WP1-WP2: Interoperability between Harmony and G²MPLS

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.

The Phosphorus WP1 **focuses on delivering advanced network services to Grid users and applications interconnected by heterogeneous infrastructures**. This WP addresses some of the key technical challenges to enable on-demand, in advance, end-to-end network service provisioning across multiple domains.

Harmony is the network resource brokering system developed under Phosphorus WP1. **Harmony** provides co-allocation of heterogeneous network resources in multi-domain and multi-technology environments with advance reservation capabilities. **Harmony** architecture has evolved from a first proof-of-concept, **centralized** NSP to a **distributed** NSP model, passing through a mid-term, multi-level **hierarchical** model. Moreover, **Harmony** is flexible enough to allow even complex service plane configurations, such as **daisy chain** or **hybrid** deployments.

Objectives

The WP1-WP2 collaboration aims to make interoperable both Harmony and G²MPLS by means of the HG²-GW, thus having the capability of dealing with multi-domain, multi-vendor scenarios controlled by Harmony or under the control of the G²MPLS control plane. This interoperability will allow end Users or Grid middleware to use resources located in G²MPLS domains or located within Harmony domains.

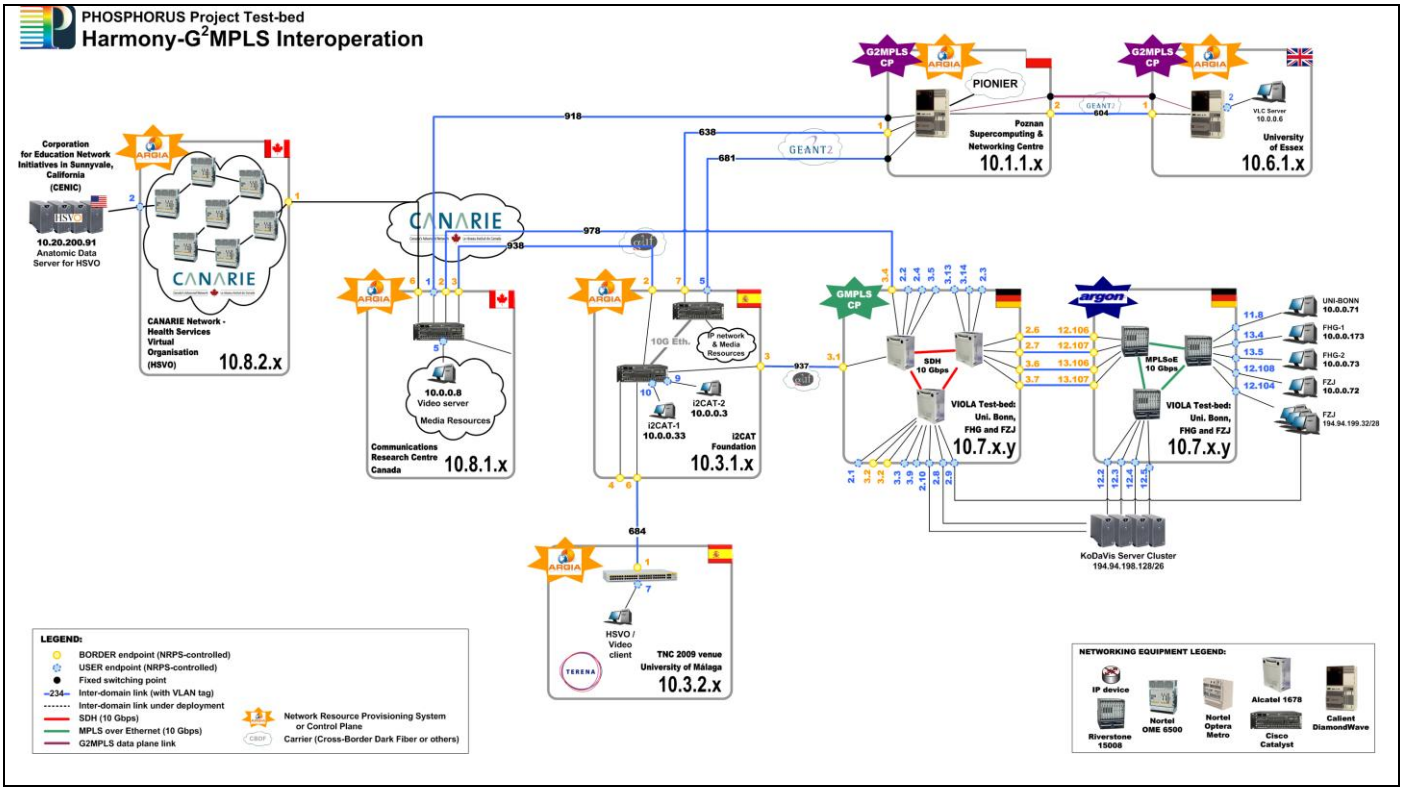
Developments

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 kind of controllers can be run depending just on the node configuration: G²MPLS UNI-C controller, G²MPLS edge controller, G²MPLS core controller, and G²MPLS border controller.

Phosphorus WP1 has implemented Harmony service architecture with the set of interfaces for interoperability in a seamless environment between different NRPS and the standard GMPLS towards the Grid Middleware, and novel G²MPLS control plane of the Phosphorus project.

The Harmony-G²MPLS GW (HG²-GW) is the developed module that enables the interoperability between WP1 and WP2 developments. It is currently located at PSNC, and its main functionality is to translate service requests from Harmony to G²MPLS and vice-versa.

The TNC 2009 demonstration: Harmony - G²MPLS interoperability



The demonstration presents the feasibility of interconnecting heterogeneous domains (Argia, G²MPLS) controlled under the umbrella of Harmony. The demonstration shows the Health Services Virtual Organization (HSVO) application which consists in a remote server and visualization client. The client is locally deployed at TNC while the remote server is located in Sunnyvale, California. The computed path crosses multiple domains (CRC – Canada, PSNC – Poland, i2CAT – Barcelona, TNC – Malaga) controlled by its own provisioning system or control plane. Specifically, CRC and i2CAT domains use Argia (Harmony) and PSNC uses G²MPLS to control its Calient optical cross-connect.

When starting the HSVO client, it requests Harmony connectivity to the remote server. After the calculation of the path, Harmony sends individual requests to each domain (Canada, Poland, Spain) to setup the network provisioning systems and trigger the configuration of the physical layer. In case of G²MPLS, HG²-GW is used to translate Harmony requests into G²MPLS methods. These requests just specify the end points within the G²MPLS domain, the desired Bandwidth, the connection scheduling (start time, duration) and a Job identifier. Then, G²MPLS protocols perform the internal path computation and connection establishment. When the whole multi-domain path is established, the application client is notified and data can be transmitted.

The demonstration aims to show the interoperability between Harmony and G²MPLS by the developments done by WP1 and WP2 within the Phosphorus project. Thus, this demonstration covers one of the main achievements of the project, and, at the same time, shows how the developments of WP1 and WP2 can deal with heterogeneous, multi-domain, and multi-vendor realistic scenarios.