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Improving the Data Access of Caching Service in Wireless P2p

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ABSTRACT

All researches shown that cooperative cache can improve the system performance in wireless P2P networks such as ad hoc networks and mesh networks. And all these studies have been done up to some level only. So for that purpose now using an protocol technique called Dynamic Source routing (DSR). And previous studies have been done mainly by using an AODV routing technique and these are all at high level and leaving many design and implementation issues unanswered. In this paper, I am mainly presenting my design and implementation of cooperative cache in wireless P2P networks, and propose solutions to find the best place to cache the data. For that one I propose a novel asymmetric cooperative cache approach by using a Dynamic Source Routing Protocol. By using these techniques I can say that packet routing to be trivially loop-free, avoids the need for up-to-date routing information in the intermediate nodes through which packets are forwarded, and allows nodes forwarding or overhearing packets to cache the routing information in them for their own future use. All aspects of the protocol operate entirely on-demand, allowing the routing packet overhead of DSR to scale automatically to only that needed to react to changes in the routes currently in use. The data has been accessed easily by the user. And also by using a data pipelines we can reduce the end-to end delays between the server and client. My results show that the Dynamic Source routing out performs the AODV in wireless P2P networks. Some recent studies have shown that cooperative cache can improve the system performance in wireless P2P networks such as ad hoc networks and mesh networks. All these studies are at a very high level, leaving many design and implementation issues unanswered. In this project, design and implementation of cooperative cache in wireless P2P networks is considered, and solutions to find the best place to perform caching is proposed.

Key Words -- wireless networks; caching; protocols; DSR

I. INTRODUCTION

In wireless networks, the nodes are unaware whether the other nodes are active are not. When a node wish to transmit some data to other node, a shortest possible path is found and intermediate nodes along the chosen path need to forward the data from source to destination. But if any intermediate node along the path is not active, the source node is unaware of this and sends the data. But the data is not received by the destination node. To overcome this, a solution is proposed in which the nodes cache the status of other nodes in the network. This can be done by maintaining cache layer by the nodes. Due to this every node in the network caches the status of other nodes. The source node knows the status of intermediate nodes along the chosen path and send data if all are active. But in real time, it is not possible for all nodes to cache status of all other nodes. To overcome this, an asymmetric approach is proposed. In this, only few nodes are chosen to cache the status of other nodes in its vicinity. All nodes can refer this caching node while sending data to others. The results show that the asymmetric approach outperforms the symmetric approach in traditional 802.11- based ad hoc networks by removing most of the processing overhead [1].

Wireless P2P networks, such as ad hoc network, mesh networks, and sensor networks, have received considerable attention due to their potential applications in civilian and military environments such as disaster recovery efforts, group conferences. Most of the previous researches in ad hoc networks focus on the development of dynamic routing protocols that can efficiently find routes between two Communicating nodes. Although routing is an important issue in ad hoc networks, other issues such as information (data) access are also very important. In the next generation of wireless communication systems, there will be a need for the rapid deployment of independent mobile users [14]. Significant examples include establishing survivable, efficient, dynamic communication for emergency/rescue operations, disaster relief efforts, and military networks. Such network scenarios cannot rely on centralized and organized connectivity, and can be conceived as applications of Mobile Ad Hoc Networks [2, 3]. A MANET is an autonomous collection of mobile users that communicate over relatively bandwidth constrained wireless links. Since the nodes are mobile, the network topology may change rapidly and unpredictably over time. The network is decentralized, where all network activity including discovering the topology and delivering messages must be executed by the nodes themselves, i.e., routing functionality will be incorporated into mobile nodes [4].

A disruption-tolerant network (DTN) is a network designed so that temporary or intermittent communications problems, limitations and anomalies have the least possible adverse impact. Disruption tolerant networks (DTNs) consist of mobile devices that contact each other opportunistically [12]. 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.

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 [5].

II. RELATED WORK

Cache placement algorithms mainly differ in the metric to evaluate the significance of data items. In popularity based algorithm, placement decision is made based on how “popular” the data item is.

