Transparent Ring Interconnection Using Multi-wavelength Photonic switches

TRIUMPH proposes the development of Multi-wavelength Photonic switches that perform optical processing including transparent optical grooming/aggregation and multi-wavelength 2R optical regeneration.

At A Glance: *TRIUMPH*

Project Coordinator
Juerg Leuthold
University of Karlsruhe
Tel: +49 - 721 - 608 2480
Fax: +49 - 721 - 608 9097
Email: Leuthold@IHQ.Uni-Karlsruhe.de
Project website

Partners: *University of Karlsruhe (DE), Siemens S.A. (PR), Kailight Photonics (IS), RESIT- Athens Information Technology (GR), University College Cork (IR), Optoelectronics Research Centre, University of Southampton (UK), Technical University of Berlin (DE), University of Essex (UK)*

Duration: *03/2006 – 02/2009*
Total Cost: *€3.8m*
EC Contribution: *€2.75m*

Main Objectives:

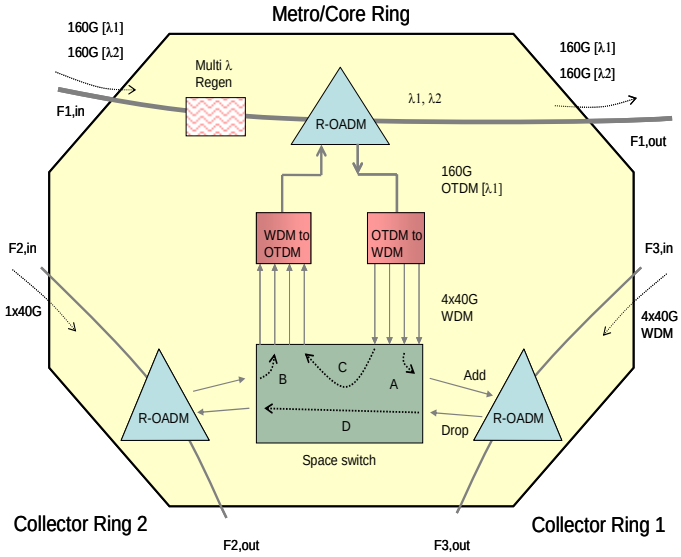
This project proposes the development of network architectures and system solutions that will facilitate future broadband access networks. The effort will focus on Transparent Ring Interconnection using multi-wavelength photonic switches with the aim to increase the network functionality and capacity. The proposed scenario refers to a high capacity networks with transparent connectivity between core/regional-metro rings supporting data rates up to 160Gbit/s and metro-access rings supporting up to 40Gbit/s. The required functionality in such architecture will be provided through an optical switching node located at the interconnection points between rings. The design and development of this node will be the focus of the project with the aim to provide a cost effective solution that can transparently offer inter-domain connectivity. This solution will also support functionalities currently unavailable in the optical layer. Our approach will offer transparent optical grooming/aggregation and multi-wavelength 2R optical regeneration. This transparency will enable a variety of data rates, protocols and formats that are present in the metro and access network environments and are associated with the requirements of new and emerging services and applications that are rapidly becoming available to the end-users.

Technical Approach

The work described above is planned to be performed within the framework of 6 different workpackages that are closely linked. One additional workpackage was dedicated to project management.

- WP2: One of the main objectives of this workpackage is to define the network architecture that the project will focus on. It will also provide the network and system level requirements and specifications. Comparative studies among various technology options together with value analysis studies and benchmarking will be also performed.
- WP3: The main activity of this workpackage is the development of a fully functional optical switching node for CWDM operation that includes the design, the implementation and the performance evaluation of the optical switching node at data rates between 10 Gbit/s and 160 Gbit/s.
- WP4: This workpackage focuses on the design, fabrication and characterization of devices suitable for 2R multi-wavelength regeneration. The technologies that will be used are active involving quantum-dot semiconductor optical amplifiers and passive involving highly nonlinear fibers.
- WP5: This workpackage will focus on the development of linear and nonlinear optical modules

- suitable to perform transparent grooming and aggregation involving also bit-rate adaptation. These modules will offer mapping of WDM channels to OTDM signals and vice versa.
- WP6: This workpackage will concentrate on the demonstration of the developed sub-systems in a network environment based on a lab testbed, consisting of optical nodes and emulated transmission impairments as well as in a demo together with a commercially available system.
- WP7: This work package will focus on drawing a manufacturability plan for the commercialization of the TRIUMPH platform. It will generate intellectual property and disseminate the project results.



Key Issues

Due to the unpredictable growth of data, particularly internet traffic, the emergence of higher-bandwidth applications originating from the users and the requirements for content delivery the future communication grid must be agile and able to react rapidly to support end-to-end bandwidth requirements. Related to this there is an incredible amount of pressure placed on metropolitan area networks as the metro network segment imposes limitations in the delivery of broadband services to the end-users.

- A new generation of metro networks is required to relieve this pressure and to offer the means to enable the metropolitan network to allow for quality end-to-end connectivity and value-added services.
- Technical breakthroughs in research are required to further accelerate the realization of transparent optical networks to offer increased transmission bandwidth, integrated transmission and switching capabilities and optical signal processing functionality.
- Transparent networks will be based on advanced photonic infrastructures that will employ optical signal processing and dynamic impairment management to eliminate the limitations of the analogue nature of optical networks. In addition new enhanced features need to be supported.

Expected Impact

The innovations introduced by the project aim at establishing a breakthrough in the implementation and deployment of advanced optical communications across an interdisciplinary array of both industrial and research stakeholders. It is expected to bring a significant impact in a number of areas including: network architectures, system implementation and technologies suitable for future broadband networks: access, metro-access and core-metro. More specifically it will:

- Provide improvement of the signal quality and the overall network performance through optical multi-wavelength 2R regeneration, thus enabling the transparency requirements.
- Provide all optical grooming/aggregation, i.e. conversion of lower rate WDM signals into higher rate single channel OTDM streams and vice versa, further enhancing the transparent functionality of the proposed system, offering an additional feature required in metro and access network environments.
- Offer reduced-power consumption and compact size

Through these advanced functionalities and features the TRIUMPH will support:

- improved network infrastructures with very high capacity and increased scalability

- transparency to data-rates, format and protocols
- interoperability of existing network infrastructures and smooth migration to future network solutions
- end-to-end intelligent optical networking
- flexibility in bandwidth provisioning
- reduced capital and operational expenditure