COOPERATIVE CACHING FOR TIMELY AND SECURE DATA ACCESS IN DISRUPTION TOLERANT NETWORKS

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ABSTRACT

Disruption Tolerant Networks (DTNs) consist of mobile devices that contact each other opportunistically. Propose the original approach to support cooperative caching in DTNs, which enable the sharing and coordination of cached data among multiple nodes and reduces data access delay. The fundamental idea is to intentionally cache data at a set of network central locations (NCLs), which can be easily access by other nodes in the network. Propose an efficient method 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. The selected NCLs attain high chances for prompt response to user queries with low overhead in network storage and communication. A utility based cache replacement scheme to dynamically adjust cache locations based on query history, A Contact Duration Aware Approach a novel caching protocol adaptive to the challenging surroundings of DTNs. To derive an adaptive caching bound for each mobile node according to its specific contact pattern with others, to limit the quantity of information it caches. Extensive trace driven simulations show that our cooperative caching protocol can significantly improve the performance of data access in DTNs.

***Keywords - Cache Scheme, Cooperative caching, Data Access, Disruption Tolerant Networks, Network Central Location*.**

1. INTRODUCTION

Disruption Tolerant Networks (DTNs), movable nodes connect to each other using opportunistic contacts. 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, which greatly impairs the performance of data access. In such networks, node mobility is exploited to let mobile nodes carry data as relays and forward data opportunistically when contacting others. It is 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.

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. A common technique used to improve data access performance is caching, 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 cached 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.

To efficiently support cooperative caching in DTNs. The basic idea is to by design 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. Every NCL is represented by a central node, which has high reputation in the network and is prioritized for caching data. Due to the incomplete caching buffer of central nodes, several nodes near a central node may be involved for caching, and ensure that popular data are always cached nearer to the central nodes via dynamic cache replacement based on query history.

II. LITERARTURE SURVEY

2.1 Epidemic Routing

Efficient relay selection metrics to approach the performance of Epidemic routing with lower forwarding cost, based on prediction of node contacts in the future. Some schemes do such prediction based on their mobility patterns, which are characterized by filter or semi-Markov chains. In some other schemes, node contact pattern is exploited as abstraction of node mobility pattern for better prediction accuracy based on the experimental and theoretical analysis of the node contact characteristics

2.2 Predict and Relay Method

Routing is the most important challenging in disruption tolerant networks (DTNs) because of short lived wireless connectivity environment. Most of the previous work focused on the prediction of whether two nodes contact would have a contact, without considering the time of the contact.

Proposed the predict and relay (PER), a routing method for DTNs that relies on predicting future contacts. We use a model based on a time homogeneous semi - markov process model to predict the probability distribution of the time of contact.

2.3 Asymmetric Cooperative Cache Approach

Asymmetric cooperative cache approach, where the data requests are transmitted to the cache layer on every node, but the data replies are only transmitted to the cache layer at the intermediate nodes that need to cache the data.

This solution not only reduces the overhead of copying data between the user space and the kernel space, it also allows data pipelines to reduce the end-to-end delay. Cooperative caching which allows sharing and coordination cache data among multiple nodes has been applied to improve p2p networks.

2.4 Maxprop A Protocol

MaxProp comes in determining which messages should be transmitted first and which messages should be dropped first. In essence, MaxProp maintains an ordered-query based on the destination of each message, ordered by the estimated likelihood of a future transitive path to that destination. . At the core of the Mayprop protocol is a ranked list of the peer's stored packets based on a cost assigned to each destination. The cost is an estimate of delivery likelihood. In addition, MaxProp uses acknowledgments sent to all peers to notify them of packet deliveries. MaxProp assigns a higher priority to new packets, and it also attempts to prevent reception of the same packet twice. The remainder of this section presents the details of destination cost estimation, our other mechanisms, and buffer management.

2.5 Rapid Protocol

RAPID this is an acronym for Resource Allocation Protocol for Intentional DTN routing, RAPID, like MaxProp, is flooding-based, and will therefore attempt to replicate all packets if network resources allow.

The protocol is composed of four steps:

- Initialization: Metadata is exchanged to help estimate packet utilities.
- Direct Delivery: Packets destined for immediate neighbors are transmitted.
- Replication: Packets are replicated based on marginal utility (the change is utility over the size of the packet).
- Termination: The protocol ends when contacts break or all packets have been replicated.

2 .6 A Hybrid Caching Scheme

The performance analysis showed that Cache Path and Cache Data can significantly improve the system performance. To Cache Path performs better in some situations such as small cache size or low data update rate, while Cache Data performs better in other situations. To further improve the performance, we propose a hybrid scheme Hybrid Cache to take advantage of Cache Data and Cache Path while avoiding their weaknesses. Simulation results show that the proposed schemes can significantly reduce the query delay and message complexity when compared to other caching schemes.

2.7 Multicast Forwarding Algorithm

Delegation forwarding (DF) in DTNs multicast and compare it with single and multiple copy multicast models, which are also proposed in this paper. From the analytical results, we have the following conclusions: (1) although the single copy model has the smallest number of forwarding's, its latency is much longer than the other two models. (2) Among these three models, the delegation forwarding model has the least delay. The effectiveness of our approach is verified through extensive simulation both in synthetic and real traces multicast in DTNs with single and multiple data items, investigate the essential difference between multicast and uncast in DTNs, and formulate relay selections for multicast as a unified knapsack problem by exploiting node centrality and social community structures. Extensive trace-driven simulations show that our approach has similar delivery ratio and delay to the Epidemic routing, but can significantly reduce the data forwarding cost measured by the number of relays used.

