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# MINIMIZE RESPONSE DELAY IN MOBILE AD HOC NETWORKS USING DYNAMICREPLICATION

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***Abstract*— A mobile ad hoc network (MANET) is a most interest area of research in network . The communication range and the node mobility that are affect the efficiency of file querying. The MANET having the P2P file sharing mechanism. The Main advantages of P2P file are files can be shared without base stations, and it avoids overload on server. File replication has major advantage it enhancing file availability and reduce file querying delay. The current replication protocol having the drawbacks, they are node storage and the allocation of resources in the replications In this paper, we introduce a new concept of Distributed File Replication techinique which considers file dynamics such as file addition and deletion in dynamic manner. This protocol achieves minimum average response delay at minimum cost of other replication protocols.**

***Keywords—Mobile Ad hoc Network (MANET), file Replication, peer-to-peer, Query Delay.***

## I. INTRODUCTION

In mobile ad hoc networks (MANETs), the movement of nodes that makes the network partition , where the nodes in one partition cannot be access the data by the nodes of other partitions. File replication is the better solution to improve file availability in distributed systems. By replicating the file at mobile nodes who are not in the owner of the source file.the file availability can be improved because of there are multiple replica files in the network and the probability of identifying one copy of the file is higher. Also,the file replication can be minimize the query delay.the mobile nodes can be obtain the file from some nearby replicas. But the most of the mobile nodes only have limited amount of memory space, range, and power,and hence it is difficult for one node to collect and hold all the files considering these constraint and independent nodes in MANETs cause file unavailability for the requesters. When a mobile node that only replicates part of the file, there will be a trade-off between query delay and the file availability**.**

MANET varying significantly from the wired networks from network topology,configuration of network and network resources. Features of MANETs are dynamic topology due to host movements, partition of network due to untrusted communication and minimum resources such as limited power and limited memory capacity [1, 2]. File sharing is one of the important functionality to be supported in MANETs. Without this facility, the performance and usage of MANET is greatly minimizes [3].The best example where file sharing is important, in the conference where several users share their presentations on discussing on a particular issue, and it is also applicable in defence application, rescue operation, disaster management etc. The method used for file sharing deeply depends upon the features of the MANET [3]. The sequential network partition due to host movements or limited battery power minimize the file availability in the network. To overcome file un-availability, the replication technique deals all these problems such that file is available at all times in the network.

### *File replication*

File Replication is a technique which improves the file availability by creating copies of file. Replication allows better file sharing. It is a key approach for achieving high availability. File replication has been widely used to maximize file availability in distributed systems, and we will apply this technique to MANETs. It is suitable to maximize the response time of the access requests, to distribute the load of processing of these requests on several servers and to eliminate the overload of the paths of transmission to a unique server. The replications that are accessed in the time variations.

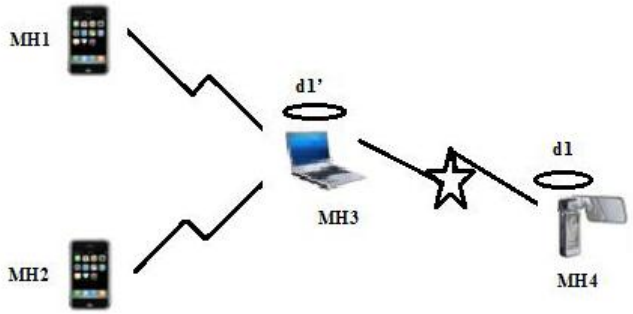


Fig. 1 File Replication in MANETs

## II. BENEFITS OF FILE REPLICATION

In distributed systems ,the files should be accessed in multiple locations,so it is beneficial to replicate through out the network.

***A.increased file availability***

The multiple replications of files that improves the file availability and reliability in the case any of network failures.

***B.faster query response***

The Queries initiated from the nodes where replicas are stored that can be satisfied directly without affecting network transmission delays from remote nodes.

***C.load sharing***

The computational load of responding to the queries can be distributed in the number of nodes in the network.

