PERFORMANCE OF MANET USING ALCC ALGORITHM & ENERGY MODEL BASED ON CROSS LAYER APPROACH.

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ABSTRACT

The study of MANET remains attractive owing to the eagerness to achieve better performance and scalability. MANETs are autonomous systems consisting of mobile nodes that are connected by wireless links. Such systems are self organized and allow communication in the network without any centralized body. Clustering has set as a mandatory research field that increases a network performance such as delay and throughput in MANETs in the presence of both mobility and a large number of mobile hosts. Few protocols have chosen the cooperative caching scheme, allowing multiple mobile nodes within a cluster to cache and share data in their local caches. Energy model based Adaptive Least cluster change (ALCC) algorithm is proposed to minimize the energy consumption and a handshaking mechanism is introduced to reduce the overhead of network layer during route finding by reducing power consumption. The simulation results in the NS-2 simulation environment show that the proposed algorithm improves network performance.

Keywords: MANETs, Cluster, cooperative caching, Energy model, and cluster handshaking.

I. INTRODUCTION

MANETs are autonomous systems consisting of mobile nodes that are inter-connected by multi-hop wireless links. MANETs are decentralized networks that will form by self organization. MANETs are constituted by the number of nodes that can transmit, receive and relay data among themselves. In MANET, there is no fixed infrastructure therefore the mobile nodes communicate over multi-hop wireless links. These are often cited as infrastructure-less network model because the mobile hosts in the network establish route between themselves. Caching has been proved to be a very important method for improving data recovery and performance in mobile communication area. Caching, data or information process delay is minimized since queries or requests are served from the local cache there by clearing the need for data transmission. Caching methods used in one hop mobile scenario may not be applicable to many hosts mobile scenario since the data or request may need to go through a number of hops. As mobile clients in MANET may have identical tasks and common interest. Therefore the cooperative caching can be utilized to reduce the bandwidth and power utilization [2].

II. PROPOSED MODEL

First the information search and cache admission control schemes are built on clustering architecture [1]. Clustering has a unique way to organize MANETs. Clustering reduces traffic overhead, flooding, and collisions in MANETs. It also rides the MANET more scalable. Subsequent cross-layer design scheme is adopted to enhance caching performance. A data structure referred to as stack profile is created, which is independent of the protocol stack and works as a data exchange buffer for different protocol layers. Stack profile fully supports cross-layer design scheme because all protocol layers can get cross-layer information through the stack profile. Finally the prefetching technique is used to increase the cache hit ratio and decrease user-perceived data request response time and to maintain cluster heads handshaking is used by introducing a welcoming packet concept.

2.1. Cluster Based Cooperative Caching (CBCA)

The system architecture of Cluster Based Cooperative Approach (CBCA) is shown in figure 1. CBCA is a cluster-based middleware which stays on top of the underlying network stack and provides caching and other data management services to the upper layer applications in MANET [5].CBCA includes prefetching modules, stack profile, information search, clustering, cache management. The stack profile module provides cross-layer information exchange, by the help of stack profile. Cached item IDs which are in the middleware layer can be obtained by the network layer. CBCA instances run in each mobile node. The network traffic information which is in the data link layer (DLL) can be obtained by the middleware layer for prefetching purposes.

