

acters like é, á, ő, and ö occur quite often. For example, the character 'o' has three accented variants in the Hungarian language (ö, ő, ó); together with the capital equivalents, this makes eight different but barely distinguishable characters for the OCR software. Even during post-processing, it is hard to tell which variant is the correct one, as there are many meaningful word-pairs that differ only in a single accent (eg kor, kór, kör). Complete statistics were gathered for the most common accented character identification errors.

The fault-tolerant search algorithm that was developed based on these findings has been integrated into the new versions of the Contentum content management product, and may also be used for further collaboration in European projects related to data repositories. In addition, and along with the list of the most common character substitutions, the analysis and the algorithm may provide a good basis in the future for building a robust search index for digital repositories comprising digitized documents.

Links:

Meta-Contentum R&D project (FreeSoft, 'A meta-contentum k+f projekt."): <http://www.contentum.hu/hu/news/meta-contentum-kf>

Department of Distributed Systems, SZTAKI: <http://dsd.sztaki.hu>

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Enhanced, Ubiquitous and Dependable Broadband Access using MESH Networks

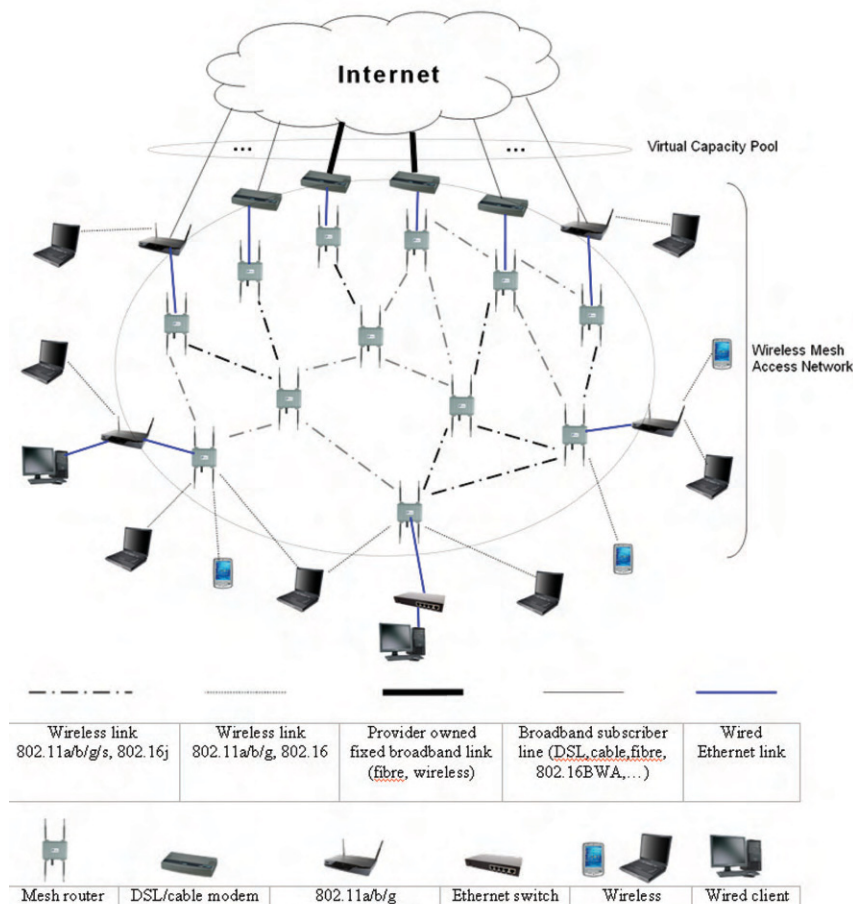
by Vasilios Siris, Ioannis G. Askoxylakis, Marco Conti and Raffaele Bruno

The reduction of network deployment and operation costs and the integration of wireless access networks with fixed broadband access technology are crucial to allowing small and medium-scale enterprises to enter the high-growth potential mobile broadband access market, and for the introduction of innovative services that require pervasive broadband access.

This is the focus of the thirty-month EC-funded project EU-MESH (Enhanced, Ubiquitous and Dependable Broadband

Access using MESH Networks), which commenced in January 2008 and is targeting the objective 'Network of the

Future' of ICT's 'Pervasive and Trusted Network and Service Infrastructures' challenge.



Mesh access network topology.