## III. RESEARCH ISSUES RELATED TO FILE REPLICATION

***A. Power consumption***

The Mobile nodes in the MANET are used battery power. If a node with less power is replicated with many frequently accessed file items, it soon gets drained and it cannot provide services any more. Thus replication algorithm should replicate file in the nodes that need sufficient power by periodically checking the remaining battery power of each node.

***B. Node mobility***

In MANET, hosts are mobile which leads to dynamic topology. Thus replication technique has to support movement prediction such that if a host is likely to move away from the network, its replicas will be changed in some other nodes which is expected to retain in the network for a particular unit of time.

***C. Resource availability***

Every nodes participating in MANET are portable hand held devices, stroage capacity is limited. Before sending a replica to the node, the technique has to find whether a node has sufficient storage capacity to hold the replication files or not.

***D. Real-time applications***

MANET applications like rescue and military operations are time-critical and may have both firm and soft real-time transactions. Therefore, the replication technique should be able to deliver correct information before the expiry of processing limits, taking into consideration both real-time firm and soft transaction types in order to minimize the number of transactions missing their deadlines.

***E. Network partitioning***

The frequent disconnection of mobile nodes,the network partitioning occurs more often in MANET databases than in traditional databases. Network partitioning is a important problem in MANET when the server that contains the required file is isolated in a separate partition, thus reducing file accessibility to a large extent. Therefore, the replication technique should be able to determine the time at which network partitioning may having a replicate file items.

***B.Peer-to-Peer Replication model***

The peer-to peer model removes the restrictions in the client server model. Replica files can be transmitted to hosts with out necessity of all hosts that are including the communication in the network. the peer-to-peer model is useful for mobile systems that have poor network connectivity. The single point of failure in naturally eliminated.

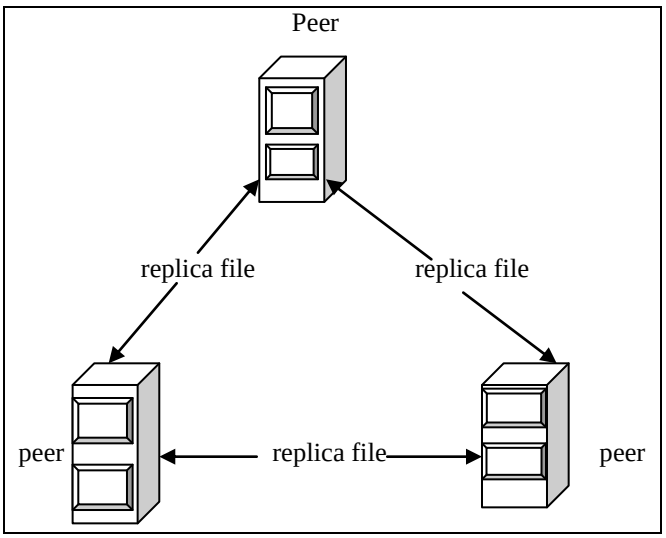


FIG 2:Peer-to-Peer File Replication.

## IV. AN OVERVIEW OF EXISTING TECHNIQUES:

Kang Chen[4] was proposed distributed file replication protocol name as priority competition and split replication protocol (PCS) that realizes the optimal replication rule in a fully distributed manner .The usage of replica distribution on the average querying delay under constrained available resources with two movement models, and then derived an

optimal replication rule that can allocate resources to file replicas with minimam average querying delay.