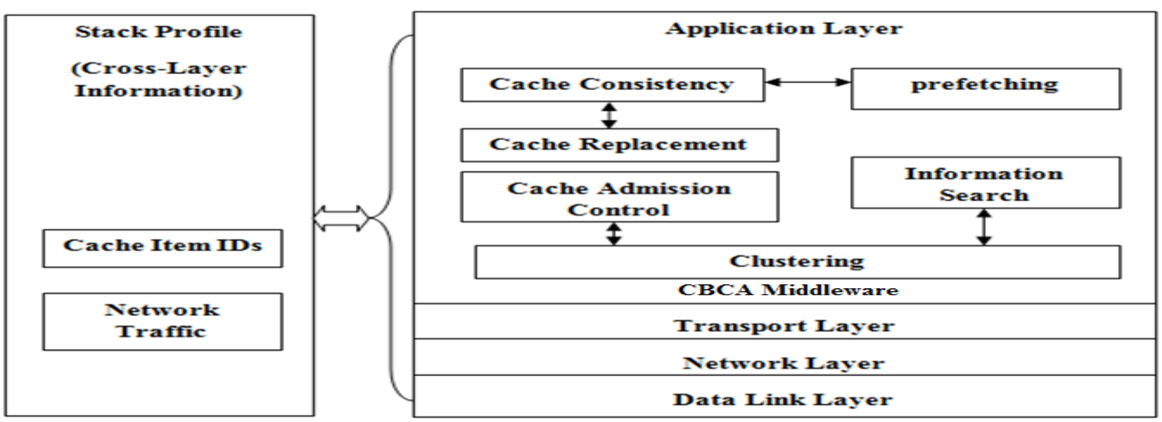

Fig.1.System architecture of CBCA

2.2. Cluster Formation and Maintenance

Clustering is utilized to partition a network into several virtual groups (known as clusters) based on certain predefined criteria.. ALCC algorithm carries the below steps.

1) Each node learns direct contact possibilities for other nodes.

2) A node decides to join or leave a cluster based on its contact possibilities for other members of that cluster. Cluster only if it’s pair-wise contact possibilities to all existing members are greater than a threshold value. A node leaves the current cluster if its contact possibilities for some cluster members drop below threshold value.

2.3. Local Cache and Neighbors

Information search operation requests data items in the following order: local cache, neighbors, and eventually the Data Center [5]. When a mobile host requests a data item, it first checks its own local cache. If the requested item is found in the local cache the request succeeds, which has the least communication overhead and the least query latency. Otherwise the search operation will continue to the next step. Sending requests to neighbors, in this step a mobile host searches the requested data item within the neighborhood. By exchanging hello messages, each mobile host makes a record of all its neighbors. First it checks whether the DC is its neighbor. If it is the request is sent to the DC. If it is not there are two situations. The mobile host is a cluster head and hence it checks its ID list or it is a cluster member and it sends the request packet to its cluster head. When a cluster head receives a request packet from its cluster member, it sends the requested item to the requester if it has already cached the requested item. If the cluster head does not cache the requested item, it forwards the request packet to the DC directly or via intermediate nodes

2.4. Proposed Algorithm

The Cluster formation algorithm is built on the energy levels of each node.

1) All nodes are arranged geographically to constitute the cluster.
2) Select a node which has the highest energy level in that cluster.
3) Choose this node as Cluster Head and this information is broadcasted to all the member nodes of that cluster.
4) If the selected cluster has low energy or does not have the highest energy then declare this node as a member node and send a message to cluster head of that cluster indicating that node wants to join the cluster.

2.4.1. Cross Layer Handshaking Mechanism

A cross layer handshaking mechanism between the data link layer and the network layer has been implemented by introducing a friendly packet between the two layers. To reduce the overhead of route finding in terms of delay and power consumption we suggest that this friendly packet provides necessary information from the data link layer to its upper network layer.

III. PROPOSED METHODOLOGY

3.1. Simulation Model and Parameters

We use NS2 to simulate our proposed algorithm. In our simulation, 15 mobile nodes move in a 1000m x 1000m square region for 50 100 150 200 seconds simulation time. We assume each node moves independently with the same average speed. All nodes have the same transmission range of 100 meters. The simulated traffic is Constant Bit Rate (CBR). Our simulation settings and parameters are summarized in table 1

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Table-1: Simulation Settings & Parameters

No. Of Nodes	15
Area Size	1000 X 1000
MAC	802.11
Radio Range	100m
Traffic Source	CBR
Packet Size	1500
Mobility Model	Random Way point

VI. SIMULATION RESULTS AND DISCUSSION

Figure 2 shows the packet delivery ratio as a function of Simulation time. It shows that the proposed system always outperforms the present system at all different simulation time. When simulation time is greater than 150 seconds the packet delivery ration is same whereas in the present system it is slightly down.

Figure 3 shows the throughput as a function of simulation time. It shows that the throughput of proposed system is greater than present system at all simulation times. Thus ALCC algorithm gives good throughput.

Figure 4 shows the normalized routing overhead as a function of simulation time. From the result we can see that the routing overhead of the proposed system is much less than the present system.

