DCIM: Distributed Cache Invalidation Method for Maintaining Cache Consistency in Wireless Mobile Networks

Abstract—

This paper proposes distributed cache invalidation mechanism (DCIM), a client-based cache consistency scheme that is implemented on top of a previously proposed architecture for caching data items in mobile ad hoc networks (MANETs), namely COACS, where special nodes cache the queries and the addresses of the nodes that store the responses to these queries. We have also previously proposed a server-based consistency scheme, named SSUM, whereas in this paper, we introduce DCIM that is totally client-based. DCIM is a pull-based algorithm that implements adaptive time to live (TTL), piggybacking, and prefetching, and provides near strong consistency capabilities. Cached data items are assigned adaptive TTL values that correspond to their update rates at the data source, where items with expired TTL values are grouped in validation requests to the data source to refresh them, whereas unexpired ones but with high request rates are prefetched from the server. In this paper, DCIM is analyzed to assess the delay and bandwidth gains (or costs) when compared to polling every time and push-based schemes. DCIM was also implemented using ns2, and compared against client-based and server-based schemes to assess its performance experimentally. The consistency ratio, delay, and overhead traffic are reported versus several variables, where DCIM showed to be superior when compared to the other systems.