



PROJECT RESULTS

New dimension in multi-domain optical networks

From legacy to integrated multi-layer implementation



The TBONES project designed and implemented the first-ever simulator for assessing the performance, scalability, and flexibility of multi-layer, multi-domain optical networks operated by Generalised Multi-Protocol Label Switching (GMPLS), rather than by conventional static optical transport networks managed on a per-layer basis. This ITEA initiative makes it possible to fine-tune the full operation of GMPLS-controlled networks, with embedded dynamics and optimised resource occupancy. Its capabilities are the key to reduction of overall exploitation cost in terms of factors such as dynamic traffic variations, failures, and re-configurability speed.

Current multilayer optical market demands are less focused on capacity expansion than on the provision of cost-efficient, revenue-generating, highly flexible and traffic-volume-adapted networks. By maintaining the deployment of multi-service solutions in both the optical metroplitan and backbone areas, and by having undertaken the migration towards GMPLS, current commercial expectations are clearly that tangible results will arise from a coordinated GMPLS approach in the development of technology roadmaps. This will depend upon the creation of standards to facilitate automation, and a corresponding increase in worldwide market forces. In particular, distributed restoration based on GMPLS is seen as the

TBONES (ITEA 02024)



Partners

- Alcatel Bell
- Alcatel CIT
- Atos Origin
- CTTC
- IMEC
- Telefonica I+D

Countries involved

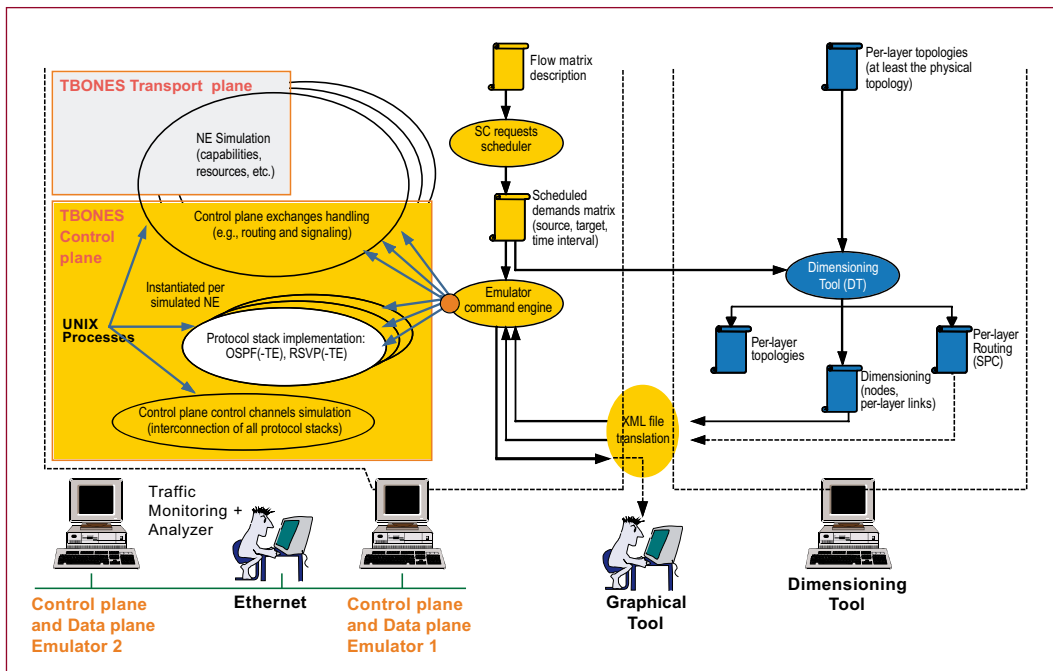
- Belgium
- France
- Spain

Start of the project

May 2003

End of the project

April 2005





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route to a future multi-vendor network that should reduce the required levels of investment.

Exploitation underway

The outstanding achievements of TBONES are the benchmarking of software load and performance for the Open Shortest Path First-Traffic Engineering (OSPF-TE), Resource ReSerVation Protocol Traffic Engineering (RSVP-TE) stack, together with the validation of dynamic label-switched path (LSP) provisioning in packet-optical multilayer networks. In addition, the project proposed traffic engineering (TE) algorithms in single- and multi-area networks.

Based on the simulation in packet-optical multilayer networks (with specific focus on IP/MPLS), the performance quantification in terms of resource and speed of constraint-based routing, pre-planned and dynamic re-routing was performed, with investigation of control plane interactions. Adequate dimensioning of the network topology according to a traffic matrix was obtained via the interfaced Dimensioning Tool (DT) developed in the context of the project. Practical questions commonly raised about dynamic optical networks were answered through the provisioning of LSP using cooperative mechanisms between GMPLS and the management plane.

For partners Alcatel CIT and Alcatel Bell, the project outcomes provide business divisions with the scientific and technical inputs necessary to support the corporate strategy on high-speed optical communications, integrated packet-optical platforms and elaborated value-added service capabilities. These participants are also exploiting the results in product portfolio for packet-aware optical networking, switching and routing components, as well as complete network systems.

Furthermore, components integrated into the Atos Origin network simulator allow demonstration of the benefits of a GMPLS-based distributed control approach. Software developed as part of the TBONES management plane simulator may also become a permanent part of Telefonica's management platform, and be reused in other commercial or research projects.

Knowledge acquisition and added expertise in the multi-layer packet-optical networking has been beneficial for IMEC's training activities, involving Ph.D., regular, and industry students. Direct transfer by CTTC of the knowledge gained from greenfield situations in intelligent optical networking, where GMPLS can be used in a production environment to provide fast broadband access to different kinds of user.

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ITEA - Information Technology for European Advancement - is an eight-year strategic pan-European programme for pre-competitive research and development in embedded and distributed software. Our work has major impact on government, academia and business.

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ITEA-labelled projects build crucial middleware and prepare standards, laying the foundations for the next generation of products, systems, appliances and services. Our projects are industry-driven initiatives, involving complementary R&D from at least two companies in two countries. Our programme is open to partners from large industrial companies, small and medium-sized enterprises (SMEs) as well as public research institutes and universities.

Major project outcomes

Dissemination

- 51 publications
- 9 presentations and demonstrations at conferences/events
- Demonstration at IEEE Infocom, March 2005, Miami (Florida), USA
- Collaboration with IST NOBEL, RNRT RYTHME projects

Exploitation

- 1 new product
- 2 new services of which one is intended for internal use

Standardisation

- 27 IETF Working Group documents