Figure 5 shows the residual energy as a function of simulation time. Here residual energy of the proposed system is more than the present system. Thus introducing an energy model in clustering saves much energy consumption.

Figure 6 indicates the delay as a function of simulation time. Here delay of the proposed system is less than the present system.

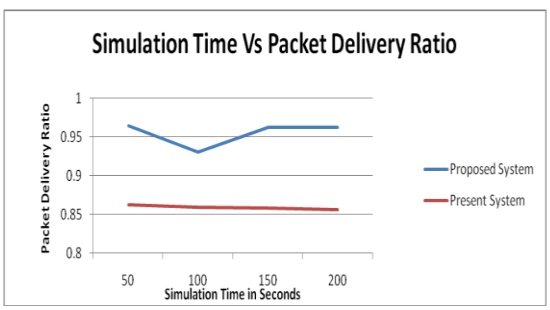

Fig.2 Simulati on Time Vs Packet Delivery Ratio

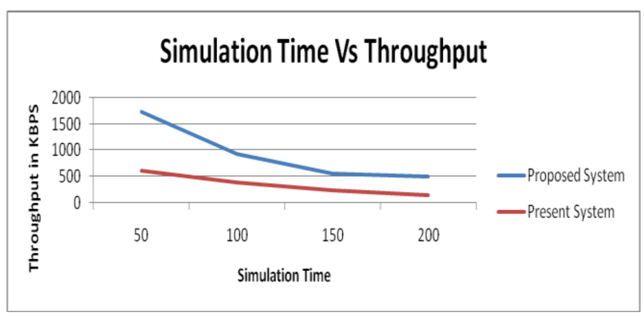

Fig.3 Simulation Time Vs Throughput

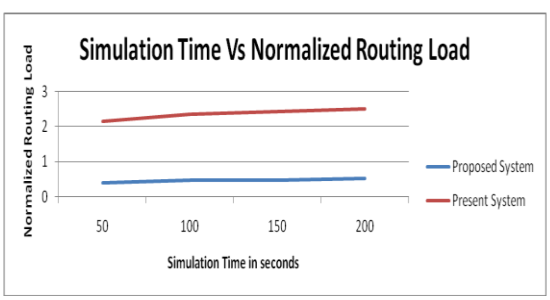

Fig:4 Simulation Time Vs Normalized Routing Load

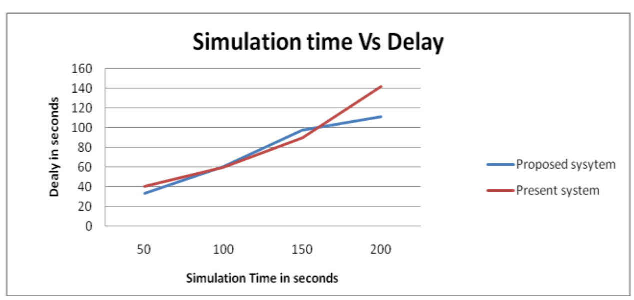

Fig:5 Simulation Time Vs Delay

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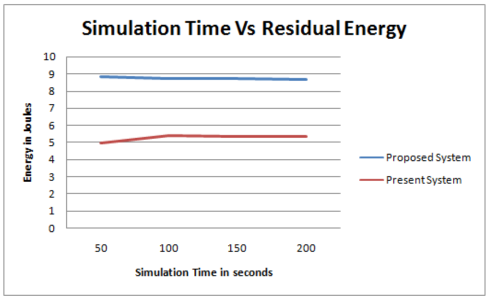

Fig:6 Simulation Time Vs Residual Energy

V. CONCLUSION

In this paper, the fundamental concepts about clustering were provided, including the definition of the cluster and the necessity of clustering for a large dynamic MANET. Then we presented an energy conscious algorithm which is scalable and adaptable for various mobility conditions. The simulation results show that the performance of MANET in terms of throughput, packet delivery ratio, routing overhead and residual energy is improved when compared with and without Energy Model based ALCC.The problem of cluster maintenance is taken care by the handshaking mechanism. Therefore an effective cluster maintenance scheme can be incorporated with the proposed clustering algorithm designed protocols that can be taken up as the future work.

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