8 Second System: Local Cloud

This chapter presents the iterative development of the second system developed in the frame of this work. The Local Cloud system is a messenger application that reuses the same network paradigm as the Help Beacons system in order to opportunistically enable local P2P networks between smartphones. Two prototypes have been developed which provide an additional reference how to implement the quality attributes defined in section 5.2. First, the chapter describes the core idea and concept of the system, and then describes in detail the course of development for the two prototypes. This chapter concludes by explaining how the considered qualities have contributed to the resilience in the design of the presented mobile ad-hoc system.

8.1 Concept

The Local Cloud concept envisions the idea of sharing information in a P2P fashion by opportunistically creating MANETs and interconnecting them by means of devices moving from one MANET to another until eventually data can be shared with the online world. This idea behind one or more local cloud¹ is inspired by patterns observed in disasters with large geographic extension, such as the earthquake in Chile in 2010 (see section 4.2.2.4), which created “islands” of connectivity whose users stranded within the affected territory. As people traveled, they moved across these islands. This observation shows an interesting opportunity: people moving across separated “islands” of connectivity could propagate messages from one cloud to other clouds. Eventually, a device carried or deployed by a person may be able to gain Internet access and relay the collected data, acting as a mediator between isolated areas and the online world. This relaying mechanism can facilitate the construction of temporary bridges to move data across poorly connected areas, and moreover support the distribution of important information for the population and the search for missing people. Figure 54 illustrates how messages could be shared inside a MANET (dotted lines) and transported from a MANET to another one (dashed lines) until messages would finally flow into the online world.

¹ For the sake of readability the author will often solely write “cloud” instead of “local cloud”.
The concept of the Local Cloud system is similar to store-and-forward mechanisms. These mechanisms have been used successfully in other networks with restricted availability such as FidoNet\(^1\), which in the mid 90’s used residential phone calls to move millions of message posts and emails across bulletin board systems.

### 8.2 First Prototype

This section describes the first prototype of the Local Cloud system. The prototype is tested in a simulated sniper scenario. Parts of this section were originally published in (Al-Akkad, Raffelsberger, et al. 2014), but have been partially rewritten and extended to fit the format and structure of the thesis.

#### 8.2.1 Design

Technically, the Local Cloud concept can be constructed by leveraging the WiFi capabilities in smartphones, namely the 802.11 infrastructure mode. Table 18 explains the setup of deploying a local cloud (HUB).

Figure 55 depicts the flow chart of enabling the HUB mode. In particular, in case no device has associated with the HUB device, the device disables the advertised wireless network after a certain time interval and switches into client mode to look for other potentially available HUBs. The flow chart in Figure 56 depicts how a second device, called the client, enables its WiFi interface. The client scans its vicinity for some time interval for the availability of WiFi networks. The client finds the HUB device and identifies it as a HUB by means of recognizing the marking string of characters contained in the SSID.

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\(^1\) FidoNet, [http://www.fidonet.org](http://www.fidonet.org)