Chapter 7.9
A Concept for Mobile Ad-Hoc Messaging Networks (AMNet)

Stefan Stieglitz
University of Potsdam, Germany

Christoph Fuchß
Virtimo Webbased Applications, Germany

Sascha Stöckel
Brandenburg University of Applied Sciences, Germany

Christoph Lattemann
University of Potsdam, Germany

ABSTRACT

This article shows an innovative approach for an ad-hoc messaging network (AMNET) which uses simple store-and-forward message passing to spread data asynchronously. This approach primarily focuses on application specific needs that can be covered by simple message passing mechanisms. In this paper we will describe a powerful network by using simple devices and communication protocols on the basis of AMNETs. Simulation results of our AMNET approach provide insights into speeding up the network setup process and enable the use of AMNETs even with few participants by introducing a hybrid infrastructure and mobile nodes.

INTRODUCTION

New mobile phones are equipped with multiple communication interfaces which provide a potential interconnectedness for various applications. But the underlying networks tend to depend on infrastructures that are bound to stationary devices, such as access points, cellular mobile radios, providers who regulate access to the Internet and to the traffic control. In our research we concentrate on a new “message-based” approach. This allows data exchange between mobile devices without the need for a centralized service unit. Data exchange mechanisms are based on the Bluetooth standard and follow store-and-forward principles. By categorizing the transferred data into personalized or anonymous messages it is
possible to analyze the different requirements in ad-hoc messaging networks (AMNETs) regarding security, stability, and flexibility (Fuchß et al., 2006). This contribution is embedded in research on routing problems (Zhen et al., 2003) between nodes on mobile ad-hoc networks, e.g. common MANETs or mesh-networks (Macker et al., 1998). On the basis of this, we will present the AMNET concept and provide empirical research in this field of ad-hoc networking based on Bluetooth connectivity.

Furthermore we test the AMNET concept in a simulation and investigate the message transfer behavior in AMNETs. For this reason we set up an environment that allows numeric simulations of message transfers. Therefore we are able to track the influence of additional stationary nodes that are statically connected. This structure represents a hybrid network of mobile and stationary nodes which speed up message diffusion compared to scenarios containing mobile nodes only. This is the most important factor concerning a potential diffusion of AMNET technology in reality. This contribution ends with the description of the simulation results and final conclusions.

**ROUTING IN MOBILE NETWORKS**

In this section we will present the essentials of the AMNET approach, the ad-hoc platform, based on the IEEE 802.15 Bluetooth standards for wireless local networks (e.g. personal area networks). First, we will concentrate on the issue of addressing and routing messages. Second, we will discuss the potentials and possible applications for AMNETs.

In recent years a growing number of research has been conducted on routing in MANETs (Chin et al., 2002; Royer et al., 1999; Xu et al., 2003), particularly with regard to the limitations of routing protocols (Ni et al., 1999). Some reactive and proactive routing algorithms are provided with respect to different situations. Common protocols show specific vulnerabilities according to scalability, mobility, and network utilization. In growing networks both methods run out of control because scalability is not suitable and depends on the network’s structure. According to Broch et al. (Broch et al., 1998) the main factors that retard the effectiveness of the algorithms in scaling networks are unpredictable mobility, network load, and complex topology. Networks with fast moving nodes often change their topology. These “vivid” networks rely on mechanisms to find routes that are too complex to grant enduring topologies (Chlamtac et al., 2003).

These highly dynamic MANETs which contain a large number of network nodes are based on ad-hoc routing protocols (Ni et al., 1999; Woo et al., 2001). In practice a trade-off between stability and the maintenance of bandwidth overhead limits the effectiveness of those settings in growing scenarios. Especially reactive algorithms tend to be not usable within huge networks and reactive routing algorithms do not tend to scale well in large settings (Xiaoyan et al., 2002; Yu-Chee et al., 2002).

Promising improvements have been suggested by the work of Hass et al. combining proactive and reactive paradigms to a hybrid routing algorithm, such as the “Zone Routing Protocol (ZRP)” (Haas et al., 2002), which proves efficiency in various environments. With respect to a remarkable increasing complexity of the cutting-edge MANET routing algorithms which are the main obstacle for implementing and using them in practice we follow an approach of a different direction: To keep routing as simple as possible considering messages as the point of interest and deny the ambition to bring all internet features to mobile networks. AMNET concentrates on mechanisms to provide a best-fit solution for certain application’s needs in vivid network environments.