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Cache Discovery Over a Multihop Wireless Ad Hoc Network

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Multihop ad hoc wireless networks consist of mobile nodes that communicate with each other without any fixed infrastructure. The nodes in these networks are power constrained, since they operate in limited battery energy. Cooperative caching is an attractive solution for reducing network traffic and bandwidth demands in mobile ad hoc networks. Deploying caches in mobile nodes can reduce the overall traffic considerably. Cache hits eliminate the need to contact the data source frequently, which avoids additional network overhead. In this paper we propose a cache discovery policy for cooperative caching, which reduces the power usage, caching overhead and delay. This is done by power control and transmission range adjustment. A cache discovery process based on position coordinates of neighboring nodes is developed for this. The simulation results gives a promising result based on the metrics of studies.

Keywords : Cache Discovery, Cache Placement, Cache Replacement, Cooperative Caching, Data Dissemination.

1. INTRODUCTION

In mobile ad hoc networks (MANET)s, no base stations exist and each mobile client act as router and packet forwarder. Networks can be formed and fragmented on the fly without the intervention of a system administrator or the presence of fixed network devices. Ad hoc networks have multiple applications in the areas where wired infrastructure may be unavailable such as battle fields and rescue areas. In these types of networks new hosts can appear and old ones can disappear at any time. The topology of this network is very fragile; it can change at any moment and disconnections are frequent due to mobility or activity status changes. Mobile hosts are powered by battery while they are on move.

Thus, to ensure good continuity of system operations over time, several approaches are taken to enhance the battery life. One such approach is to design power aware transactions, which make efficient use of the overall energy resources of the network. Conserving power prolongs the life time of a node and also the life time of the network as a whole. The transmit power of a node can be adjusted to achieve maximum possible power savings. From a data-management point of view, these restrictions introduce several issues that need to be addressed. The mobile clients may suffer from long access delay or access failure, when the nodes holding the data items are far away or unreachable. Data transfers must be reduced and mechanisms must be deployed to address the frequent disconnections and low bandwidth constraints.

Data caching is recognized as a feasible approach to improve the performance in many traditional systems. Caching is the process of pre-fetching the needed data and storing it closer to the source. In mobile ad hoc networks, caching can improve mobile client perception in three ways. First, retrieving data from a remote data center involves wireless media network transfers and there is a chance of data loss due to the wireless link characteristics. Second, when the data is served locally, the network latency is reduced. The data server processes the data request only when there is a local and cooperative cache miss. By doing this the server load is balanced, which consequently reduces the latency in serving client request. Thirdly,

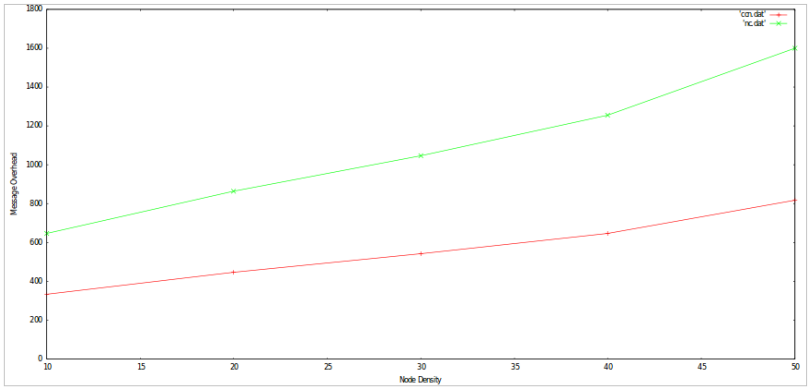

Figure 1. Message Overhead for Different Node Densities

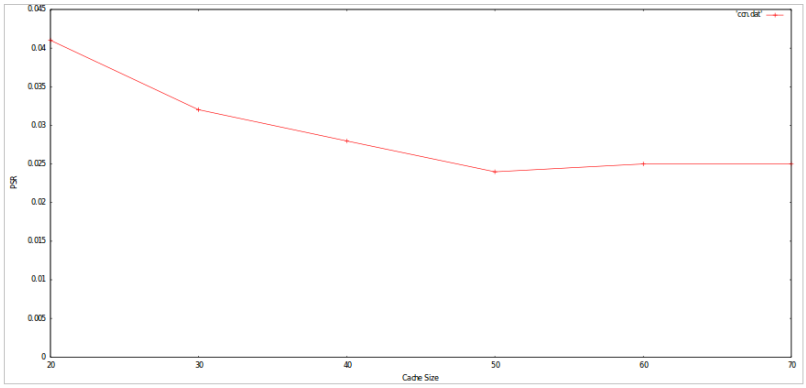

Figure 2. Power Savings Ratio for Different Node Densities

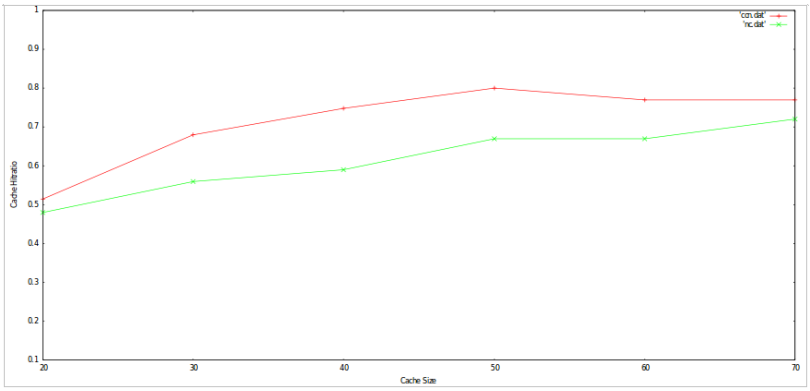

Figure 3. Cache Hit Ratio for Different Cache Sizes

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