T.Hara, 2001 [5] proposed the effective replica allocation methods in mobile ad hoc networks for improving file accessibility.The writer proposed three replica allocation techniques to improve file accessibility by replicating files on mobile nodes i.e. Static Access Frequency (SAF) techniques, Dynamic Access Frequency and Neighbourhood (DAFN) techniques and Dynamic Connectivity based Grouping (DCG) techniques. These techniques make the following assumptions: (i) each file items and each mobile node is assigned a seperate identifier,(ii) Every mobile node has finite storage space to store replica files; (iii) There are no modify processings; and (iv) The access frequency of each file item, which is the number of times a particular mobile node accesses that file item in a unit time interval, is known and does not change. The decision of which file items are to be replicated on which mobile node is based on the file items access frequencies and this decisions are taken during a particular period of time, called the relocation period. In the SAF techniques, a mobile host allocates replications with huge access frequencies. In the DAFN method, replicas are preliminary allocated based on the SAF techniques, and then the replica duplication is overcome among neighbourhood mobile nodes. In the DCG techniques, static groups of mobile nodes are created, and replica files are shared in each partition. The simulation result shows that in most cases the DCG techniques gives the maximum accessibility, and the SAF techniques gives the lowest traffic.

Yang Zhang et.al, 2012 [5] describes, in MANETs, nodes mobility freely .The link and node failures are common, which occurs to repeated network partitions. When a network partition occurs, mobile nodes in one partition are not able to access files replicated by nodes in other partitions, and hence significantly reduce the performance of file access. To solve this problem, file replication techniques are used.
V. Ramany and P. Bertok 2008 [6] studied solutions for replicating location dependent data in MANETs to handle untrusted network connections. Replication aims to improve accessibility, shorter response time and fault tolerance. When the file is combined with one location in the subnetwork and valid only within a location around that network, the advantages from replication will apply only within this region.

## V. PROBLEM DEFINITION

There are many file replication protocols available, the main problem with them is they lack a rule to allocate limited resource to different files for replica creation in order to achieve the minimum global average querying delay that is global search efficiency optimization under limited resource. They simply consider storage as the resource for replicas, but neglect that a node's frequency to meet other nodes also controls the availability of its files. Files in a node with a higher meeting ability have higher availability. So there is a problem of how to allocate the limited resource in the network to different files for replication and how to create and delete the files in dynamically.

## VI. PROPOSED SOLUTION

In this section we propose a new distributed file replication protocol to minimize the average querying delay.Priority Based Dynamic Replication(PBDR) techinique is used adding and deleting the replica files based on the priority.the file have been succeded in the priority competition then adding the replica files,otherwise delete the replicas.

TABLE 1
VARIABLES AND CONSTANTS

| Variable/Constant | Definition |
|---|---|
| K | The total no of nodes |
| $S_i$ | The storage space of system |
| $k_i$ | The node having file |
| Max | The maximum number of replicas |
| Min | The minimum number of replicas |
| T | The time interval of replication |
| D | The replica delete permission |
| V | Set of mobile nodes in the system |
| F | Total n o of files in the system |
| $B_j$ | Size of file j |
| $Q_j$ | The probability of querying file j in the system |
| R | Total no of resource |
| $T_j$ | Average time interval of file j |
| $P_j$ | The priority of j |

**Algorithm 1** psuedo-code for File_Adding in PBDR

```
i.FILE_ADD_REPLICA(k) //node i tries to create replica files
k.FILE_ADD_REPLICA(i) //node k tries to create replica files
Begin
   If|Fi|<MAX then   //checks the available storage of nodes
         Qi->0 //initialize count
         Files_priority_check()
   For(each file f in current node)
   If(node.test_file(f)==true)
     Then
         Node(i).FILE_ADD_REPLICA()
   Else
         Count=count+1 //select  the another neighbour
   End
Procedure  priority_check()
    While(resource<j.size)
    File(f)<Si //to check the file size is less or greater
    If(priority_level >pj)
         Then
           Return file_addition()  //priority test successful
  Else
```

```
            Si<FILE(f) //priority test fails
    Return  false
  End procedure
End
```

**Algorithm 2** psuedo-code for File_Deleting in PBDR

```
i.FILE_DEL_REPLICA(k) //node i tries to delete replica files
k.FILE_DEL_REPLICA(i) //node k tries to delete replica files
Begin
   while(file(f) in current node)
   True
         Files_priority_check()
   If(node.test_file(f)==true)
      Then
         Node(i).FILE_DEL_REPLICA()
   Else
         Count=count+1 //select  the another neighbour
   End
  Procedure  priority_check()
   While(resource<j.size)
   If(priority_level <pj)Then
          Return file_deletion()  //priority test successful
 Else
     Si<FILE(f) //priority test fails
            Return  false
    End procedure
End
```

