



BONE Major Achievements

WP23: TP on Optical communication networks in support of user mobility and Networks in Motion

WP Leaders: AIT

WP Objectives

This WP is focused on three main directions identified in the following objectives:

- To perform studies on intelligent technologies and design challenges for wireless access in networks in motion (e.g. based on RoF, FSO, or conventional wireless solutions with optical fibre feed)
- To perform studies on networking properties and switching characteristics for the aggregation and core networks in support of networks in motion (e.g. Switched Ethernet based solutions or advance schemes like OBS/OPS),
- Development of control plane and signalling algorithms and protocols for networks in motion (e.g. MAC layer design or network layer approaches with QoS quarantines, resource reservation approaches etc.)

Status at start of the BONE-project

An emerging networking concept is started to grow based mainly on the requirements of mobile working groups of people of various societal sectors that demand ubiquitous connectivity. There was a fast growing need of the individual subscribers to carry around their own short-range personal networks which were constituted when networked personal devices could interconnected and create a Personal Area Network (PAN). Many groups of users existed who follow a slowly or a fast mobility pattern and therefore access on mobile vehicles (car, train, airplane) or just to people moving on foot has started become a necessity. This need of “network in motion” resulted in the investigation of the availability of surrounding infrastructure to support a large amount of personal network connections.

Major progress during BONE-project

In this work package different technologies exploiting the capabilities of “network in motion” concept are investigated. These include the areas of: components supporting FSO networks in motion, Converged MAC algorithms for unified optical wireless functionality, UWB Radio-over-fiber transmission using different media and Optimization of converged hybrid optical-wireless network.

In the area of the FSO networks in motion Optical wireless technology is used which is able to guarantee high level of security with a broadband, up to 10 Gbps and more, connection. An experiment is conducted using a Gigabit Ethernet system in a unique environment involving traffic roads and a lake. The performance results revealed the dependency on the traffic turbulence generated by the cars moving across the lake’s bridge, the humidity coming from the lake itself and the fog generated during the winter time. In this way the last mile bottleneck of telecommunication networks can be solved and at the same time taking care of the atmospheric conditions and carefully controlling the beam misalignments.

The use of converged MAC algorithms proposed efficient network planning and processing management for integrated Wireless-Optical Networks and lead to the development of novel dynamic bandwidth allocation schemes and routing protocols adapted to Hybrid Networking. It was demonstrated that the utilization of maximum transmission time-slot for each operating wavelength can consequently provide reduced packet delay. Also the performance of the DMW protocol is investigated at FTTH-based GPON network using the OPNET v.14.5 platform.

The performance of Ultra-Wide Band (UWB) signals in radio-over-fiber transmission for in building applications is also investigated. First, UWB implementations providing similar spectral efficiency were analyzed experimentally when transmitted over 300 m of standard single mode fiber (SSMF) and then a VPI-Matlab simulation model has been implemented considering the UWB channel response in indoor environments to identify a theoretical model of such environments.

A novel optimization technique is used to converged hybrid optical-wireless network to increase its reconfigurability and improve its resource usage. The feasibility of the proposed multi-layer reconfigurable optical-wireless network architecture is demonstrated experimentally.



Added value of the BONE NoE

This WP has brought together researchers from a diverse technological background focusing initially on either wireless- or optical- centered technical solutions to study user mobility and Networks in Motion. The proposed collaborations targeted in the identification of intelligent technological solutions and designs for hybrid wireless and optical networking, resulting in optimum solutions from both domains in order to increase the utilised bandwidth and mobile user accessibility.

Preliminary discussions have already been initiated over the last BONE plenary meeting in order to utilise the established strong collaborations through this WP for the upcoming EU call for research project proposals (FP7 call 8) close to the end of 2011. This call has been identified as of particular interest to the objectives of WP23 since it specifically targets on solutions for hybrid wireless and optical networking.