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Optimizing the Query Delay and Data Availability Using Data Replication Techniques in Mobile Wireless Ad hoc Network

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Abstract— Now a days, we have effectively use wireless devices like mobiles which is one of the wireless ad hoc devices. In MANET, many times we want access of the data from other mobile. Since mobile nodes do not have fixed location or link and in such condition, if a node or link fails then there may occur frequent network partition, where mobile nodes in one partition cannot access data held by nodes in other partitions. Also data availability in MANETs is lower than that in conventional wired networks. Data availability i.e. the number of successful data accesses over the total number of data accesses is less and hence degrades the performance of data access. To have remedy of this we have proposed the use of data replication technique. Earlier replication techniques were not able to deal with query delay and data availability both simultaneously. It either reduces the query delay or improves the data availability. As both the metric are important for mobile node, we propose a scheme to optimize and balance the tradeoffs between data availability and query delay under different system settings and requirements.

Index Terms— Data replication, MANET, Query delay, Data availability, Data compression.

1. INTRODUCTION

Mobile Ad hoc network (MANET) is a set of mobile nodes which communicate wirelessly over radio frequencies with no centralized infrastructure [1].Recent advancements in wireless communication and the miniaturization of computers have led to a new concept called the mobile ad hoc network (MANET), where two or more mobile nodes can form a temporary network without need of any existing network infrastructure or centralized administration [22], [23].Now a day, we have effectively used wireless devices like mobiles which is one of the wireless ad hoc devices. In MANET, many times we want access of the data from other mobile. Since mobile nodes do not have fixed location or link and in such condition, if a node or link fails then there may occur frequent network partition, where mobile nodes in one partition cannot access data held by nodes in other partitions, Also, In MANETs, mobile nodes act as routers themselves, keeping route information to reach other mobile nodes, and helping forward data packets sent from one mobile node to another. Following diagram shows that network partition due to link failure in Mobile Ad hoc Network.

Fig1. Network partition due to link failure.

To have remedy of this we proposed the data replication techniques. Since, Data replication has been widely used to improve data availability in distributed systems, and we will apply this technique to MANETs [2]. Also by replicating the data to the nearest node query delay can be minimized. Most mobile nodes only have limited storage space, bandwidth and power, and hence it is impossible for one node to collect and hold all the data .By taking these issues into consideration, we expect that mobile nodes should not be able to replicate all data items in the network. There is a solution to improve the data access performance is to let the mobile node should cooperate with each other; i.e. they should contribute part of their storage space to hold data of others [3], [4]. For example, replicating most data locally can reduce the query delay, but it reduces the data availability since many nodes may end up replicating the same data locally, while other data items are not replicated by anyone. To increase the data availability, nodes should not replicate the same data that neighboring nodes already have. However, this solution may increase the query delay since some nodes may not be able to replicate the most frequently accessed data, and have to access it from neighbors. Although the delay of accessing the data from neighbors is shorter than that from the data owner, it is much longer than accessing it locally. Hence in this project we propose new data replication techniques to address query delay and data availability issues as well as we can also consider the LZW data compression technique to address if the bulk amount of the data is available and hence compressed data will be transfer in secure form after the authentication of proper node.

1.1 Data Replication

Data Replication is technique which enhances data availability by making copies of data items [5]. Data replication is a technique, which stores the copy of the original data. Thus the data availability can be improved. In mobile ad hoc networks nodes are moving freely. Due to the failure of these nodes, link failure will occurs. For improving the data availability and query delay we propose a new replication scheme.

