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Disruption Tolerant Networks Efficient Data Access in the Cooperative Caching

R.Prasanna Lakshmi
M.Tech Student
Department of CSE
Prasad College of Engineering
Siddipet Rd, Jangaon, Telangana.

E.Madhu
Assistant Professor
Department of CSE
Prasad College of Engineering
Siddipet Rd, Jangaon, Telangana.

ABSTRACT:

Disruption tolerant networks (DTNs) are characterized by low node density, unpredictable node mobility, and lack of global network information. Most of current research efforts in DTNs focus on data forwarding, but only limited work has been done on providing efficient data access to mobile users. In this paper, we propose a novel approach to support cooperative caching in DTNs, which enables the sharing and coordination of cached data among multiple nodes and reduces data access delay. Our basic idea is to intentionally cache data at a set of network central locations (NCLs), which can be easily accessed by other nodes in the network. We propose an efficient scheme that ensures appropriate NCL selection based on a probabilistic selection metric and coordinates multiple caching nodes to optimize the tradeoff between data accessibility and caching overhead. Extensive trace-driven simulations show that our approach significantly improves data access performance compared to existing schemes.

I. INTRODUCTION

DISRUPTION tolerant networks (DTNs) consist of mobile devices that contact each other opportunistically. Due to the low node density and unpredictable node mobility, only intermittent network connectivity exists in DTNs, and the subsequent difficulty of maintaining end-to end communication links makes it necessary to use “carry and-forward” methods for data transmission. Examples of such networks include groups of individuals moving in disaster recovery areas, military battlefields, or urban sensing applications. In such networks, node mobility is exploited to let mobile nodes carry data as relays and forward data opportunistically when contacting others. The key problem is, therefore, how to determine the appropriate relay selection strategy. Although forwarding schemes have been proposed in DTNs, there is limited research on providing efficient data access to mobile users, despite the importance of data accessibility in many mobile applications. For example, it is desirable that smart phones users can find interesting digital content from their nearby peers. In vehicular ad-hoc networks (VANETs), the availability of live traffic information will be beneficial for vehicles to avoid traffic delays. In these applications, data are only requested by mobile users whenever needed, and requesters do not know data locations in advance. The destination of data is, hence, unknown when data are generated. This communication paradigm differs from publish/subscribe systems in which data are forwarded by broker nodes to users according to their data subscriptions. Appropriate network design is needed to ensure that data can be promptly accessed by requesters in such cases.

II. RELATED WORK

A common technique used to improve data access performance is caching, i.e., to cache data at appropriate network locations based on query history, so that queries in the future can be responded with less delay. Although cooperative caching has been studied for both web-based applications and wireless ad hoc networks to allow sharing and coordination among multiple caching nodes. The average inter-contact time in the network is reduced and enables efficient access on data with shorter lifetime. Ratio of data access is reduced. In this paper, we propose a novel scheme to support cooperative caching in DTNs. Our basic idea is to intentionally cache data at a set of

