Project Information

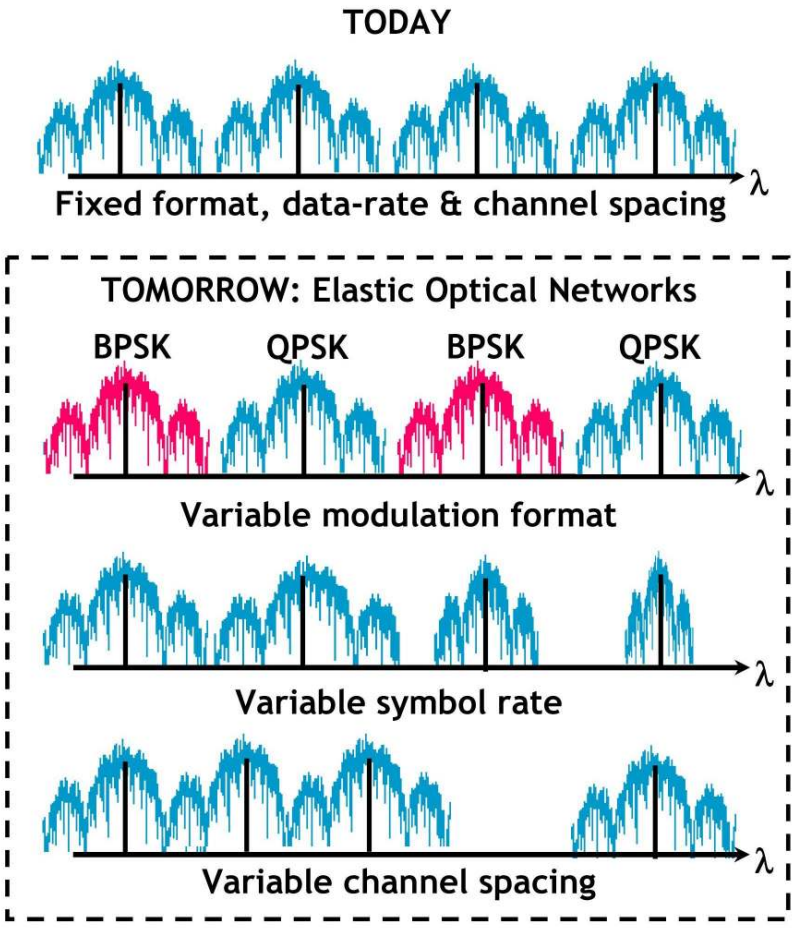
Elastic Optical Networks

The EO-Net project aims to bring "elasticity" to optical transport networks, so that is the ability to adapt the datarate and allocated bandwidth of each optical signal according to both the traffic demand and the amount of physical degradation it must overcome. By operating as close as possible to physical limits, elastic optical networks will present better scalability, cost- and energy-efficiency than currently available optical networks.

Main focus

Optical core networks have long provided almost infinite bandwidth for digital communications. By increasing the number of wavelengths propagating through a strand of fibre and increasing the datarate on each wavelength (from 10Gb/s a decade ago to 40 and now 100Gb/s), the optical industry has been able to keep up with the explosion of Internet traffic. But capacity demand in core networks shows no sign of abating while the current technology will probably not be pushed much beyond 100Gb/s in a cost- and energy-efficient manner.

As the bandwidth becomes a scare resource, EO-Net proposes to rethink core networks so that each connection can



EO-Net

Project ID: CP7-006

Start Date: 1 November 2010

Closure date: 30 April 2013

Partners:

Alcatel-Lucent Bell Labs, France

Analogies S.A., Greece

Chalmers University of Technology, Sweden

C Tech Bilisim Tek. Tic. Ve San. A.S., Turkey

Danish Technical University, Denmark

Ekinops, France

France Telecom, France

Nordunet, Denmark

Proximion, Sweden

Research Academic Computer Technology Institute, Greece

Co-ordinator:

Patricia Layec

Alcatel-Lucent Bell Labs, France

E-mail: patricia.layec@alcatel-lucent.com

Project Website

www.celticplus.eu/projects/celtic-projects/call7/EO-Net/eonet-default.asp

dynamically adjust its datarate and its bandwidth as closely as possible to the requested capacity and to the physical limits of the fibre medium.

