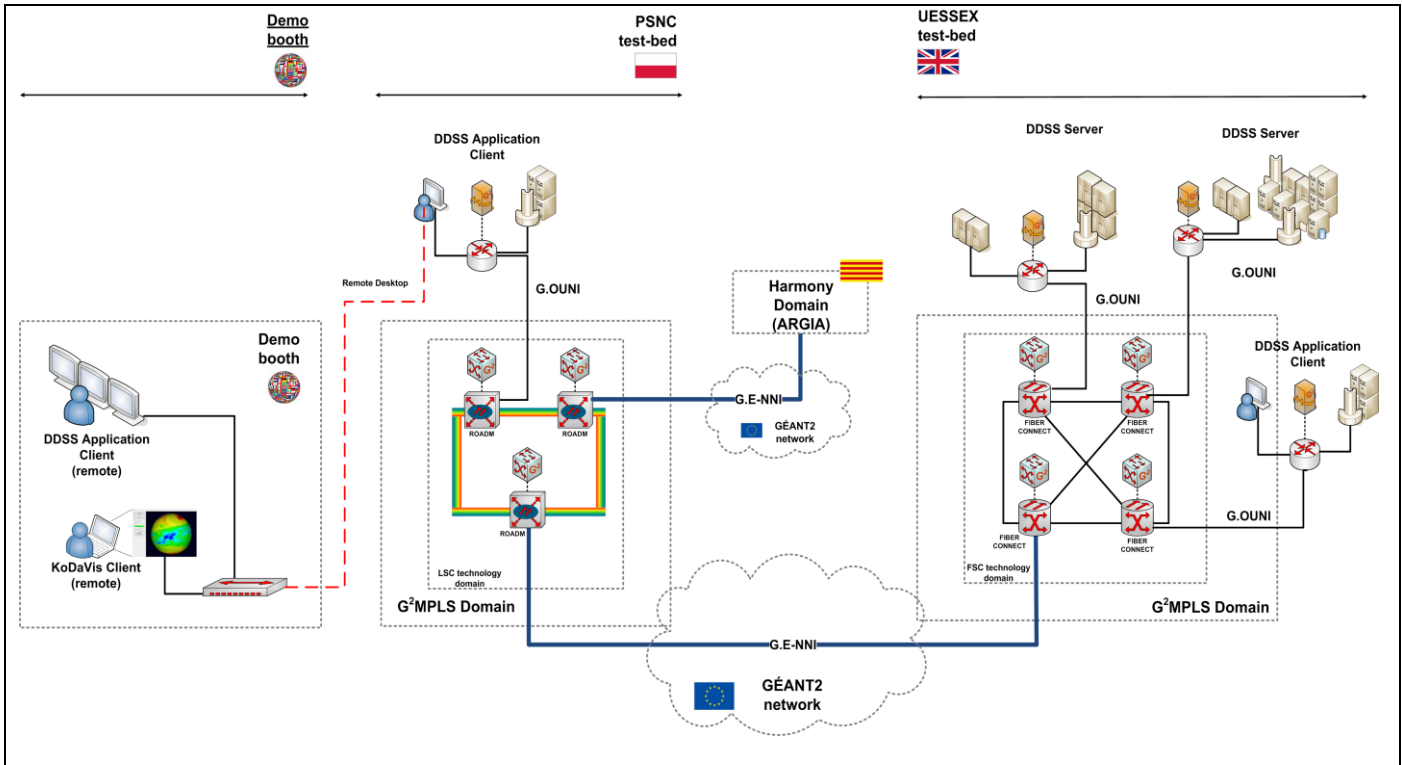
WP2 delivered the final G²MPLS Control Plane prototype that includes all the designed functionalities. It consists of all the software modules designed, implemented and publicly demonstrated, released in the form of a software package. Four different kinds of controllers can be run depending just on the node configuration:

- G²MPLS UNI-C controller • G²MPLS edge controller • G²MPLS core controller • G²MPLS border controller

Main software modules developed:

- Signalling: **G².Call Controller**, **G².Recovery Controller**, **G².RSVP-TE (@G.INNI, @G.UNI, @G.ENNI)**;
- Routing / Path Computation: **G².OSPF-TE (@G.INNI, @G.UNI, @G.ENNI)**, **G².PCE Routing Algorithm (G².PCE-RA)**;
- Interworking with legacy TN equipment: **Transport Network Resource Controller (TNRC)**;
- Interoperation with Harmony NRPS: **Harmony G²MPLS GW (HG²-GW)**.

The TNC 2009 demonstration: Multi-domain G²MPLS Control Plane



The demonstration presents the G²MPLS Control Plane in the multi-domain and the multi-technology testbed serving requests of the Distributed Data Storage System (DDSS) applications. The G²MPLS testbed is composed of two network domains:

- LSC domain containing three ROADM ADVA FSP 3000RE-II devices in PSNC (Poland),
- FSC domain with four independent virtualized nodes based on the Calient DiamondWave FiberConnect optical switch located in the University of Essex laboratory (United Kingdom).

Both domains are interconnected using the 1Gbit/s GÉANT2 data plane link. The Control Plane inter-domain connectivity is available in form of G.E-NNI reference point.

The DDSS client application, remotely connected to the demonstration booth, is located in PSNC and connected to the network domain through the G.OUNI interface. This DDSS application offers the large files backup service using Grid-FTP (part of the Globus toolkit) and free storage spaces located in DDSS server nodes.

When the user chooses to backup a big file from his local file system, the DDSS application sends anycast request specifying the size of the file to the G²MPLS Control Plane. The G²MPLS edge node chooses the best suitable DDSS server, with enough free storage space to handle the request, and proceeds with a setup of the high-bandwidth transaction over the two network domains.