Figure 1 shows an example of how data replication can be used to improve the performance of data access when network partitions. There are four nodes in the network. $N4$ is a web camera which continuously records video clips ($d1$) of its surroundings. Two clients $N1$ and $N2$ periodically access these video clips by using $N3$ as relay. However, when a disconnection occurs between $N3$ and $N4$ due to a link failure, $d1$ becomes inaccessible to the other three nodes. To improve data availability, a copy of $d1$ can be replicated at $N3$ before the disconnection. Then both $N1$ and $N2$ can access $d1$ even if they are not able to connect with $N4$. Further, by replicating a copy of $d1$ at $N3$, $N1$ and $N2$ can access d within one hop, reducing the query delay. However, many mobile nodes only have limited storage space, bandwidth and power, and hence it is impossible for one node to collect and hold all the data. For example, in disaster recovery some rescue may only have resource constrained cellular phones which have limited storage, and thus cannot replicate all the data such as pictures or video clips. Also in applications such as geological exploration, although mobile devices have large storage, these geologists may have to record videos or generate large volumes of raw scientific data, which can quickly use up the storage. Thus, replicating the data everywhere is not a good solution due to storage limitation. Furthermore, to replicate data, nodes need to transmit it from other nodes and obviously there will be huge bandwidth and power cost for large volume of data. By taking these issues into consideration, we expect that mobile nodes should not be able (or willing) to replicate all data items in the network. In a MANET, mobile nodes store data. In the case of data replication scheme these nodes stores other nodes data too. Every node has limited memory space, and every node creates data items replica. . Here we proposed one replication technique, which will balance the trade-off between query delay and the data availability.

In this project we consider an undirected graph, represented by G (V, E).Where V represents the vertices, the vertices are indicated by mobile nodes in the network and E represents the edges indicated by the physical links or logical links between the nodes and E$\subset V \times V$.Two nodes are connected by an edge and communicate with each other through these links. Let m denote the total number of mobile nodes, N is the set of mobile nodes in the network, D is the set of available data items in the network, n is the total number of data items, si is the size of d_i,C is the memory size of each mobile node for hosting data replicas, t_{ij} is the delay of transmitting a data item of unitize between node $N_i$and N_j, f_{ij} is the link failure probability between node $N_i$and $N_j$and a_{ij} is the data access frequency of node $N_i$to d_j. Each node store some amount of data and the node is called original owner of the data. Each data item has only one owner. Every node has very limited memory storage so that each node can only store ($C<n$).To improve the data availability and query delay data replication is the best option.

The following notations are used in this project.

- $\mathcal{N}$: the set of mobile nodes in the network.
- m: the total number of mobile nodes.
- $\mathcal{D}$: the set of available data items in the network.
- n: the total number of data items.
- si: the size of di.
- C: the memory size of each mobile node for hosting data replicas.
- tij: the delay of transmitting a data item of unitize between node $Ni$and N.
- fij: the link failure probability between node $Ni$and Nj.
- aij: the data access frequency of node $Ni$to d.

Example: Suppose in fig 1 the network has 4 nodes $N1$, $N2$, $N3$ and $N4$.These four nodes may access a data item $d1$.Consider that node N4 is a web camera which records the video clips (d1).N1 and N2 are two clients want to access these video clips from the node N4 where N3 act as relay. Due to link failure a disconnection is occurring in between N3 and N4.Sothat d1 becomes inaccessible to other nodes N1, N2 and N3.Before disconnection, a copy of d1 can be replicated at N3 this will helps to improve the data availability. Therefore d1 can access by N1 and N2 even if they are not connect with N4.

1.2 Data Compression

We are using one of the data compression technique i.e. LZW (Lempel – Ziv - Welch).

The LZW data compression algorithm is a powerful technique for lossless data compression that gives high compression efficiency for text as well as image data [6], [7].

- This algorithm is widely used due to its excellent compromised between compression performance and speed of execution.
- LZW is the foremost technique for general purpose data compression due to its simplicity and versatility.
- Codes 0-255 in the code table are always assigned to represent single bytes from the input file.When encoding begins the code table contains only the first 256 entries, with the remainder of the table being blanks. Compression is achieved by using codes 256 through 4095 to represent sequences of bytes.

