

Seamless Gateway-Handover in Ad Hoc Networks

Mobile Information and Communication Technology

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In disaster recovery and public safety, wireless ad hoc networks are a promising approach for mobile broadband communication. Big challenges in such multi-hop wireless networks include seamless connectivity and seamless handover for broadband real-time traffic like video transmissions among different gateways to a fixed network. In this thesis we have designed and implemented a demonstrator to show that seamless gateway-handover for real-time videoconferencing traffic is feasible when employing off-the-shelf low-cost equipment. In- and outdoor tests look promising.

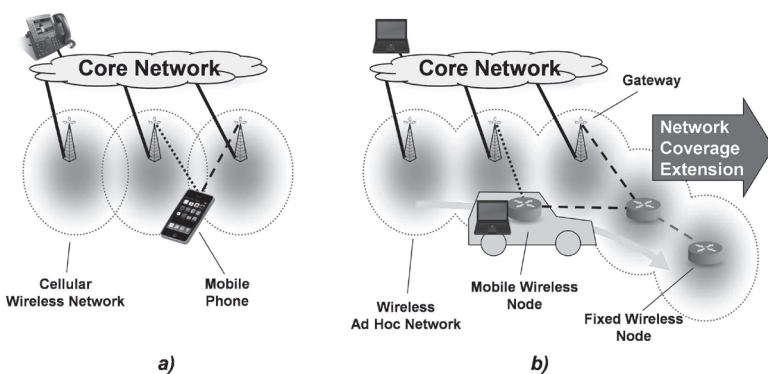


Figure 1: a) Cell handover from dotted to dashed wireless link in single-hop cellular wireless networks such as GSM, UMTS and LTE. b) Gateway handover from dotted to dashed wireless path in a multi-hop wireless ad hoc network.

Mobile publicly available communication services are based on **cellular wireless single-hop network architectures** (GSM, UMTS, LTE), where only the last hop is premised on a wireless medium as shown in figure 1a).

In rescue operations, disaster recovery and other crisis management scenarios up to military operations, the use of publicly available networks is either not possible or not appropriate. Autonomous communication systems are utilised – but these today's mobile radio networks support only narrow bandwidth.

In future, upcoming wireless network concepts can provision broadband connectivity in crisis management scenarios – even for real-time traffic like video transmissions.

A not damaged fix installed telecommunication infrastructure can

be **expanded** by rescue forces from outside into a disaster area with a wireless ad hoc network: transportable and mobile wireless nodes have to be placed for network coverage extension and build-up automatically a **multi-hop wireless ad hoc network**, interconnected to a fix installed core network by multiple gateways. When a mobile terminal with its mobile wireless node is moving around, the network has to choose dynamically the optimal path between the communication partners. Therefore, two types of handover can occur: a handover inside the wireless ad hoc network (intra-do-

main) and a **gateway-handover** (inter-domain) between the mobile node and the communication partner in the core network. The second case is similar to a **cell handover** in cellular networks, but more complex due to the multi-hop network characteristic.

For real-time traffic, every handover must happen in a **seamless** way without any interruption of running transmissions.

A seamless gateway-handover protocol for real-time traffic was designed and a demonstrator was implemented.

The demonstrator consists of a core network and a multi-channel multi-radio wireless ad hoc network with three gateways, two fixed wireless nodes and one mobile wireless node as shown in figure 1b).

This demonstrator was evaluated in a realistic setting towards its ability to guarantee seamless connectivity for real-time traffic like IP live video streaming and IP videoconferencing.

From our tests in-house and outdoor we conclude that seamless gateway-handover for broadband real-time traffic is feasible.



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