ShortCommunication

Efficient Cooperative Caching in Mobile Ad Hoc Networks

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Due to information overflow, people can no longer be disconnected from their information systems. Caching plays a vital role in providing access of data to the information systems in case of disconnection. This is a well establish way of providing faster data in the area web caching, proxy servers and browsers as described by Malpani (1995). With the advent of mobile ad hoc networks (MANET), which is demand based infrastructure less network, beingresource poor, caching plays a pivotal role in making MANETs a success in many applications like rescue operations, military operation, etc. A mobile node (MN) is envisioned to be equipped with more powerful capabilities, like sufficient storage space,more processing power etc. Even though there is no dearth of storage space in present scenario, it is always better to utilize the resources optimally. With caching, the data access delay is reduced since data access requests can be served from the local cache, thereby obviating the need for data transmission over the scarce wireless links. However, caching techniques used in onehop mobile environment may not be applicable to multihop ad hocenvironment since the data or request may need to go through multiple hops. Variable data size, frequent data updates, limited client resources, insufficient wireless bandwidth and clients' mobility make cache management a challenging task in mobile ad hoc networks. As mobile nodes in ad hoc networks may have similar tasks and share common interest,cooperative caching, which allows the sharing and coordination of cached data among multiple nodes, can be used to reduce the bandwidth and power consumption.To date there are some works in literature on cooperative caching in ad hoc networks, such as consistency by Yin (2004) and Narottam Chand (2006) and for placement by Tang (2008). To the best of our knowledge, only few of previous works by Narottam Chand (2006), GM Chiu (2009) and Narottam Chand et al. (2007), have exploited clustering as caching mechanism in MANETs. Cooperative caching has been studied in web environment by Malpani (1995), but efficient cache management is still a hot research area in MANETs. CoCa, a cooperative caching protocol have been proposed by Chow et al. (2004), which reduces the number of server requests as well as number of cache miss by sharing the cache contents. Further built on the CoCa framework a group based cooperative caching scheme called GroCoCa has been proposed by Chow (2004) in which a centralized incremental clustering algorithm is adopted by taking into consideration node mobility and data accesspattern. GroCoCa improves system performance at the cost of extra power consumption.Chiu et al. (2009) proposed two protocols IXP and DPIP. In IXP each node share its cachecontents with the nodes in its zone. The disadvantage of the IXP protocol is that when a nodeenters into a new zone, the nodes of the new zone are not aware about the cache contents of the new entrant.In this paper, we investigate the data retrieval challenge of mobile ad hoc networks andpropose a novel scheme, called global cluster cooperation (GCC) for caching. The goal ofGCC is to reduce the cache discovery overhead and provide better cooperative cachingperformance. GCC partitions the whole MANET into equal size clusters based on thegeographical network proximity (see Figure 1). To enhance the system performance, within acluster, individual caches interact with each other and within a network, the designated CSNof clusters interact with each other such that combined result is a larger cumulative cache. Ineach cluster, GCC dynamically chooses a "super" node as cache state node (CSN), to maintain the global cache state (GCS) information of different nodes within the network..