## VII. DESIGN OF PDBR FILE REPLICATION TECHINIQUE

In PBDR, each node dynamically updates its meeting ability (Vi) and the average meeting ability of all hosts in the system (V ). The replication is transfered among all the neighbour nodes.Each node also periodically calculates the $P_j$ of each of its files. The $q_j$ is calculated by using R, where q and R are the number of received requests for the file and the total number of queries generated in a unit of time period, respectively. Note that R is a pre-defined system parameter. replicating node should keep the average meeting ability of the replica nodes for file j around V . Node i first checks the meeting abilities of neighbors and then chooses the neighborhood node k that does not contain file j.

The protocol first choosing the neighbor nodes such as k,then check the node is current node or not.the priority test to be conducted by the requested file j.note the test will be succeded then ADD_replica ,otherwise Del_replica file in the each peers in the network.

Node k creates replicas for the files in a top-down manner periodically. Algorithm 1 presents the pseudo-code for the process of PBDR file addition between two encountered nodes. In detail, suppose node i needs to replicate file j, which is on the top of the list.

The neighbor node repeats above process until available storage is no less than the size of file j.Next, the node fetches the file from the top of the list and repeats the process. If file j fails to be replicated after K attempts, the node stops launching competition until the next period. if the selected neighbor's available storage is larger than the size of file j , it creates a replica for file j directly. Otherwise, a the priority test is happen among the replica of file j and replicas already in the neighborhood node based on their Ps. The priority value of the new replica is set to half of the original file's k. If file j is among the selected files, it fails the priority test and will not be replicated in the neighbor node. Otherwise, all selected files are removed and file j is replicated. If file j fails, node i will test another attempt for file j until the maximum number of attempts (K) is reached. The setting of K attempts is to ensure that each file can priority test with a sufficient subset of replicas in the system. If node i fails to create a replica for file j after K attempts, then replicas in node i whose Ps are smaller than that of file j are unlikely to win a priority test. Thus, at this moment, node i stops replicating files until next round.

The file replication stops when the communication session of the two involved node sends.Then,each node continues the replication process for its files after excluding the disconnected node from the neighborhood node list. Since file popularity, k, and available system resources change as time goes on,each node simultaneously executes PBDR to dynamically handle these time-varying factors.Each node also periodically calculates the popularity of its files (qj) to reflect the changes on file popularity(due to node querying pattern and rate changes) in different time periods. The periodically file popularity updates can be automatically handle file dynamism.

