Information Gathering and Sharing in DT-MANETs

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1 Introduction

Mobile ad hoc networks, a.k.a. MANET, are self-organizing wireless networks formed by groups of mobile devices, also called stations, able to communicate with each other in a decentralized way, without the help of any pre-existing infrastructure. Two stations can communicate if and only if they are both within their communication range, thus, a station can only communicate with devices located in its neighborhood. Among MANETs, the class of DT-MANETs represents a particular category. DT-MANET stands for Delay-Tolerant or Disruption-Tolerant Mobile ad hoc network. In such networks, there is no guarantee that a path always exists between any couple of stations. From a graph point of view this means that the connection network may be composed of more than one connected component, besides, these networks are also called disconnected networks. Within connection graphs, nodes and edges may appear and disappear at any moment, but, it is usually supposed that a journey exists between any couple of nodes. A journey between two vertices \( s \) and \( d \) is defined as a set of timely ordered edges such that \( s \) is an extremity of the first one and \( d \) an extremity of the last one [BF03]. Then, thanks to the mobility of stations, if a journey exists between \( s \) and \( d \), an information may travel between both devices. Assuming this hypothesis, sharing information between users implies that some stations play the role of data mules for carrying information.

We propose a demonstration of a DT-MANET in the context of an emergency intervention within an hazardous industrial environment. The whole application is based on a broadcasting strategy that was already validated by simulation.

2 Broadcasting in Disconnected Networks

While there exist numerous strategies for broadcasting data in MANET, very few are able to manage disconnected MANETs. In [HBG*06] a new broadcasting protocol called DFCN (standing for Delayed Flooding with Cumulative Neighborhood) was proposed. At the time of its publication, this protocol outperformed all existing ones while being easy to implement, two reasons that have motivated our choice. The principle of this algorithm is very simple and relies on the use of two thresholds for avoiding the well-known "broadcast-storm", but also to self-adapt to the environment when the distribution of stations is not uniform. Indeed, depending on the environment, stations have to be provident in dense regions and prolix in sparse ones. DFCN method allows this adaptation by relying on neighborhood information. The effectiveness of the strategy was demonstrated by simulation using madhoc [mad].

3 Target Application

The target application belongs to the risk management domain dedicated to environments to exposed to industrial and natural hazard.

Each participant in the intervention holds a mobile device (Pocket PC, PDA, smartphone, etc), equipped with a wireless interface. Each material contains a map of the site. Each participant belongs to one or several groups: firemen, emergency ambulance service, policemen, workers, decisional and operational unit. Each participant moves

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FIG. 1 – Transmission principle based on DFCN

within the environment and may take pictures, annotate the map or record audio comments and broadcasts all these
information. All neighbors receive these information, may read/exploit these data if they belong to the right groups
and relay the messages according to DFCN rules of broadcasting.

Data are of two kinds : localization (manual or generated by GPS-like equipment) and information about the
problem : description, pictures, map annotations, etc.

4 Technical Details

The demonstration will be carried out using about ten mobile devices (PocketPc and subnotebooks). These
machines are equipped with WiFi 802.11b/g radio communication devices. One subset of these machines is running
the application described above while another subset is observing and logging the communications for the purpose
of the demonstration.

The software was designed to auto-configure the devices. It can be executed on any Windows Mobile\textsuperscript{TM} Wifi
capable device without any extra human tuning. The network topology and the local representation of the network
are monitored with subsnotebooks running on Linux.

Références

[BF03] Sandeep Bhadra and Afonso Ferreira. Complexity of connected components in evolving graphs and

[HBG+06] Luc Hogie, Pascal Bouvry, Frédéric Guinand, Grégoire Danoy, and Enrique Alba. A bandwidth-


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