CHAPTER VII

ADAPTABILITY OF CBMT WITH MOBILITY AWARE MDSDV

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VII ADAPTABILITY OF CBMT WITH MOBILITY AWARE MDSDV

Mobile Ad hoc network has enormous secure group oriented applications, such as emergency and relief operations, military and disaster situations, and conferences or classroom meetings. In each of these applications, frequent node mobility is a common phenomenon.

The frequent mobility of members and limited communication resources make routing in MANET very difficult. Mobility causes frequent topology changes and may break existing paths. A routing protocol should quickly adapt to the topology changes and efficiently search for new paths. To adapt to the above scenario, mobility aware Multicast version of Destination Sequenced Distance Vector routing protocol is used. It allows fast reaction to topology changes and is specially designed for MANET.

The pattern of movement of members can be classified into different mobility models and each is characterized by their own distinct feature. It is a crucial part in the performance of MANET. The traditional mobility models[89] are (i) Random Waypoint Model (ii) Random Walk Model and (iii) Group Mobility Model.

These are randomized models in which each member chooses its velocity and direction independently without any restrictions. Hence these models do not capture correlation between the member movements. Recent work on mobility models attempts to identify common mobility movement.

Specific Problems

Frequent mobility of nodes and limited resources of Mobile ad hoc network creates specific problems which are as follows
• Makes routing very difficult
• Causes frequent topology changes
• May break existing paths

These problems of the clustering approach can be overcome by using mobility aware MDSDV routing protocol to adapt the clustering approach with different mobility models for multicast key distribution. Hence, this phase proposes the adaptability of CBMT with mobility aware MDSDV under various mobility models with frequent membership dynamism.

7.1 Mobility Aware Multicast DSDV

This phase uses Mobility Aware Multicast version of DSDV routing protocol to maintain routing table periodically. It forms multicast tree among the group members. Each node can determine their present physical location. It quickly adapts to the topology changes. It is used to discover alternate route for failure of existing route. It also sends acknowledgement for each transmission in order to reduce the retransmission.

Merits

Some of the specific merits of mobility aware MDSDV routing protocol are follows

• Maintains routing table periodically
• Forms multicast tree
• Determines each physical location
• Adapts quickly to the topology changes
• Discovers alternate route
• Sends acknowledgement to reduce retransmission.

7.1.1. Algorithm of Mobility Aware MDSDV

The main idea of the mobility aware MDSDV algorithm is to search the GC as per the information collected by the node. After identifying GC, then find LC based on the request type and broadcast the request to all its neighbors.

For every list belongs to the cache list of route request-reply, if the trust path of the list node id is greater than or equal to the threshold value then add the list to the cache list.

For a given trust degree of the node id, check if there exists trust path of list node id then return the trust path, otherwise go to trust formation.

The mechanism of Mobility aware MDSDV is described by the following Algorithm 7.1.

Algorithm 7.1 : Mobility Aware MDSDV

```
Search GC(request_type)
{
    For each (s ∈ GC)
        if (s.type = request_type) return(s);
    for each (f ∈ Cache)
        if (f.type = request_type) return(f);
    Broadcast (TEK_KEK_route_Request (request_type, 1/2));
    set timer(CONFIG_WAIT_RPLY, EXPIRED);
    Request type_GC = hear_network model (MMDSDV_Route_Reply);
    update_cache (request_GC);
    Return (request_GC);
    EXPIRED:
        return (NULL);
}
```
Search LC (Request_type) {
    For each (s ∈ LC)
        If (s.type = request_type) OR (request_type = ALL)
            known_request+=s;
    For each (f ∈ Cache)
        If (f.type = request_type) OR (request_type = ALL)
            Known_request+= f;
        broadcast (MMDSDV_Route_Request(request_type, 1/n, known_request));
        set_timer(CONFIG_WAIT_RPLY, EXPIRED);
        loop (forever)
            Request_list+= hear_networkmodel(MMDSDV_Route_Reply);
        EXPIRED:
            update_cache (request list);
            return(request_list + known requests);
}

Update_cache (list) {
    For each (l ∈ list_REQ_REP)
        if (trust_path(l.Id) ≥ value)
            Cache += l;
}

Trust degree(id) {
    if ∃ trust_path(l.Id) return this
    else
        goto trust formation
}

Thus the approach of CBMT using Mobility Aware MDSDV tends to have multicast connectivity between the nodes.
7.2 CBMT with Mobility Aware MDSDV

The main idea of CBMT is to use mobility aware MDSDV routing algorithm to elect the local controllers of the created clusters. The methods applied in this phase are as follows:

- Mobility Aware MDSDV routing protocol
- MAC 802.11 for providing communication between nodes.
- Channel bandwidth for minimization of congestion that occurs during transmission.

Thus the Cluster Based Multicast Tree (CBMT) approach is an efficient dynamic clustering scheme using mobility aware MDSDV routing algorithm, which makes easy to elect the local controllers of the clusters and updates periodically as the node joins and leaves the cluster. This phase describes the adaptability of CBMT for the three mobility models with MDSDV routing protocol for QOS based secure multicast communication in MANET.