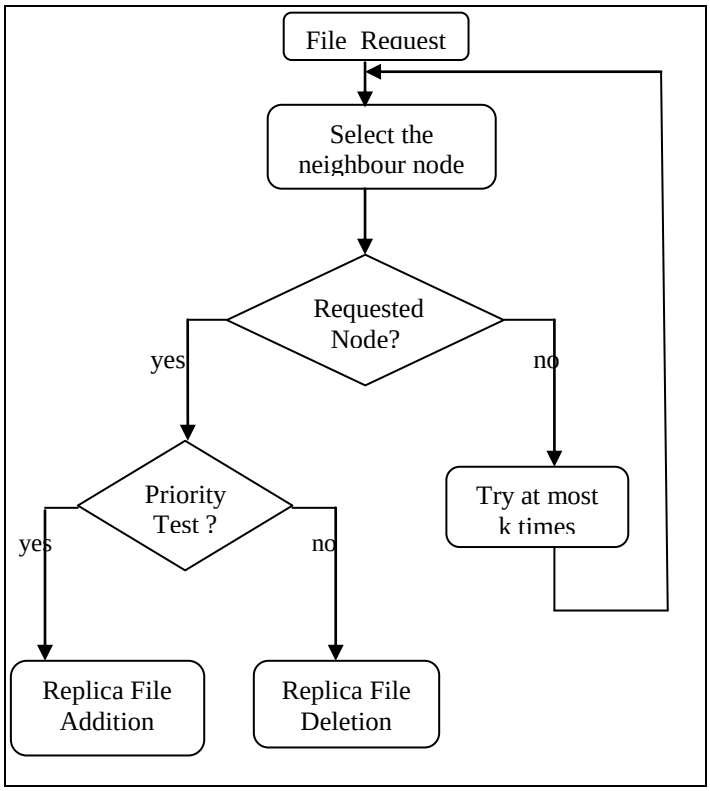


FIG 3:File Replicas Addition and Deletion Process in PBDR.

## VIII. PERFOMANCE

The output of each technique in the simulation test on NS-2. We see the hit rates and average delays of the four protocols. We used the following metrics in the experiments:

***Hit Rate***

It is the number of requests successfully handled by either original files or replica files.

***Average delay***

This is the average time of all requests that finish execution. The delay that calculate using the throughput and the performance of the requests.

**Hit Rate**

Figs. 4(a)The hit rates of the four methods with the simulations results .The hit rates continue SAF>DAFN> DCG >PBDR. The PBDR achieve higher hit rate than other methods. since PBDR realizes distributed way, it presents slightly differ from performance compared to others. PBDR considers the intermediate connection properties of disconnected MANETs and replications. DCG only considers temporarily con- nected group for fille replication, which is not stable in MANETs. Therefore, it has a low hit rate. Random assigns resources to files randomly, which means it cannot create more replicas for popular files, leading to the lowest hit rate. Such a result proves the effectiveness of the proposed PBDR on improving the over- all file availability and the correctness of our MANETs.

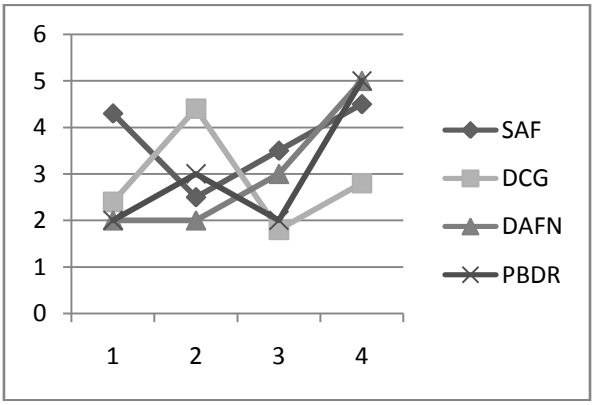


FIG 4(a) Hit Rate

**Average Delay**

Figs. 4(b) demonstrate the average delays of the four methods with simulation results.The average delays shows PBDR<SAF<DAFN<DCG which is in reverse order of the relationship between the four methods on hit rate as shown in Figs. 4a . This is because the average delay is related to the overall file availability in decending order. The PBDR have high file availability .SAF distributes every file to different Nodes while DCG only shares data among simultaneously identify neighbor nodes, and DAFN has a low file availability since all files receive equal amount of memory resources for replicas. The PBDR has the minimum average delay in the simulation results.

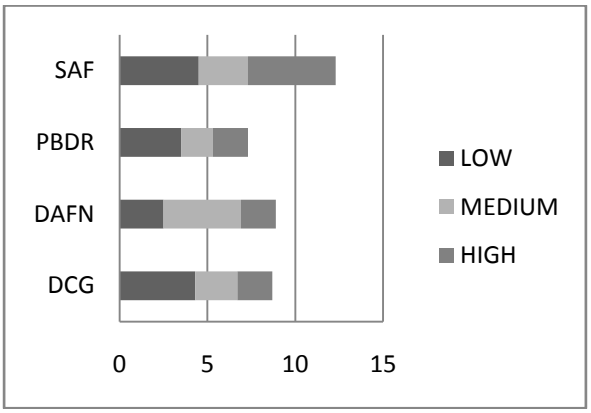


FIG 4(b) Average Delay

**Replication Cost**

Fig. 4(c) show the replication costs of the four methods. PBDR have the lowest replication cost while the costs of other three methods continues PBDR<DAFN<DCG<SAF. PBDR, nodes only need to communicate the file server for replica list, leading to the lowest cost. DCG generates the highest replication cost since network partitions and its members need to transfer a huge amount of files to remove duplicate replicas.In PBDR, a node tries at most K times to

