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Enhancing Resource Sharing in Mobile Networks Using Social Relations

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Abstract

A Mobile Ad hoc Network (MANET) is a dynamic wireless network without fixed infrastructure. Nodes move freely and organize themselves arbitrarily, and they usually have limited resources. Therefore, data sharing through this network requires cooperation among network nodes. Data sharing can be categorized to unicast and multicast. In unicast, data is shared from one source to one destination but, in multicast data is shared from one source to more than one destination. In this work, there are two challenging problems in data sharing, selfishness and data dissemination.

Selfishness is a challenging problem in the data delivery process through the network. A selfishness detect-and-motivate (SDM) approach is proposed to detect selfish nodes and motivate them to cooperate in data delivery. The other challenging problem is disseminating data efficiently. We use the influential user's concept and the social relations of users. The influential user term is described as a user that have an effective activity in the network and influence on the other users. Detecting influential nodes is useful in many applications. The detection process of influential nodes is dramatically affected by the participation behavior of the other nodes. Selfish nodes who selectively disseminate information in the network may reduce the influence of the other nodes. In this thesis, influential nodes detection is proposed taking into consideration the negative effects of different patterns of selfish behavior. A C# based simulator is used to simulate a MANET and implement the proposed approach. Using the simulator, we compare our protocols with others under different scenarios to prove our performance. The proposed protocols achieve up to 40% efficiency in each scenario.

List of Publications

[1] Doaa AbdelMohsen, and Tamer Abdelkader.” Detecting Selfish Nodes and Motivating Cooperation in Mobile Ad-hoc Networks,” Computer Engineering & Systems (ICCES), 2015 Tenth International Conference on. IEEE, 2015. pp. 301-306.

[2] Doaa AbdelMohsen, and Mohammed Hamdy. "Distributed Influential Node Detection Protocol for Mobile Social Networks." International Conference on Advanced Intelligent Systems and Informatics. Springer International Publishing, 2016. pp. 771-780.

[3] Doaa. AbdelMohsen, Tamer Abdelkader, and Mohammed Hamdy. " Selfish-free Influential Nodes Detection in Mobile Social Networks ". submitted In: Ad hoc Networks Journal (2017).

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List of Abbreviations

AODV	Ad hoc on-demand distance vector
CONFIDANT	Cooperation Of Nodes: Fairness In Dynamic Ad-hocNeTworks
DB-Scan	Density-based spatial clustering of applications with noise
FN	False negatives
FP	False positives
MANET	Mobile Ad-hoc Network
MKPAR	Multiple Knapsack Problem
SC	Selfishness considered
SDI	Selfishness Detection and Isolation
SDM	Selfishness detect-and-motivate
SI	Selfishness ignorant
SSAR	Social Selfishness Aware Routing
SU	Selfishness Unaware
SWIM	Shared Wireless Infostation Model
TCP	Transmission Control Protocol
TN	True negatives
TP	True positives
TTL	Time-To-Live

Chapter 1

Introduction

Chapter 1. Outlines

1.1 Overview

1.2 Motivation

1.3 Objectives

1.4 Contributions

1.5 Thesis Organization

Chapter 1. Introduction

1.1 Overview

A mobile Ad-hoc Network (MANET) is an autonomous system of mobile stations connected by wireless links to form a network. There are many applications of MANET in military and civilian fields. Military applications of MANET allow communications among soldiers and vehicles to form an information network, which is very sensitive to reliability and security. Civilian applications include collaborative work in the business environment to exchange information, personal area networks and vehicular networks (VANET). Other applications may be related to scientific and research studies, such as monitoring wild life using sensor networks, and emergency networks to rescue people in situations where the infrastructure is not deployable, such as in earthquakes.

The main characteristics of MANETs are the mobility of the nodes, and the limitedness of their power, storage and computation resources. Because of mobility, nodes are not continuously connected with each other. When this happens, new paths among nodes should be explored and routing tables should be reconfigured to reflect the new network topology. Moreover, because of the limited power, storage and computation resources, data delivery through this network depends critically on the cooperation among network nodes to receive and forward data packets.

Data Transmission over this network requires cooperation between network nodes. Data sharing types are Unicast and Multicast. In unicast data is delivered between two nodes, source and destination. In multicast data is disseminated from one source to more than one node. This thesis evaluates some of proposed protocols and presents solution for two of data transmission challenges, selfishness and influential nodes detection.

1.2 Motivation

Selfishness is one of the major challenges to deliver data in MANETs. Majority of the proposed protocols in MANET assume that mobile users are not selfish and they have the same degree of participation toward the other users. Selfish nodes want to maximize their individual benefits. For example, they may not relay messages of other nodes, or may willingly relay messages of their friends or the nodes inside their communities but not for strangers. A selfish node will typically not cooperate in the transmission of packets, seriously affecting network performance [1]. Some works have been conducted to solve the selfishness problem. The main concern of these works is to detect selfish nodes only. However, our concern is what to do after detection of the selfish nodes however, others isolate selfish nodes from route selection. Another problem is that most of work depends on a centralized entity that monitors all the system parts to decide about which nodes to isolate. Although isolation techniques outperform selfishness unaware techniques, they still suffer from the unbeneficial presence of selfish nodes in the network and the overload they cause to its bandwidth.

Moreover, the previous distributed techniques exchange a lot of information throughout the network, causing a huge overload on the network bandwidth and high consumption of the nodes power.

The other challenge in MANETs is disseminating data over the network to large number of users faster, efficiently, accurately, and with existence of selfish nodes. With the rapidly increasing of the number of mobile devices in recent years. Most of studies use complete social graph to solve data dissemination problem. Social contact graph is a representation of users relations in mobile social network. If the mobile social network is large the contact graph will be huge and complicated, so using social contact graph is not a good idea.

1.3 Objectives

Our objective is to enhance data sharing among networks nodes either unicast or multicast and this will be achieved by:

1- Detecting and motivating selfish nodes to cooperate in data sharing.
2- Detecting influential nodes.

The influential user is described as a user terminal that is not only having a power to influence other users, but also the users that aren't surrounded by selfish nodes that hide their dissemination, which cause a loss of their influence. So, that to be an influential user, a node needs to reach a large number of audiences and also has an effect on them. Influential nodes