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New Strategy For Cache Replacement In Manets

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ABSTRACT
In Mobile Ad hoc Networks (MANETs) data access applications suffer from dynamic network connections and restricted resources. However, cooperative data caching can clearly improve information access process, which acts as an efficient solution for this problem. Research in cooperative caching of MANETs has many directions. In this paper we will focus on cache replacement strategies and propose a new vigorous one, the proposed strategy will achieve better utilization of the cache space, minimize cache duplications, and increase data availability, which results in a better performance in the overall system.

KEYWORDS
MANETs, cooperative caching, cache replacement.

1. INTRODUCTION
Mobile Ad Hoc Networks (MANETs) is a Wireless mobile communication network which augmented or replaced wired communications in many places of today's network communications, in MANETs there is no pre-existing infrastructure or service subscription available, it is a self-configured wireless network, consisting of nodes responsible for its creation, operation and maintenance, each node of the network acts as forwarding router. Some nodes have interfaces to the other networks, as they act like gateways to enable MANET nodes to connect to the other networks. MANETs have some special features [1]:

- Wireless network channel: because of the broadcast nature, the nodes within range have to share with each other the network channel.
- Dynamic topological structure: the high mobility thence changing of network topology may cause route breaks and introduce extra overhead for establishing new routes.
- Multi-hop routing: the number of hops between a server and a client increases, the throughput will decrease and the response delay will increase.
- Limited resources: A node usually has limited power supply, computing ability, and cache size.

These features bring some problems for data access applications, and data availability, figure.1, shows MANET's environment.

A. Cooperative Caching:
In cooperative caching, the cooperated nodes share and cooperatively manage their caches; each node serves and stores data requests not only for its need but also for the other nodes forming a large united cache. So in

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cooperative caching environment, the mobile nodes can obtain data items not only from its own cache but also from their neighboring nodes caches. This will reduce the server delays and decreases the response time for the client. In many applications of MANET like automated highways, smart homes, smart classrooms, nodes share common interest. So sharing cache contents between mobile nodes provides substantial benefits.

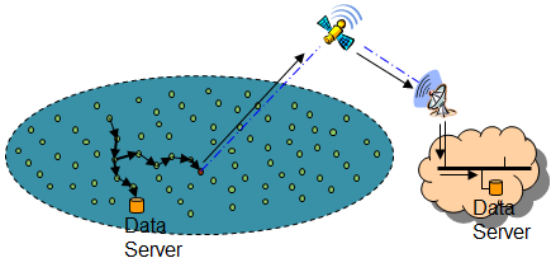

Figure 1: MANET architecture [1].

B. Important issues in cooperative caching:

C. Cache resolution

A mobile node decides where to bring a data item requested based on cache resolution. Cooperative caching tries to discover a data source which induces less communication cost by using historical profiles and forwarding nodes.

1) Cache Management

A mobile node decides which data item to be placed or deleted in its local cache based on cache replacement strategy.

Cooperative Caching minimizes caching duplications between adjacent nodes and allows the nodes to store more different data items to improve the overall performance. Choosing a good cache replacement policy remarkably contributes in better utilization of the cache space and improving the system performance in overall. Her we are reviewing some cache replacement strategies in the literature and propose a new policy aiming for a better using of replacement parameters which are considered for data caching.

2. LITERATURE REVIEW

In [1], a new cooperative caching strategy for data access applications in MANETs was proposed. (COOP) aimed to improve data availability and access efficiency by cooperating local resources of mobile nodes. COOP addressed two basic problems of cooperative caching: cache resolution and cache management. For cache managing, COOP uses the inter- and intra-category rules to minimize caching replications between the nodes within a same cooperation zone and this improves the overall capability of cooperated caches.

In [2], authors classified cache replacement policies in MANETs into two groups: uncoordinated and coordinated, in uncoordinated policy; the data item to be replaced is determined independently by each node based on its local access information; in coordinated policy the mobile terminals which forms cooperative cache together takes the replacement decision.

In Least Recently Used (LRU) replacement strategy when cache is full the data item that has been unused for the longest time is evicted. It is a commonly used algorithm in cache replacement. On each data reference the data is moved from its existing position to the front of the data list. When a new data cached it is placed on the top of the list and the data at the end is removed. LRU doesn't take in to account the size of data, which is an important issue in mobile communications.

In [4] a new proactive approach for cooperative caching in MANETs has beenproposed, the data of leaving node will be cached; each mobile node will broadcast a "LEAVE" message when it leaves its zone. Zone director will decide which data is to be cached based on its caching information table. This will help to improve the data availability and overall performance of the network.

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In [5], a modified version of LRU that tries to minimize the number of items replaced. It is similar to LRU in implementation take in account the size of the data during replacement. The data is sorted based on the access time, if a data item of size S needs to be cached it will search for items least recently accessed with size larger than S.

