Title: Real-time services in Wireless Mesh Networks

Introduction
The Internet has been serving us as a data communication infrastructure for more than one decade. Given the user demands and technology pushes, the Internet is increasingly used to provide real-time multimedia communications services such as Voice over IP (VoIP) and video conferencing, and continues to reach more and more mobile users. How to provide mobility support in the Internet have been a long-standing challenge, and a variety of solutions, such as IETF Mobile IP v4 and v6, HAWAII, and Cellular IP, have been designed.

Wireless multi-hop networking has recently attracted much attention as a quick-and-cheap solution to offer wide wireless coverage for the last-mile Internet connection, which is a necessary first-step to enable pervasive mobility services. A wireless multi-hop network generally consists of a set of nodes that interconnect with each other via wireless medium to form a wireless backbone. Some or all of the nodes also serve as access points for mobile users under their coverage. One or more nodes may have wired connections to the Internet and work as the gateway.

One of the main current challenges in multi-hop scenarios is the support of real-time communications in mobile environments, considering issues such as Quality of Service, routing and seamless mobility, due to its shared and mobile environment. Also, although these scenarios started using WiFi technologies, WiMax is also getting much attention for these environments, as it provides high bandwidths, wireless access for remote areas and multi-hop support, and then, is able to significantly extend the wireless coverage.

Objectives
The aim of this PhD Thesis is to study and propose new mechanisms for the support of real-time services in Wireless Mesh Networks including new technologies such as Wimax, supporting emerging services with high quality requirements, and enabling and controlling the mobility of users seamlessly to the running services (Figure 1). For this purpose, the following areas of work are of main importance:

- Real-time services support with quality of service requirements. This will include tasks such as: developing models and tools to measure the available bandwidth in wireless mesh networks that will then help on the distributed admission control of new services and users in the networks; provide differentiation of services and users; detect and collaboratively react to congestion situations; detect and predictively react to mobility of users, providing the seamless move of the users maintaining its services quality in the network.

- Efficient routing in a multi-hop, multi-technology and mobility environment, addressing efficient exploitation of cross-layer information to enable an optimized neighbour selection technique through QoS aware and physical proximity mechanisms, and addressing different technologies and groups of wireless nodes. This routing will address naming and addressing flexibility, to support a clean architectural separation between name and routable address.

- Seamless and distributed mobility, where mobility is integrated with distributed location mechanisms to spread updates of the location throughout the network, in a

fast and with low-overhead process. It is also important to consider fast update of the path to the new location of the user resorting to extension of the routing mechanism, being able to optimize multi-hop handovers in order to allow global connectivity, and incorporating resource management features. New trends for future Internet architectures also aim at being centred on data and information (instead of nodes and links), which involve mobility prediction, pre-fetching and data caching, being of interest the evaluation of what level of support should be provided by the network layer.
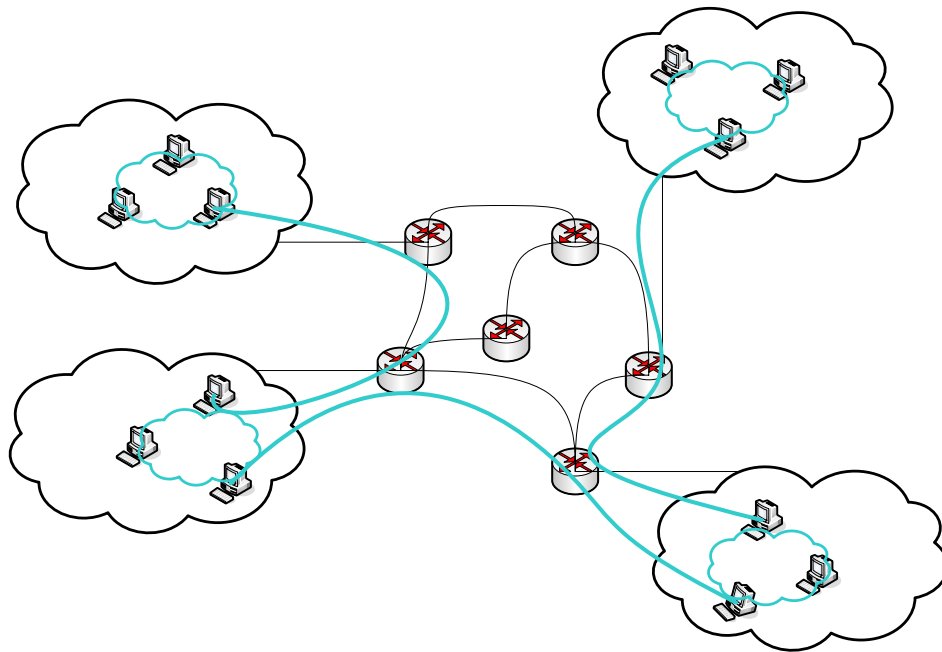

Fig. 1. Multi-hop environment for the extension of the wireless coverage

Advisory
Susana Sargento (*http://www.av.it.pt/ssargento/*, ssargento@det.ua.pt). Possible cooperation with internal and external elements, from Portugal and abroad, may exist.

Research Institution
The work will be integrated in the Institute of Telecommunications – Aveiro.

Financial sources
If required, it may be possible to provide a scholarship funded mainly from European projects.