Popularity can be represented by access frequency, time interval from last access, etc. These algorithms differ in whether and how the access of a neighbor host is considered. The work of Yin and Cao focuses on information cached at a node. Depending on the access frequency and cache space, a node may cache the data itself or the path to the nearest cache node. On the other hand, in a benefit based algorithm, data items are selected according to how much "benefit," e.g., the reduction in message cost, query delay, energy consumption, etc., can be obtained by caching the data items [6]. Compared with popularity-based approach, the benefit based one is more efficient. This is because "benefit" can directly and precisely reflect the objective of data caching, i.e., the reduction in data access cost. Therefore, we also adopt benefit-like metric in our design Cooperative caching was implemented in wireless p2p networks to cache the data [11]. It was based on asymmetric approach. In asymmetric approach to cache the data, a layered design was considered. Cooperative cache is designed as a middleware lying right below the application layer and on top of the network layer (including the transport layer). In asymmetric cooperative cache approach, 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 users space and the kernel space, it also allows data pipelines to reduce the end-to-end delay [7].

To improve the human mobility in terms of social structure and to use these structures in the design of forwarding algorithms for Pocket Switched Networks (PSNs). Taking human mobility traces from the real world to discover that human interaction is heterogeneous both in terms of hubs(popular individuals) and groups or communities so they propose a social based forwarding algorithm BUBBLE which is shown empirically to improve the forwarding efficiency significantly compared to oblivious forwarding schemes. Content-based service is dynamically routes and delivers events from sources to interested user is extremely important to network services. The content-based protocols for static networks will expose unaffordable maintenance costs if they are applied directly to the highly mobile environment that is featured in disruption-tolerant networks (DTNs) [13]. A unique publish/subscribe scheme that utilizes the long-term social network properties which are observed in many DTNs to facilitate content-based services in DTNs [8]. Different trade-off for content-based service can be achieved by tuning the closeness threshold in community formation or by adjusting the broker-to-broker communication scheme.

Data caching is a fully distributed scheme where each node upon receiving requested information determines the cache drop time of the information or which content to replace to make room for the newly arrived information. These decisions are made depending on the perceived "presence" of the content in the nodes proximity whose estimation does not cause any additional overhead to the information sharing system. Some recent studies have cooperative cache can improve the system performance in wireless P2P networks such as ad hoc networks and mesh networks [9]. However, all these studies are at a very high level leaving many design and implementation issues unanswered. In this paper they present our design and implementation of cooperative cache in wireless P2P networks and propose solutions to find the best place to cache the data. We propose a novel asymmetric cooperative cache approach

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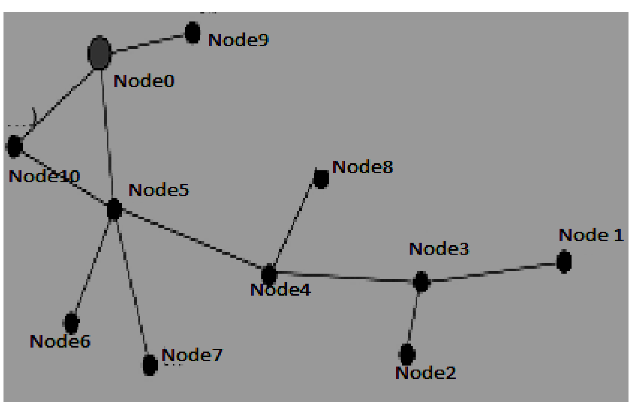
where the data requests are transmitted to the cache layer on every node but the data replies are only transmitted to the cache layer at the intermediate nodes that need to cache the data. This solution not only reduces the overhead of copying data between the user space and the kernel space it also allows data pipelines to reduce the end-to-end delay [10].

III. PROPOSED SYSTEM

Cooperative Caching Schemes: Figure illustrates the Cache Path concept. Suppose node N1 requests a data item from Node0. When Node3 forwards di to Node1, Node3 knows that Node1 has a copy of the data. Later, if Node2 requests the Node3 knows that the data source Node0 is three hops away whereas Node1 is only one hop away. Thus, Node3 forwards the request to Node1 instead of Node4. Many routing algorithms (such as AODV and DSR) provide the hop count information between the source and destination. Caching the data path for each data item reduces bandwidth and power consumption because nodes can obtain the data using fewer hops. However, mapping data items and caching nodes increase routing overhead, and the following techniques are used to improve Cache Path's performance.