Such "elasticity" of connections, very common and successful in other telecommunication means, is a newcomer to optical transport and is expected to strongly improve the scalability as well as cost-and energy-efficiency of future optical core networks.

Approach

In order to rip the aforementioned benefits, elastic optical networks require a redesign of optical networking at several important levels and EO-Net aims to provide innovative solutions at each of these levels, paving the way to a rapid industrialization and commercialization of the "elasticity" concept.

The first crucial enablers that EO-Net will provide for elastic networks are datarate- and bandwidth -adaptive transceivers. In particular EO-Net proposes to focus on the technology recently developed for 100Gb/s transmission systems and to show how it can be leveraged for cost-efficient elastic transceiver solutions.

Secondly EO-Net will investigate in depth the impact of physical impairments on elastic optical signals (noise accumulation, chromatic dispersion, nonlinear interactions between wavelengths…). While extensive work has been done over the years for fixed-rate static networks, little is known on the subject for highly heterogeneous architectures like elastic networks.

Thirdly, EO-Net will study resource allocation problems in elastic optical networks, i.e. the problem of assigning for each service demand one or more paths, datarates, wavebands and wherever necessary optoelectronic resources for impairment compensation.

EO-Net will also provide prototypes for the interfacing of fixed-rate standardized technologies of networks upper layers (e.g. IP router ports) with the highly-flexible elastic transceivers used for the optical layer.

The outcomes of all aforementioned activities will feed detailed techno-economic studies for a quantitative assessment of cost- and energy-efficiency of elastic solutions and comparison with currently available network architectures.

EO-Net has gathered for that purpose a consortium of operators, industries and academics with the broad spectrum of expertise and interests required to address such an ambitious target.

Main results

EO-Net's main results closely correspond to the different domains of optical networking identified in the previous section and to their interworking:

1. Prototypes of elastic transceivers capable of adjusting their datarate-rate, modulation-format and/or required bandwidth for the transports of payload ranging from 10Gb/s to 100Gb/s or more
2. Detailed performance estimation software providing a reliable estimate of the bit error rate of a wavelength as a function of its path, datarate, bandwidth and physical impairments such as noise and nonlinearities (which crucially depend on the network state, i.e. the characteristics of other signals propagating in the network)
3. Planning tools and dynamic resource allocation software leveraging the aforementioned performance estimation software to efficiently allocate paths, datarates, bandwidths and optoelectronic resources to incoming service demands.
4. Client interfaces for 10-100Gb/s elastic transponders allowing their connection with fixed-rate 100Gb/s ports of IP routers

Impact

The EO-Net project targets the market of optical transport (~12b$ yearly revenue). While the size of the market is fairly stable, recent years have seen a dramatic increase in the market share of extra -EU vendors to the detriment of European industries. EU industries may not be able to compete on costs in this market and must therefore spearhead innovation to maintain or improve their market share.

The disruptive approach of EO-Net does just that and the timing of the EO-Net project (2010-2013) will allow its partners to propose innovative solutions when they become most needed, i.e. after 100Gb/s systems (available since June 2010) have been extensively rolled out and new solutions are required to push network efficiency further.

The flexible management of the optical layer allowed by elasticity is also expected to offer new business opportunities for operators, with, for instance, bandwidth-on-demand directly from the optical layer.

About Celtic

Celtic is a European research and development programme, designed to strengthen Europe's competitiveness in telecommunications through short and medium term collaborative R&D projects. Celtic is currently the only European R&D programme fully dedicated to end-to-end telecommunication solutions.

Timeframe: 8 years, from 2004 to 2011

Clusterbudget: in the range of 1 billion euro, shared between governments and private participants

Participants: small, medium and large companies from telecommunications industry, universities, research institutes, and local authorities from all 35 Eureka countries.

Celtic Office

c/o Eurescom, Wieblinger Weg 19/4,

69123 Heidelberg, Germany

Phone: +49 6221 989 405, e-mail: office@celtic-initiative.org

www.celtic-initiative.org

EUREKA