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## A mobility-based cluster formation algorithm for wireless mobile ad-hoc networks

Javad Akbari Torkestani and Mohammad Reza Meybodi

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### Abstract

In the last decade, numerous efforts have been devoted to design efficient algorithms for clustering the wireless mobile ad-hoc networks (MANET) considering the network mobility characteristics. However, in existing algorithms, it is assumed that the mobility parameters of the networks are fixed, while they are stochastic and vary with time indeed. Therefore, the proposed clustering algorithms do not scale well in realistic MANETs, where the mobility parameters of the hosts freely and randomly change at any time. Finding the optimal solution to the cluster formation problem is incredibly difficult, if we assume that the movement direction and mobility speed of the hosts are random variables. This becomes harder when the probability distribution function of these random variables is assumed to be unknown. In this paper, we propose a learning automata-based weighted cluster formation algorithm called MCFA in which the mobility parameters of the hosts are assumed to be random variables with unknown distributions. In the proposed clustering algorithm, the expected relative mobility of each host with respect to all its neighbors is estimated by sampling its mobility parameters in various epochs. MCFA is a fully distributed algorithm in which each mobile independently chooses the neighboring host with the minimum expected relative mobility as its cluster-head. This is done based solely on the local information each host receives from its neighbors and the hosts need not to be synchronized. The experimental results show the superiority of MCFA over the best existing mobility-based clustering algorithms in terms of the number of clusters, cluster lifetime, reaffiliation rate, and control message overhead.

**Keywords** MANET - Network clustering - Learning automata

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### A mobility-based cluster formation algorithm for wireless mobile ad-hoc networks

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#### 1 Introduction

Dynamic network topology changes, network mobility, severe constraints on network resources such as communication channel bandwidth, processing power, and battery life, and the lack of a fixed infrastructure or centralized administration are the major challenging issues from which the ad hoc networking protocols suffer. A mobile ad-hoc network is a self-organizing and self-configuring multi-hop wireless communication network supporting a collection of mobile hosts which can be instantly developed in situations where either a fixed infrastructure is unavailable (e.g., disaster recovery), or a fixed infrastructure is difficult to install (e.g., battlefields). Two hosts can directly communicate if they are within the transmission range of each other and otherwise (i.e., when the source can not directly send the packets to the destination due to the limitation of the radio transmission range) the intermediate hosts assume the role of router and relay the packets toward the final destinations. Hence, each node in a MANET acts as both host and router. Besides the multi-hop nature of the MANET and the lack of a fixed infrastructure, these networks inherit the traditional problems of the wireless and mobile communication systems. Host mobility brings about a wide range of new challenges in the design of the MANET protocols. Frequent and hard to predict topology changes due to the host mobility,

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