In [6], a local replacement policy which considers the data size and access frequency for replacement. Larger sized data items are removed first as they take more cache space. By replacing bigger objects, more cache space can be made available. The other parameter taken is data access frequency, replacement is done by combining the two parameters, and the advantage of this scheme is that the parameters used are easily available.

In [7], an energy efficient cache replacement policy for cooperative caching in mobile ad hoc networks used, the replacement decision here is taken based on the energy utilization for each data access. To do this; the authors considered the energy for: in zone communication, sending and receiving the object and energy cost for forwarding the object. Based on this they proposed two dynamic algorithms to replace data of the mobile node cache.

3. CACHE DISCOVERY AND MANAGEMENT

A. Chace discovery

Based on the idea of cooperative caching, each node in the Cooperation Zone (CZ) maintains a data table with its neighboring nodes within the same zone, each table contain information about the data of each node cache, when some node in the CZ request a specific data item, it firs checks its local cache, if the data is not found in its local cache it checks the CZ data table, if it is found then the request will be forwarded to the node which caching the requested data, otherwise the request will be forwarded hob by hob to the data server [1, 4].

B. Cache Management

When the new data requested and not found in the CZ, the will be fetched from the data server, this new data should be stored in the requester node cache, if there is home for this data it will be stored as new data and access count for this data will be set to zero. However when the cache is full then a cache replacement policy should be used, the following new policy is proposed.

4. PROPOSED STRATEGY

When caching a data item is needed; if the cache is full the system will call method evict to remove some data item from the cache to make home for the new data item, the eviction decision is based on the following parameters:

- Access count: the node with the maximum access count will be chosen because it has the highest probability to be found in the neighbor's nodes caches.
- Size: the removal of the largest data will give more space for the coming data.
- Access time: the data with lowest access time also has the highest probability to be found in the neighbor's nodes caches.
- Time to Live: if the time to live equals 0; then the data item is expired so it will be the first nominated for removal.

Figure. 2 shows the pseudo code of the proposed replacement algorithm.

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```
When node N want to cache a new data item d
dc =d // dc mean the cached data item
if (cache is full call method evict() to choose the victim v)
{
v.available =FALSE;
dr= v; // dr means removed data item
}
else
dr = NULL;
cache d;
d.available = TRUE;
Broadcast the cache update packet <N, dc, dr> to
neighbors node;
Method evict ()
{
      for each data item d in node  N calculate
 {
 ac=access count (d);
s=size (d) ;
at= access time (d);
ttl= TTL (d) ;
}
Return d where ttl=0
else return d where min (ac),  max(s),  oldest(at) and min
(ttl)
}
```

Figure 2. Pseudocode of replacement algorithm

5. DISCUSSION AND CONCLUSION

Because of the limitation surrounding the MANETs environment; this type of networks need to keep working as possible as it can in hard circumstances without failure, data availability is the most important issue for existing networking system, to increase the data availability the idea of cooperative caching appeared. There two main issues in cooperative caching: cache discovery and cache management. For data management anew efficient algorithm proposed in this paper. By combining four parameters: access count, data size, access time, and time to live, cache replacement of proper data item will be more accurate, this will maximize data availability, minimize data duplication, and therefore ensures high performance of the whole system.

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6. REFERENCES

[1] Y. Du, S. Gupta, and G. Varsamopoulos, "Improving on-demand data access efficiency in MANETs with cooperative caching", Ad Hoc Networks, (579–598), 2009.

[2] P. Joy and K. Jacob, "Cache replacement policies for cooperative caching in mobile ad hoc networks", IJCSI International Journal of Computer Science Issues, Vol. 9, No 2, May 2012.

[3] P. Kuppusamy, K. Thirunavukkarasu, and B. Kalaavathi "A review of cooperative caching strategies in mobile ad hoc networks", International Journal of Computer Applications (0975 – 8887) Volume 29, No.11, September 2011.

[4] P. Kumar, N. Chauhan, L. Awasthi, and N. Chand "Proactive approach for cooperative caching in mobile ad hoc networks", IJCSI International Journal of Computer Science Issues, Vol. 7, Issue 3, No 8, May 2010.

[5] M.K. Denko and J. Tian, "Cross-layer design for cooperative caching in mobile ad hoc networks", in Proceedings of IEEE Consumer Communications and Networking Conference, 2008.

[6] L. Yin and G. Cao, "Supporting cooperative caching in ad hoc networks", IEEE Transactions on Mobile Computing, 5(1):77-89, 2006.

[7] W. Li, E. Chan, and D. Chen, "Energy- efficient cache replacement policies for cooperative caching in mobile ad hoc networks", in Proceedings of the IEEE WCNC (3349–3354), 2007.