Enhanced Methods of Mobile Cache Sharing and Pre-fetching for Required Web Contents

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Abstract: Availability of content over the web is increasing exponentially. The demand for content by users is also increasing rapidly. The problem of making the right content available to user at the right time will continue to be a crucial issue. As variety of contents are available and variety of users are involved, there is no single way of matching the availability versus need and deliver content instantly especially in a limited mobile environment. Hence a hybrid method is proposed in this paper by combining the different techniques such as caching, pre-fetching and cache sharing with noise reduction to improve the overall performance of mobile for optimal cache memory utilisation, efficient bandwidth utilization, network traffic reduction and latency reduction. Efficiency of mobile caching and pre-fetching is improved using Enhanced Bloom Filter technique and data is shared among cooperative users by establishing a voluntary hub. The unwanted contents in the web page can be considered as noise which is removed when storing the web pages in cache or pre-fetch area. The success of the proposed method greatly depends on the hit ratio of contents rendered locally rather than getting it from server. In order to reduce server hits, sharing the contents of cache and pre-fetch area amongst mobile users is effective. Whenever any user requires new content, even if it is not available in browser cache or local cache of that user, the content can be rendered from the cache or pre-fetch area of collaborative mobile users rather than hitting the server. This hybrid cooperative cache sharing and pre-fetching for accessing the required contents improve the overall performance and hit ratio than the existing methods.

Keywords: bandwidth, cache sharing, cooperative users, latency reduction, mobile caching, pre-fetching.

I. INTRODUCTION

The caching and pre-fetching techniques have been used since the client server era. The number of users accessing the internet is increasing exponentially and their dream is to access the data instantly. With content explosions, implementation of caching alone was found to be insufficient, and caching and pre-fetching were combined for better content delivery. Even the existing modern techniques were found to be not very effective for users who keep browsing new contents. With MANET there is a huge opportunity of collaboration amongst network nodes. Each device as a node can share and collaborate with each others, especially in content sharing to reduce network traffic, sever hits and latency. However, if these collaborative techniques were not implemented wisely, it may have a contrary effect as well.

Another area of improvement is to remove noise contents while caching/pre-fetching. If contents are stored and shared without noise, the hit ratio of caching/pre-fetching can be increased and the performance of cooperative users' content sharing can be improved.

There are many research works on caching, pre-fetching and content sharing to improve hit rate which reduces latency and network traffic. Some methods adopted the sharing of cache/pre-fetch area without any central system to monitor it. Alternatively, nodes may collaborate amongst themselves using a central node to facilitate/manage the caches. In the proposed method, cooperative users are established and cache/pre-fetch area contents are shared between them using a hub. While storing data in cache/pre-fetch area, the unwanted contents are identified and the prevalent noise is removed for efficient memory utilization. A voluntary cooperative environment is established to enable relevant content sharing which reduces the disadvantages of random content sharing or central node processing as well as reduces the complexity of keeping the content consistent and current. The performance of caching and pre-fetching is enhanced using Bloom Filters and the consistency is maintained using Least Recently Used (LRU) combined with First In First Out (FIFO) algorithms.

The rest of the paper is organized as follows: Section II discusses the related research works by reviewing the existing techniques, Section III describes the proposed methodology, Section IV presents the analysis of results and discusses the performance evaluation and Section V concludes the paper.

II. BACKGROUND RESEARCH

A. Collaboration amongst nodes

The collaboration amongst nodes can be achieved and the contents stored in any willingly participating node can be accessed by any other requesting node, if available. There is no dependency on central node/hub. Only if there is a local miss, contents are delivered by sever and then stored locally by the requesting node, which can be served in future locally. Consistency is maintained by the node itself[1]. Similar approach is used in cooperative caching in Vehicular networks, each device in moving vehicle decides and gets content from sever which can be shared among other vehicles to satisfy their content based need[2].

Contents are downloaded into base stations(nodes) close to users and these base stations request contents amongst themselves before hitting the sever enabling faster content delivery [3]. MuNCC consists of content request nodes, routers and content providers, when content is requested, each provider serves set of contents and routers cache some of the contents based on path coordination.The caching content in every node is also possible by global coordination. In this method, cache replacement could be tricky and implemented with

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