Performance Analysis and Improvement of Information Dissemination Protocols in DTNs

Abstract

Networking using smart mobile devices, equipped with short range transceiver antennas, is becoming popular nowadays. These networks can follow the principles of Delay Tolerant Networks (DTNs) in order to provide low-cost services among the participating devices. The devices in these networks are capable of communicating with each other only when they come in radio range due to their individual mobility. Such point-to-point communications lead to eventual end-to-end delivery. Performance of broadcasting and routing in these networks primarily depend on the properties of agent-agent contacts and the antenna model used for the same. This thesis studies a set of problems related to broadcasting and routing in DTNs.

Firstly, we analyze the impact of using directional antenna, instead of traditional omnidirectional antenna, on the performance of epidemic broadcasting protocol, and on the performance of routing protocols in DTNs. The results show that the delay performance of both broadcasting and routing can be improved significantly by using a small number of directional antennas in the network. However, the use of directional antenna may slightly increase the number of hops needed to deliver a message when agent density is very low.

Next, the time correlation of the contacts among the agents is analyzed with an ultimate goal of designing a space-time routing protocol for DTNs. Existing studies have shown that the contacts between humans get repeated at regular intervals with a high probability. Such repetition of contacts in the network is represented in a time varying graph in order to find space-time paths between any pair of nodes in the graph. In particular, an efficient algorithm is proposed to compute best space-time paths that are then used to build a space-time routing table to be used for routing in DTNs independently at every node.

Finally, the impact of a number of properties of human movement on some targeted protocols is analyzed. In particular, a set of properties that has been observed in human mobility patterns is summarized and organized into layers to reflect a layered dependency relation among them. A generic framework of a mobility model is proposed in order to systematically exploit the impact of human movement patterns on information dissemination protocols in DTNs. The analysis shows that the correlations among the properties may not get equally reflected on the performance of a targeted protocol, and hence all the properties of human movement do not affect the performance of a particular protocol in the same way.