EU-MESH's goal is to develop, evaluate and trial a system of software modules for building dependable multi-radio multi-channel mesh networks with QoS support that provide ubiquitous and ultra-high-speed broadband access. The system will be based on a converged infrastructure that uses a wireless mesh network to aggregate the capacity from both subscriber broadband access lines and provider fixed broadband links to form a virtual capacity pool, and will provide access to this capacity pool for both stationary and mobile users. It will support low operation and management costs, through novel configuration and management procedures that achieve efficient usage of both the wireless spectrum and fixed broadband access lines. This will increase the competitiveness of existing providers, lower the barrier for small enterprises to enter the mobile broadband access market, and enable innovative services.

Existing mesh systems are based on non-standard solutions, do not achieve efficient resource utilization, have sub-optimal channel and power control that prohibits large-scale deployment, and

lack a comprehensive security solution combining proactive and reactive mechanisms.

To address the above, EU-MESH's objectives are to develop:

- algorithms that combine channel access with power and channel control to reduce interference
- QoS and opportunistic routing algorithms to support scalable end-to-end QoS and efficient resource usage
- location-aware automated (re-)configuration procedures that adapt to varying network conditions to provide robust connectivity
- lightweight application layer procedures for seamless mobility over heterogeneous and multi-operator mesh networks, and
- secure routing, communications and handover in multi-operator mesh net-

works, and intrusion detection and mitigation mechanisms that exploit cross-layer monitoring.

The system will be assessed through local experiments and metropolitan-scale trials, from the perspective of a pure wireless network operator and a wired/wireless telecom provider.

The nine European organizations participating in the EU-MESH project are: FORTH-ICS (Coordinator, Greece), National Research Council - CNR (Italy), Technical University of Berlin (Germany), University of Applied Science of Ticino - SUPSI (Switzerland), Budapest University of Technology and Economics - BME (Hungary), Proximity (Poland), Forthnet (Greece), Thales Communications (France), and Ozone (France).

Link:

<http://www.eu-mesh.eu/>

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Establishing the First European Research WiMAX Testbeds

by Kostas Pentikousis, Marilia Curado, Pedro Miguel Neves and Marcos Katz

The WEIRD (WiMAX Extension to Isolated Research Data Networks) project is unique in the European R&D scene: by the end of May 2008, WEIRD will deliver not one but four WiMAX testbeds, all interconnected via GEANT2, the pan-European research and education network. By combining theoretical methods with empirical research and prototype development, the project identifies and addresses the needs arising from a variety of scenarios, ranging from environmental monitoring to telemedicine. WiMAX has been much touted (and criticized) during the last years. The WEIRD testbeds are instrumental in separating hype from reality.

In recent years, increasing attention has been paid to the IEEE 802.16 family of wireless local and metropolitan area network (LAN/MAN) standards and its potential to change the field of telecommunications operations and business models. Along with the WiMAX Forum extensions that define an end-to-end architecture, this wireless LAN/MAN technology emerges as a potent proposal for building next-generation wireless networks. According to some projections, 1.3 billion people could have access to WiMAX networks by 2012. Despite the buzz however, there is very little data on what can actually be done with WiMAX, in practice, today. In fact, the current WiMAX-related literature is based primarily on analysis and simulation, making use of the general properties of systems employing Orthogonal Frequency Division Multiple Access (OFDMA), and for the most part draw-

ing on specifics from vendor-provided data.

The primary goal of WEIRD is to establish four cutting-edge research WiMAX testbeds (see Figure 1), which employ both IEEE 802.16d (Portugal and Romania) and 802.16e (Italy and Finland) and interconnect them via GEANT2. In addition to the use of WiMAX as a backhaul and wireless local loop solution, the project considers three specific deployment scenarios: volcano monitoring, telemedicine and fire prevention.

Moreover, WEIRD proposes an architecture that is compliant with recent work by the relevant standardization bodies, such as IEEE 802.16, IETF 16ng and the WiMAX Forum. For example, in order to guarantee full interoperability among different

WiMAX vendors, the WiMAX Network Reference Model (NRM) is used as a foundation, and the Next Steps in Signalling (NSIS) framework is used for Quality of Service reservations. Applications employing the Session Initiation Protocol (SIP) enjoy additional services from the WEIRD system. Legacy applications are supported, and the IEEE 802.21 Media Independent Handover standard has also been considered and integrated into the WEIRD architecture. This allows multi-access nodes to take advantage of the WEIRD architecture and optimize seamless handovers between WiMAX (and other) access networks. Furthermore, in order to allow for independence from the particulars of WiMAX vendor equipment, an abstraction layer has been defined that separates the lower-layer specific functionalities from the upper-layer ones. In order to