III. SYSTEM ARCHITECTURE

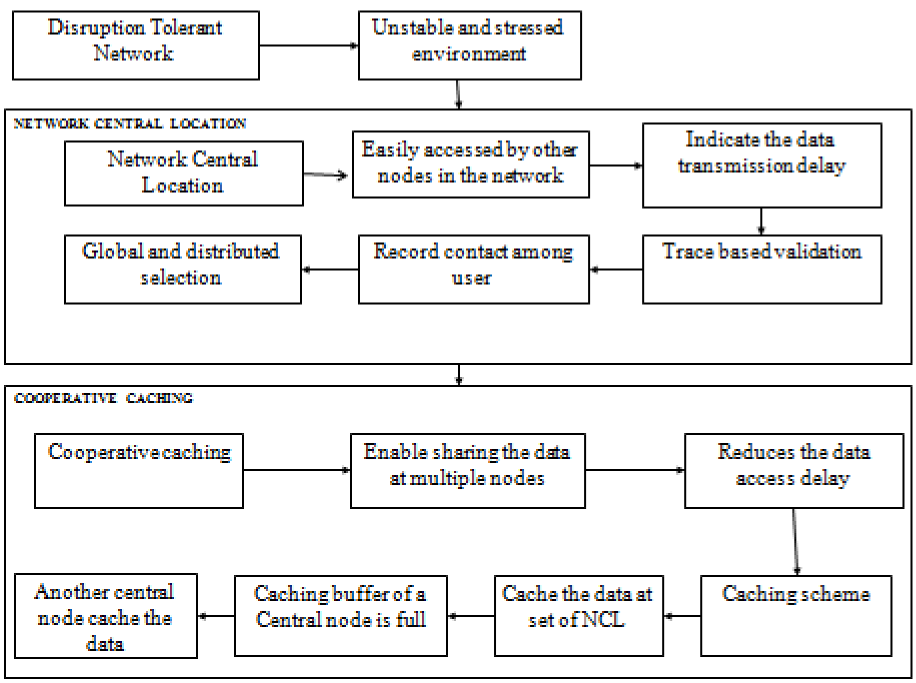

Fig.1: Architecture Design

IV. COOPERATIVE CACHING TECHNIQUE

The cooperative caching in DTNs, which enables the sharing and coordination of cached data among multiple nodes and reduces data access delay. The 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. 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. Propose a novel scheme to address the aforementioned challenges and to efficiently support cooperative caching in DTNs.

The 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 ensure that popular data are always cached nearer to the central nodes via dynamic cache

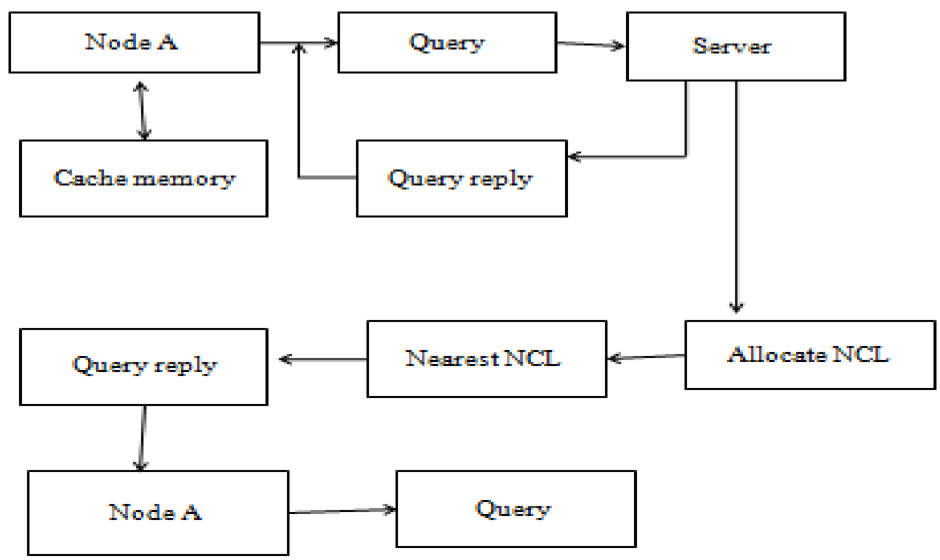

Fig .2: Network Central Location

Replacement based on Query history. To 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.

The propose a utility-based cache replacement scheme to dynamically adjust cache locations based on query history, and the scheme achieves good tradeoff between the data accessibility and access delay.

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. A common technique used to improve data access performance is caching, 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.

V. CONCLUSIONS

To support cooperative caching in DTNs. The basic idea is to intentionally cache data at a set of NCLs, which can be simply accessed by other nodes. To ensure appropriate NCL selection based on a probabilistic metric; our approach coordinates caching nodes to optimize the tradeoff between data accessibility and caching overhead. To identified the effects of the contact duration limitation on cooperative caching in DTNs. The theoretical analysis shows that the marginal caching benefit that a caching node can provide diminishes when it caches more data. Based on this observation, have designed a contact Duration Aware Caching (DAC) protocol, exploits social network concepts to address the challenge of the unstable network topology in DTNs. Trace-driven simulations show that by adopting DAC, the performance of data access can be significantly improved.

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