create a replica for each of its files, producing much lower replication cost than SAF and DCG. Such the result demonstrates the high energy-efficiency of PBDR. Combining all above results, we conclude that PBDR has the highest overall file availability and efficiency compared to existing methods, and PBDR is effective in file replication in MANETs.

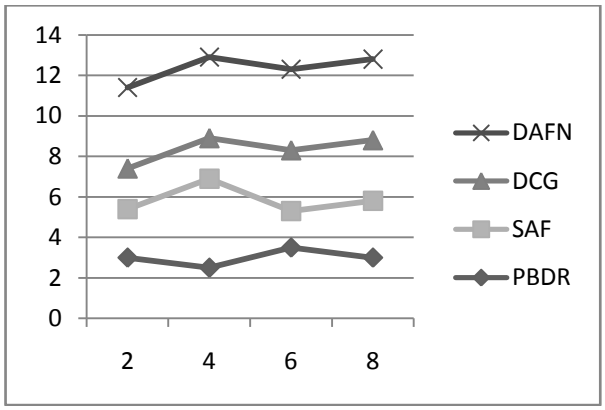


FIG 4(c)Replication Cost

**Replica Distribution**

Fig. 4d show the proportion of resources allocated to replicas in each protocol in the simulation. We see in both figures, PBDR presents very close similarity to DAFN and the other two follow SAF and DCG. SAF also presents similarity to PBDR on the replica distribution. However, the difference between PBDR and SAF is that PBDR assigns priority for popular files and check the priority test for files in the networks. DAFN gives even priority to all files. Since popular files are queried more frequently, SAF still leads to a low performance in the file replications.

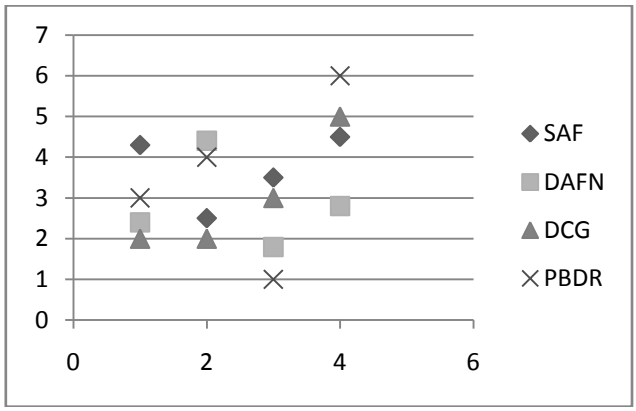


FIG 4(d) Replica Distributions

Therefore, the resources are allocated more strictly following the PBDR, leading to efficiant. The other replication protocols having the higher replication costs. The other three methods that favor popular files, we find that the closer similarity with PBDR a protocol. The PBDR has the better performance over all in manets. The storage capacity of the file replication can be overcome due to the file dynamics. The file distributions among all the nodes in the distributed network having better performances. The file distributes across the different partitions.This proves the correctness of our theoretical analysis and the resultant for MANETs.

## IX. CONCLUSION

In this paper, we analyze the problem of how to allocate limited resources in the replications and manage the resources in MANETs. Although previous protocols that only consider storage and resources, we also consider the file additions and deletions in dynamic manner in the peer-to-peer communication in distributed systems.the Priority Based Dynamic Replication(PBDR) techinique that are efficiently adding and deleting the file replications and manage the replicas in the particular time intervals. NS-2 simulator that are analysis the effectiveness of the PBDR techinique.The hit rate is higher then the previous protocols and average query delay is reduced and the replication cost is lower then the previous protocols. Finally, the PBDR protocol that minimize the average response delay in MANETs.

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