Enhancing Connectivity Based on the Thresholds in Mobile Ad-Hoc Networks

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Abstract. In general mobile nodes in mobile Ad-hoc networks have a limited power capacity. Therefore power management is an important issue. Some protocols are proposed considering node power consumption, such as MTPR, MBCR, MMBCR, CMMBCR. But they have no measures on link breakdown from power exhaustion of relay nodes. We propose three algorithms to prevent link breakdown and to extend the connectivity of the routes in mobile Ad-hoc networks. In these ways, the lifetime of routing nodes can be extended and the link connectivity can be enhanced. Moreover the delay due to reacquisition of the route is reduced and the throughput degradation from link breakdown is avoided.

1 Introduction

Ad-hoc network is a multi-hop wireless network with no fixed infrastructure. Ad hoc networks can be usefully deployed in applications such as disaster relief, tether les[1]s classrooms, and battle field situations. In ad hoc networks, the power supply of the individual nodes is limited, the wireless bandwidth is limited, and the channel condition can vary greatly. Moreover, since the nodes can be mobile, routes may constantly change. Therefore, many groups such as a MANET (Mobile Ad hoc Networks) have tried to solve these problems. Since the existing routing protocols don't consider a limited battery of the mobile node, they can not support a reliable transmission efficiently. The MPTR [1], MBCR [2], MMBCR [3][4], CMMBCR [2][5] are suggested to solve these battery consumption problems. These protocols transmit data through a power management by a power consumption equation. But, since the node with any frequent movement should continuously maintain a path for a stable data transmission, it has many overheads. We propose three algorithms to prevent link breakdown and to extend the connectivity of the routes in mobile Ad-hoc networks. When the received signal strength decreases below a threshold, the

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proactive arrangement of an alternate route is performed. In case that residual power goes below threshold, the node broadcasts a negative signal. On receiving this signal, the neighbor nodes establish alternate routes except for the signaling node. A relay node, operating in multi-channel mode selectively rejects any link establish request when the power requirement of the new link is larger than the threshold. The threshold is computed based on the residual power of the node. In these ways, the lifetime of the relay nodes is extended and the link connectivity is enhanced. Moreover the delay resulted from the reacquisition of the route is reduced and the throughput degradation from any link breakdown is avoided.

The rest of the paper is organized as follows. In Section 2, we propose three schemes for routing connectivity enforcement. Section 3 shows the performance results for the proposed scheme, and conclusions are given in Section 4.

2 Routing Connectivity Enforcement

The nodes in the ad-hoc network have many path changes because there is frequent movement [7][9]. Therefore, the link maintenance problem between the nodes is very important in the ad-hoc network. In general, if a source node doesn't receive ACK, transmitted from a destination node; it uses the retransmission scheme or operates the link recovery by recognizing a connection failure. This paper proposes three mechanisms to enhance the path connectivity by extending the path lifetime in an Ad-hoc network.

2.1 Detour Routing Based on Signal Strength

On the asymmetric channel assigned dynamically, the up-link node sends data to a destination by a downward channel. The down-link node sends a response message to a source by an upward channel. The Signal attenuation occurs because of the environment variables on link of middle node or sending and receiving node. The power status of the nodes is assumed to be environment variables in this paper. Signal attenuation occurs according to the power consumption of node; these lead to the instability of the connection. Hence, the reconfiguration process of the path between the sending and the receiving node is an executed in the existing method due to the close of the link connection. These lead to a delay or decrease in the processing rate.

Fig. 1 show the acquisition process of the detour routing before the disconnection of the link for continuity of the link when signal strength for up-link node is decreased in an asymmetric channel. When the signal strength that the node *b* receives from the node a, is below the threshold value, the node *b* transmits the control message (C_Msg), that the signal strength is weak, to the node *a* before the disconnection of the link in Fig. 1(a). After first searching for the nearest node, the node *a* that received the control message transmits the path request message of which node can receive the data at normal strength so as to configure a detour routing the new destination node before the link is disconnected.