別表６
（３）

Keio University

Thesis Abstract

No.

Registration Number	□ "KOU" □ "OTSU" No. *Office use only	Name	ボク　サフダル　フサイン Bouk, Safdar Hussain

Thesis Title

Autoconfiguration, Mutli-Metric Clustering and Gateway Selection Schemes for Mobile Ad-hoc Networks

Thesis Summary

Mobile Ad-hoc Networks (MANETs) are on demand, spontaneous, self-configuring, self-administrative, distributed, and plug-n-play type networks consisting of mobile wireless nodes. These properties attracted large research community to actively carry out research on MANETs. Also these properties make it difficult to solve most of the open issues in MANETs. These issues include IP address assignment to all the mobile nodes that are coming and leaving the MANET, manage network architecture or structure to effectively organize, utilize and manage the network resources, and in the case of connected MANET, MANET connected with IP network, fairly and efficiently provide IP services to all the MANET nodes etc. In this thesis, the solutions to the above-mentioned issues are proposed.

Chapter 1 describes the background of ad-hoc networks, general issues in MANETs, and the purpose and position of this dissertation.

Chapter 2 focuses on the solution for the IP address assignment to the mobile nodes of the connected MANET. To connect a MANET with an IP network and to carryout communication, mobile nodes need to be configured with unique IP. Dynamic Host Configuration Protocol (DHCP) server autoconfigures nodes in wired networks. However, this cannot be applied to the ad-hoc network as it is due to intrinsic properties of the network. We propose a scalable autoconfiguration scheme for connected MANETs with hierarchical topology consisting of leader and member nodes, by considering the global Internet connectivity with minimum overhead. In our proposed scheme, a joining node selects one of the pre-configured nodes for its Duplicate Address Detection (DAD) operation. We reduce overhead and make our scheme scalable by eliminating the broadcast of DAD messages in the network. We also propose the group leader election algorithm, which takes in account the resources, density and position information of a node to select a new leader. Also our scheme provides an efficient method to heal the network after partitioning and merging by enhancing the role of bordering nodes in the group.

Chapter 3 discusses the proposed scheme that efficiently organizes the MANETs into clusters called Energy Efficient and Stable Weight Based Clustering (EE-SWBC) algorithm. EE-SWBC elects cluster heads without sending any additional weight message. It propagates node parameters to its neighbors through neighbor discovery message (HELLO Message) and stores these parameters in neighborhood list. Each node normalizes parameters and efficiently calculates its own weight and the weights of neighboring nodes from

Thesis Abstract

No.

that neighborhood table using Grey Decision Method (GDM). GDM finds the ideal solution (best node parameters in neighborhood list) and calculates node weights in comparison to the ideal solution. The node(s) with maximum weight (parameters closer to the ideal solution) are elected as cluster heads. In result, EE-SWBC fairly selects potential nodes with parameters closer to ideal solution with less overhead.

Chapter 4 describes the proposed gateway selection scheme for the connected MANETs. In case of connected MANET, where MANET is connected to the IP Network through Gateway nodes, it is important to select a gateway node with stable path, a path with less traffic load, and small delay. Several gateway selection schemes have been proposed that select gateway nodes based on single Quality of Service (QoS) path parameter, for instance path availability time, link capacity or end-to-end delay etc. or multiple non-QoS parameters, e.g. the combination of gateway node speed, residual energy, and number of hops, for MANETs. Each scheme just focuses to improve only single network performance i.e. network throughput, packet delivery ratio, end-to-end delay or packet drop ratio etc. However, none of those schemes improve overall network performance because they focus on single QoS path parameter or multiple non-QoS parameters. To improve the overall network performance, it is necessary to select a gateway with stable path, a path with maximum residual load capacity and less latency. Here, we propose a gateway selection scheme that considers multiple QoS path parameters such as path availability time period, its available capacity and path latency, to select a potential gateway node. Also we improve the path availability computation accuracy, introduce feedback system to send updated path dynamics to the traffic source node and propose an efficient method to propagate QoS parameters in our scheme.

Finally, Chapter 5 concludes and summarizes this dissertation and discusses the future directions in the above mentioned research areas.