Node not record the path information of all passing data, records the data path when it is closer to the caching node than the data source. For example, when N0 forwards di to the destination node Node1 along the path Node5 - Node4 - Node3, Node4 and Node5 won't cache di path information because they are closer to the data source than the caching node Node1. In general, a node caches the data path only when the caching node is very close. The closeness can be defined as a function of the node's distance to the data source, its distance to the caching node, route stability, and the data update rate. Intuitively, if the network is relatively stable, the data update rate is low, and its distance to the caching node is much shorter than its distance to the data source, then the routing node should cache the data path.

Cache Path and Cache Data can significantly improve system performance. Analytical results show that Cache Path performs better when the cache is small or the data update rate is low, while Cache Data performs better in other situations. To further improve performance, we can use Hybrid Cache, a hybrid scheme that exploits the strengths of Cache Data and Cache Path while avoiding their weaknesses. Specifically, when a node forwards a data item, it caches the data or path based on several criteria. In recent years, wireless ad hoc network, as a promising technology for pervasive Internet access, has received a lot of attention from both academia and industry communities. In a wireless ad hoc network, there is no support of any fixed infrastructure (e.g., the base stations in 3G networks or access points in wireless LANs), and network nodes communicates with each other through multi hop paths. A network node can be any computing device, ranging from a mobile computer, e.g., smart phone, laptop, to a backbone network device, e.g., mesh routers, or even an embedded small sensor node. Due to the advantages in flexible deployment, low cost and easy maintenance, wireless ad hoc networks are especially suitable for the scenarios where the deployment of network infrastructure is too costly or even impossible, e.g., outdoor assemblies, disaster recovery and battlefield. On the other hand, wireless ad hoc networks are resource constrained in terms of bandwidth, power, etc., so data access cost is a major concern. Data caching has been widely used to reduce data access cost in traditional computer networks. It is much more desirable and effective in wireless ad hoc networks. When data are delivered through multi hop paths, caching the data at intermediate nodes can significantly reduce the message cost and consequently save various resources, from network bandwidth to battery power. Accessing data at cache node can also help reduce data access delay (AD).

Quite a lot of work has been conducted for data caching in wireless ad hoc networks, including cache placement, cache discovery and cache consistency. Cache placement refers to determining where and what to cache; cache discovery refers to the mechanism to find and obtain a cached data item; and cache consistency means to ensure that the data value in cache copies is consistent with the source copy at the data server. The first two problems are so closely related that they are usually studied together.

The cache placement problem in ad hoc networks has been proved to be NP-hard, even if only one data item is considered. Existing works on cache placement mainly focus on how to make use of the data access frequency information and network topology information in selecting cache nodes. For cache discovery, recent research has been focused on combining passive and active query approaches. Although there have been quite a number of algorithms for ad hoc networks, the openness of wireless link has not been considered in designing cooperative caching system. Due to the openness of wireless links, a network node transmits data in a broadcast way by nature, so a packet can be received by any node within the transmission range even if the node is not the intended target of this transmission. In this case, we say that the node "overhears" the packet. Correspondingly, we say that the intended target node "hears" the packet. Here, the target node means the node specified as the receiver of the packet in MAC address. It can be an intermediate node in the routing path or the destination node of the massage.

In this paper, we propose a novel cooperative caching algorithm for wireless ad hoc networks by taking overhearing into consideration. Our algorithm makes use of the overhearing property to significantly improve the performance of data caching in several aspects. First, by overhearing, a requesting node can obtain data copies from an intermediate node forwarding the data copy so as to reduce data access cost. Second, overhearing helps collect more data access information, e.g., access frequency, which is necessary to make decision on cache placement.

IV. CONCLUSION

We propose a novel scheme to support cooperative caching in DTNs. The basic idea is to purposely cache data at a set of NCLs, which can be easily accessed by other nodes. We ensure appropriate NCL selection based on a probabilistic selection metric. This 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. Localization in DTNs faces two major difficulties the node can only use sparse reference points to estimate its location and the tracking server need to determine and predict movement trajectories with partial location information. To overcome these difficulties, the proposed method is Pulse Counting and Prob Tracking for positioning and tracking in DTNs.

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