Master 2 Internship 2013

Subject: Multicast Provision
in Optical Networks with Mixed Line Rates

Location: LIA, University of Avignon, France

1 Subject Description

For satisfying heterogeneous traffic demands, the cost-effective optical backbone network tends to support Mixed Line Rates (MLR) with the help of different modulation techniques, e.g. 10/40/100 Gbps [1, 2]. In this internship, we study the problem of provisioning a set of multicast sessions simultaneously in transparent MLR optical networks [3]. Generally, big bandwidth is required by these multicast sessions, which means that a multicast session may be carried out by using several line rates. As the optical transponder is costly and the wavelength channel usage is expensive, our objective is to minimize the joint cost of transponder cost and wavelength channel usage cost while accommodating all multicast sessions.

In the studied multicast provision problem, we not only need to solve the multicast routing and wavelength assignment (MRWA) subproblem but also need to deal with the line rate selection subproblem. The MRWA problem aims to find the light-trees for each session and assign wavelengths between these light-trees, while the purpose of the second one is to configure the line rate of each light-tree such that the bandwidth requirement of each multicast session is satisfied. However, different line rates are subject to different maximum transmission reaches. The fact that the MRWA subproblem and the selection of line rate should be solved at the same time makes light-tree optimization complicate. In order to solve this complicate optimization problem, we propose to use Mixed-Integer Linear Programming (MILP) formalism and tools. Aiming at solving exactly larger scale problems, we will investigate different MILP decomposition schemes, exploiting the special structure of the problem. In order to provide good quality solutions in a limited computing time, heuristic algorithms will also be developed to provision multicast communications in large-scale optical networks.

2 Required Skills

Master in operation research, computer networks, or related disciplines, good programming skills in C++ and some knowledge of CPLEX (optional)

3 Duration

6 (or 10) months, from March to September (December) 2013 (negotiable)

4 Contacts

The internship will be conducted at the LIA lab in the University of Avignon, France. It will be jointly supervised by Dr. Fen Zhou and Dr. Boris Detienne. If you are interested at this position, please send your CV to the following emails

- Fen Zhou (Associate Professor), fen.zhou@univ-avignon.fr

- Boris Detienne (Associate Professor), boris.detienne@univ-avignon.fr

References

[1] Pulak Chowdhury, Massimo Tornatore, Avishek Nag, Ezra Ip, Ting Wang, and Biswanath Mukherjee. On the design of energy-efficient mixed-line-rate (mlr) optical networks. *IEEE Journal of Lightwave Technology*, 30(1):130–139, Jan. 2012.

[2] Juzi Zhao, Suresh Subramaniam, and Maite Brandt-Pearce. QoT-aware grooming, routing, and wavelength assignment (GRWA) for Mixed-Line-Rate translucent optical networks. In *Proc. of the 1st IEEE International Conference on Communications in China*, pages 318–323, Aug. 2012.

[3] Fen Zhou. Multicast provision in transparent optical networks with mixed line rate. In *Proc. of IEEE ONDM'13*, 2013.