1. Mobile Ad-Hoc Networking Study using **OPNET**

Nowadays, ad hoc networking represents an increasingly studied technology which makes possible a wireless network environment making unnecessary neither access point nor infrastructure. These peer-to-peer networks in which nodes communicate over wireless links forming a multihop radio network are cases of study of many research projects empowered by all kind of institutions such as universities, industry, government...

This project analyzes, using **OPNET** modeler, ad hoc networks and its behavior and performance through OSI layers from 1 to 3.

Since nodes in a MANET (Mobile Ad hoc NETwork) environment communicate over wireless links, they are affected by several problems related to radio communications such as noise, interferences... It is expected to compare not only in terms of networking performance de-centralized ad hoc networking (lack of infrastructure) versus wired networks or classic wireless networking (which require some infrastructure for the network to be operative). As a part of the physical level scheme, physical level regarding UMTS and cross-layer optimization in mobile ad hoc networks will be also studied and analyzed.

![Mobile Ad Hoc Network]

*Figure 1: Ad Hoc network*

Although a physical layer study is an important issue, one of the main goals of this project is to analyze MAC layer protocols in ad hoc networks and its integration with wired traditional networks using **OPNET** modeler. Also, this project will focus its study on the LAMAN protocol (Load Adaptable for Ad Hoc Networks) and how it is differentiated from another ad hoc MAC layer protocols. The LAMAN protocol is based on a CDMA (Code Division Multiple Access) generic scheme and on the utilization of multi-user detectors (MUD). In fact, LAMAN supports multi-user communications in an ad hoc environment, making ad hoc networking not just only a single peer-to-peer communication; with LAMAN, more than one node would be able to send packets at a time. Medium access is traffic-dependent: when traffic is low, the medium is accessed randomly, while when traffic is high, the medium is accessed in a deterministic way.
When analyzing MANET networks, we should think in a group of mobile users which communicate over bandwidth-limited links. Since these users are mobile nodes, network topology can change rapidly and without following any prevision, so designing OSI layer 3 protocols for this kind of networks is a very complex task. There are several factors (inexistent in wired networks) as variable wireless link quality, path loss, radio interferences, which convert a best path in a not so preferred one. Also efficient routing protocols are necessary to permit nodes to communicate over multihop paths without spending more resources than strongly needed, in order not to produce network overhead, because of the link limits wireless networks are affected by. This is the reason why an OPNET guided study of ad hoc routing protocols would be a useful tool in analyzing MANET networking performance.