

# WT2.5: Politecnico di Milano

## Report

Activities performed during the visit

in Politecnico di Milano, Department of Electronics and  
Information, Milan, Italy

period: 06.02.2016 to 13.02.2016

author: Wojciech Kmiecik



## Personal Information

**Mr. Wojciech Kmiecik**, faculty member of **Wroclaw University of Technology, Poland**

*(name of sending institution, country)*

visited **Politecnico di Milano, Department of Electronics and Information, Milan, Italy** in

*(name of the visited institution, country)*

The period from **06.02.2016** to **13.02.2016** in order to carry out research and training activities in the field of **computer network optimization**.

*(give the area)*

## Information about Seminars

The seminar presentation was organized on **10.02.2016**

*(the date)*

It was entitled:

**Dynamic Overlay Multicasting Scheduling in Elastic Optical Networks**

## Description of scientific activities

(Please describe value added to the ENGINE project i.e. new knowledge, new skills with respect to the objectives of the project, the assigned common area of future cooperation with the partner, plans for common research, projects, publications and how it could be used in the scope of ENGINE)

During my stay in Politecnico di Milano I had an opportunity to collaborate with the staff of the Department of Electronics and Information, especially with the researchers (prof. Massimo Tornatore and Francesco Musumeci) and PhD students (Marco Savi) from Broadband Optical Networks, Security & Advanced Internet Lab (Bonsai Group). During many discussions, I learned a new knowledge related to:

- Optimization of computer networks, with a special focus on elastic optical networks.
- Organization of the education at Politecnico di Milano and other Italian universities (including organization of the PhD studies)
- Organization of the research work and academic teaching at Politecnico di Milano and possibilities to develop as a researcher
- Information referring to the intellectual property in Italy
- Cooperation between universities and SME in Italy

During the visit in Milan, two main subjects of the research were discussed. The topics relate to the optimization of elastic optical networks - the technology, which is expected to be a future of optical networks. The topics are as follows:

### 1. Overlay Multicast transmission in Elastic Optical Networks

The most effective technique (in terms of cost and performance) to provide data streaming to multiple users in computer networks is multicast transmission, defined as one-to-many communication. All-optical multicast is not deployed in most of real-world backbone networks. Therefore, we discussed the idea to implement the multicast transmission in an overlay mode, which is a virtual network, realized in the application layer, on the top of an underlying physical network, which, in our case, corresponds to the Elastic optical network. Nodes of the overlay network can be considered as being connected by virtual or logical links, each of which corresponds to a path, possibly through many physical links, in the underlying physical network. Thanks to that independence from the physical layer, overlay networks are flexible, scalable and robust. Moreover, it is comparatively easy and inexpensive to design and implement new overlay communication protocols and environments.

### 2. Scheduling/ Deadline-Driven Requests

Modern, deadline-driven applications and services may have diverse bandwidth and deadline requirements. For example, real-time applications, such as large bulk data transfers or stock market information exchange applications, require immediate service, while database/server backup applications may require a large bandwidth, but not necessarily immediately, thus having looser deadlines. The possibility to use different transmission rates to serve an application combined with the deadline requirements creates different scenarios by which the service provider can serve these deadline-driven requests (DDR). This creates opportunities for the service provider to enhance the network performance by exploiting these opportunities while meeting the customer's requirements (i.e., deadlines). Elastic Optical Networks could be a better fit for those services, because of their main advantages:

- effective use of optical spectrum,
- Support of various modulation formats,
- Distance-adaptive transmission;

I had opportunity to participate in the weekly meeting of the Bonsai group. During the meeting, I had a talk about dynamic routing, multicasting and scheduling in elastic optical networks.

## Information referring to the intellectual property

(the generally binding law in this area in the visited country and procedures of patenting);

N/A

## Description of the cooperation between universities and industry

(how it is organized in partner's organization, the sources of funding, the opinions about drawbacks and strengths of existing solution).

N/A

## Other activities

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**REMARK:** Apart from this information also a program of the visit and the presentation in electronic version should be given to the project office (please send all of them to Urszula.Markowska-Kaczmar@pwr.wroc.pl). Please respond to the points 1-5 for outgoing visit and points 1-3 for incoming visit. Point 6 is for extra activities that are not put in points 1-5.