NCLs, which can be easily accessed by other nodes. We ensure appropriate NCL selection based on a probabilistic metric; our approach coordinates caching nodes to optimize the tradeoff between data accessibility and caching overhead. Our scheme greatly improves the ratio of queries satisfied and reduces data access delay and performance. When T is large, indicating long inter-contact time among mobile nodes in the network, our experimental setup increases the data lifetime accordingly. A common technique used to improve data access performance is caching, i.e., to cache data at appropriate network locations based on query history, so that queries in the future can be responded with less delay. Although cooperative caching has been studied for both web-based applications and wireless ad hoc networks to allow sharing and coordination among multiple caching nodes, it is difficult to be realized in DTNs due to the lack of persistent network connectivity. First, the opportunistic network connectivity complicates the estimation of data transmission delay, and furthermore makes it difficult to determine appropriate caching locations for reducing data access delay. This difficulty is also raised by the incomplete information at individual nodes about query history. Second, due to the uncertainty of data transmission, multiple data copies need to be coached at different locations to ensure data accessibility. The difficulty in coordinating multiple caching nodes makes it hard to optimize the tradeoff between data accessibility and caching overhead. In this paper, we propose a novel scheme to address the aforementioned challenges and to efficiently support cooperative caching in DTNs. Our basic idea is to intentionally cache data at a set of network central locations (NCLs), each of which corresponds to a group of mobile nodes being easily accessed by other nodes in the network. Each NCL is represented by a central node, which has high popularity in the network and is prioritized for caching data. Due to the limited caching buffer of central nodes, multiple nodes near a central node may be involved for caching, and we ensure that popular data are always cached nearer to the central nodes via dynamic cache replacement based on query history. Our detailed contributions are listed as follows: We develop an efficient approach to NCL selection in DTNs based on a probabilistic selection metric. The selected NCLs achieve high chances for prompt response to user queries with low overhead in network storage and transmission. We propose a data access scheme to probabilistically coordinate multiple caching nodes for responding to user queries. We furthermore optimize the tradeoff between data accessibility and caching overhead, to minimize the average number of cached data copies in the network. We propose a utility-based cache replacement scheme to dynamically adjust cache locations based on query history, and our scheme achieves good tradeoff between the data accessibility and access delay.

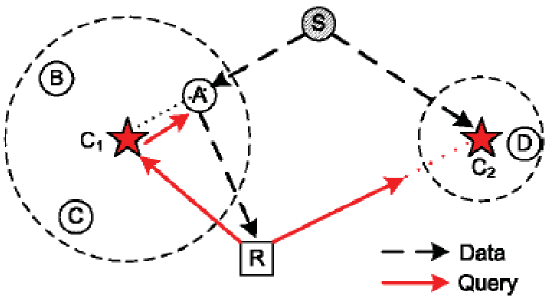

FIG 1: SYSTEM ARCITECTURE

III. SYSTEM PREMELIRIES:

A. SERVICE PROVIDER

In this module, the Service Provider sends their file to the particular receivers. For the security purpose the Service Provider encrypts the data file and then store in the network central locations (NCL 1, NCL 2 and NCL 3). The Service Provider can have capable of manipulating the encrypted data file. The service provider will send the file to particular receivers.

B. ROUTER

The Router manages a multiple nodes to provide data storage service. In Router n-number of nodes are present, before sending any file to receiver energy will be generate in a router and then select a smallest energy path and send to particular receivers. Service Provider encrypts the data files and stores them in the network central locations for sharing with data receivers. To access the shared data files, data receivers download encrypted data files of their interest from the Network Central Location and then decrypt them.

C. NETWORK CENTRAL LOCATION

All uploaded files are stored in Network Central Locations (NCL 1, NCL 2 and NCL 3), via network central locations file will send to particular receivers. Receiver has request the file to router, then it will connect to NCL and check the file in network central locations & then send to receiver. If the requested file is not present in network central locations then response (file is not exist) will send to receiver. The receivers receive the file by without changing the File Contents.

D. RECEIVER (END USER)

In this module, the receiver can receive the data file with the encrypted key to access the file. The Receiver has request the file to router, it will connect to NCL and check the file in all network central locations & then send to receiver. If receiver enters file name is not present in all network central locations then the receiver is getting the file response from the router and also shows delay of time in router. The receivers receive the file by without changing the File Contents. Users may try to access data files within the network only.

IV. CONCLUSION

In this paper, we propose a novel scheme to support cooperative caching in DTNs. Our basic idea is to intentionally cache data at a set of NCLs, which can be easily accessed by other nodes. We ensure appropriate NCL selection based on a probabilistic metric; our approach coordinates caching nodes to optimize the tradeoff between data accessibility and caching overhead. Extensive simulations show that our scheme greatly improves the ratio of queries satisfied and reduces data access delay, when being compared with existing schemes.

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