2. RELATED WORK

Data replication has been extensively studied in the Web environment [8], [9], where the goal is to place some replicas of the web servers among a number of possible locations so that the query delay is minimized. In the Web environment, links and nodes are stable. Thus, the performance is mainly measured by the query delay. Moreover, these schemes replicate at the whole database level; that is, the whole database is replicated as a unit to one or more locations. It is more complex when replication is done at the data item level, i.e., how to replicate data items to various nodes with limited memory space. Data replication has been studied in distributed database systems [10]. In such systems, nodes that host the database are more reliable and less likely to fail, disconnect compared to those in MANETs. Therefore, a small number of replicas can be used to provide high availability. However, in MANETs, node/link failure occurs frequently, and data avail- ability becomes an important issue. Padmanabhan [11] et al. identified several research issues in data replication in MANET and attempted to classify existing data replication techniques. Hara [2], [12] proposed data replication schemes for ad hoc networks. These schemes are based on the intuition that replicating the same data near neighboring nodes should be avoided in order to improve data availability. However, this intuition may not be valid when the link failure probability is taken into consideration. Also, it only considers the availability, without considering the query delay. We will address these issues in this paper to provide better data replication. Some other researchers address data access issues in MANETs considering network partitions. Jorgic and Stojmenovic et al. [13] introduced several localized algorithms to detect critical nodes and links for connectivity in MANETs. Huang and Chen [14] addressed the problem of replica allocation in a MANET by exploring group mobility. Wang and Li [15] proposed schemes to deal with network partitions due to node movement by replicating services in the network. Their schemes can provide guaranteed service with minimum number of replicated services. Hara [16] proposed several metrics to evaluate the impact of mobility on data availability. Ramany and Bertok [17] studied solutions for replicating location dependent data in MANETs to handle unreliable network connections. Different from these previous works, we study the tradeoffs between query delay and data availability. Besides data replication, caching can also be used to improve data availability and reduce the query delay [18]–[20]. In [21], we have proposed a cooperative cache based data access framework, which allows the sharing and coordination of cached data among multiple mobile nodes. In this solution, after a node sends a data request to the data owner, the data owner sends the data back. Since the data may go through multi-hops before reaching the requester. Intermediate nodes may cache the data or the path to the data. Later, if some other nodes request for the same data, and the intermediate nodes can return the data or the path to the data. As the number of hops is reduced, the query delay is also reduced. Although the proposed solution can reduce the query delay, there is a limitation on how much they can achieve. Generally speaking, these schemes are passive approaches, since the data is only cached after some nodes start to use it. To further increase the data availability and reduce the query delay, we study proactive data replication techniques where nodes actively replicate data.

3. Analysis of problem

Existing System:-

Existing data replication solutions in either wired or wireless networks aim at either reducing the query delay or improving the data availability, but not both. However, most mobile nodes only have limited storage space, bandwidth and power, and hence it is impossible for one node to collect and hold all the data considering these constraints.

Disadvantages:-

One drawback of the earlier scheme is that it does not consider the cooperation between the neighboring nodes and hence its performance may be limited [24].

4. PROPOSED WORK AND OBJECTIVE

In this project, we propose new data replication techniques to address query delay and data availability issues. As both metrics are important for mobile nodes, we propose techniques that balance the tradeoffs between data availability and query delay under different system settings and requirements. We also use a LZW data compression scheme to ensure that proper availability of the data because of that the memory space required on every node will be minimized and hence large amount of the data can be acquired by node on other side.

Advantages:

1. Low query delay.
2. Data Availability is high.

Modules:

1. Data Replication
2. The One-To-One Optimization (OTOO) Scheme
3. The Reliable Neighbor (RN) Scheme
4. Reliable Grouping (RG) Scheme
5. LZW Data compression scheme.

5. DESIRED IMPLICATION

Network partition is common in mobile ad hoc network whenever link failure is happened. Due to link failure in MANET mobile node on one side cannot access the data by mobile node on other side and the data availability & query delay are very important metrics in mobile ad hoc network. Thus to optimize the data availability and delay in query we have present in one technique which is data replication technique. Data Replication is technique which will enhances data availability by making copies of data items [5].In this project we will proposed a data replication technique by using the LZW data compression technique which is lossless compression scheme. This scheme can compressed the data and reduces the memory space required by the each node to replicate the data item by neighboring node and hence reduced the query delay in the network.

Also we will try to achieve the minimum query delay and maximum data achieve maximum data availability by using the data replication in one to one optimization scheme, reliable neighbor scheme and reliable group scheme as well as we ensure that the availability of the data will be proper and in compressed form so that delay required for the query will be minimized.

6. APPLICATION

Such routing scheme are useful for applications in which mobile users directly communicate with each other, e.g., video conferencing systems.

However, in MANETs, there are also many applications in which mobile nodes share data and access data held by other mobile nodes.

Typical examples are collaborative rescue operations at a disaster site, military operations, sensor networks, and exchange of word-of- mouth information in a shopping mall [16].

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