BONE Major Achievements

WP27: Physical Impairments Constraint Based Routing in Packet Switching Networks

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WP Objectives

This WP is focused on routing and physical layer impairments related actions and mechanisms able to improve the management and performance of packet based networks.

For that main guidelines were defined related to the potential speed of actuation, therefore related application potential, e.g. at router or management level. For supporting decisions at the different levels, monitoring strategies should be observed and characterized. Also, the type of decisions to be taken should be evaluated and implemented differently depending on the need and the type of problem in hands (e.g. one packet degraded, or a link with increased degraded performance). For the whole management there exist already a set of ICBR (impairment constraints based routing). The ICBR have been mostly developed for circuit oriented networks, it is required to redress the concepts related.

Status at start of the BONE-project

ICBR is a topic which has been along the recent years getting some attention. Several were the works published in the last five years. The topic is very popular in static or quasi-static path establishment and regenerator placement. The BONE WP27 project tried to push the ongoing efforts a little bit further by challenging the existing concepts at the light of the future packet networks. In the area of monitoring, no evident solution for monitoring packets, in a packet by packet manner. In this field BONE WP27 has also tried to assess some solutions and observe its potential for fast monitoring. Bit by bit management has been, for long time, a study topic in optical signal processing, therefore difficult to innovate, but in BONE WP27, new concepts on packet control and management were pushed.

Major progress during BONE-project

During WP27 time duration, 5 joint activities were designed, in which 13 partners were involved. The partners, as in all other WP's, gathered around some of the proposed objectives of the project, since at proposal time, not all ingredients were known. As a summary, in this WP, major advanced were achieved and recognized internationally by the number of publications obtained.

The project managed to be successful in a subset of the overall objectives, namely in the revision of the ICBR state of the art, the monitoring techniques at packet level, the interoperability between layers, regenerator placement and impact of physical constrains in the definition of paths. Most of the work was fully focused on true packet monitoring and processing, however, due to the existing gap in research and deployment of this type of networks, several parts were devoted to both packet and burst or path oriented solutions.

The major results of the collaborative work between partners were:

- Packet monitoring techniques based on nonlinear optical preprocessing and filtering were studied and experimentally evaluated, and the prediction of packet accumulated dispersion was performed;
- The interoperability between management, control planes and monitoring functions was proven through an integrated cross-layer solution, accomplishing dynamically assessment of quality of the optical paths. One solution was a clock tone-based PMD monitoring technique, CD and OSNR-insensitive, which provided a cost-effective solution for OPS networks;
- The impact of the fiber link distance in dynamically provisioning connections within a GMPLS-enabled translucent WSON was evaluated. The comparison between two link-cost strategies (uniform and distance-based) was carried out;
- The Routing and Wavelength Assignment (RWA) and Regenerator Placement (RP) in translucent networks were investigated. Experimental tests on the impact of different regenerator placement strategies under dynamical provisioning proved that one proposed solution is optimal and require low computation times.

Added value of the BONE NoE

The impact of BONE in WP27 was very high, but the second order impacts were even more important. As what regards the BONE WP27, the JA's were only possible due to the efforts and distributed competences among the partners. Within the WP partners, even with reduced funds, due to the existing common topics and complementary expertise, timely and committed integration of efforts at very low cost was possible, since, in many cases there was no specific motion to engage the resources for the subject in hands. For WP 27 this effect was clear in the realization of some works, which did not required even mobility, e.g. the packet monitor where filters were made and sent by one partner and integrated by the other, and to those with mobility, simple and fast integration and alignment was possible due to the already mentioned general topic alignment in the framework of BONE. Also, the availability of opinions and contacts on a variety of subjects inside the WP framework is a major advantage.

Outside the framework of BONE and the WP, the fact of being inside BONE, and touching the subjects of the WP's, a certain type of general accreditation was rose, since collaborations with external entities and countries was better seen due to the weight of such a network, in terms of representation of the knowledge in the area of optical networks. On of the cases is NICT, Japan, which, afterwards joined as external partner, and with which was possible to realize a set of experiments and expand the existing collaborative relationship with some groups to an even broader relation within groups in Europe with more partners from the BONE consortium to interact with this institute.

In general, the benefits at project, WP or institutional level stemming from the BONE participation are mainly related to visibility and knowledge base access due to the broad set of partners involved and their high quality and dynamism.