7.3 Performance Evaluation

The performance is evaluated in terms of QOS metrics such as end to end delay, energy consumption, key delivery ratio and packet drop ratio during multicast key distribution for three different mobility models. The simulation will be conducted in two different scenarios to obtain an efficient result in terms of QOS performance metrics.

i) Scenario 1 compares the CBMT and OMCT with different mobility models in varying number of nodes.

ii) Scenario 2 compares the CBMT and OMCT with different mobility models under varying speeds.
7.4 Simulation Results

This section presents simulation results to compare and analyze the performance of CBMT approach with different mobility models for QoS based secure MANETs. The simulation results are based on two scenarios which illustrates the performance.

7.4.1. Scenario 1: Different Number of Nodes

In this scenario, all the three mobility models are evaluated on CBMT and OMCT approach based on QoS requirements with number of nodes. Figures 7.1a. – 7.1d. shows the adaptability of OMCT and CBMT clustering approaches in random mobility model. Figures 7.2a. – 7.2d. shows the adaptability of OMCT and CBMT clustering approaches in random walk model. Figures 7.3a. – 7.3d. shows the adaptability of OMCT and CBMT clustering approaches in Group mobility model.

![Figure 7.1a. End to End Delay](image1)

![Figure 7.1b. Energy Consumption](image2)
Figure 7.1 Random Way Point Mobility Model

Figure 7.1c. Key Delivery Ratio  Figure 7.1d. Packet Drop Ratio

Figure 7.2a. End to End Delay  Figure 7.2b. Energy Consumption
Figure 7.2 Random walk mobility

Figure 7.2c. Key Delivery Ratio  Figure 7.2d. Packet Drop Ratio

Figure 7.3a. End to End Delay  Figure 7.3b. Energy Consumption
The above simulation results illustrates that the performance of CBMT approach with different mobility models at varying number of nodes in terms of QoS metrics.

7.4.2. Scenario 2: Different Node Mobility Speed

This section presents simulation results to compare the impact of nodes mobility speed on the performance of CBMT and OMCT with different randomized mobility models for multicast communications in terms of key delivery ratio, latency and energy consumption. Figures 7.4a. – 7.4d. shows the adaptability of OMCT and CBMT clustering approaches in random mobility model. Figures 7.5a. – 7.5d. shows the adaptability of OMCT and CBMT clustering approaches in random walk model. Figures 7.6a. – 7.6d. shows the adaptability of OMCT and CBMT clustering approaches in Group mobility model.
Figure 7.4a. End to End Delay

Figure 7.4b. Energy Consumption

Figure 7.4c. Key Delivery Ratio

Figure 7.4d. Packet Drop Ratio

Figure 7.4 Random Way Point Mobility Model
Figure 7.5a. End to End Delay

Figure 7.5b. Energy Consumption

Figure 7.5c. Key Delivery Ratio

Figure 7.5d. Packet Drop Ratio

Figure 7.5 Random walk mobility
7.5 Analysis of Simulation Results

This section presents simulation results to compare and analyze the performance of CBMT and OMCT approach for different mobility models in MANETs. In this scenario, all the three mobility models are evaluated on CBMT
approach and OMCT approach based on performance metrics under various network conditions. The comparison of the three mobility models for the CBMT and OMCT are shown in the following figures.

Figure 7.7 compares the performance of CBMT and OMCT for three mobility models as Random waypoint mobility model, Random walk mobility model and Group mobility model in terms of average end to end delay in multicast communication. Results illustrate that CBMT gives less delay than the existing OMCT for all the three mobility models in secure multicast communication.

**Figure 7.7 Average end to end delay**

**Figure 7.8 Energy consumption**
Figure 7.8 compares the performance of CBMT and OMCT for three mobility models in term of energy consumption in multicast communication. Results obtained that CBMT consumes more energy than the existing OMCT for all the three mobility models in secure multicast communication as the mobility increases.

Figure 7.9 shows the comparison in term of key delivery ratio. Results illustrate that the CBMT gives increased delivery ratio than OMCT for the three mobility models in secure multicast communication.

![Key Delivery Ratio](image1)

**Figure 7.9 Key delivery ratio**

![Packet Drop Ratio](image2)

**Figure 7.10 Packet Drop Ratio**
Figure 7.10 shows the comparison in term of Packet drop ratio. Results illustrate that the CBMT reduces the packet drop ratio compared to OMCT for all the mobility models.

The above simulation results illustrates that the adaptability of CBMT approach for different mobility models give better results than the existing approach OMCT in terms of performance metrics under varying network conditions.

**Specific Advantages of Phase IV**

Some of the Specific advantages of Adaptability of CBMT with Mobility aware MDSDV routing protocol over the existing OMCT approach is as follows.

- Presents the impact of mobility models
- Illustrates the adaptability of CBMT with MDSDV for different mobility models.
- Reduces end to end delay
- Reduces Packet Drop ratio
- Increases key delivery ratio

**7.6 Chapter Summary**

Membership dynamism is a major challenge in mobile ad hoc networks for secure multicast communications. Importance of mobility patterns of mobile ad hoc network is studied. Simulation results illustrate, that the adaptability of CBMT compared with OMCT for different mobility models varied widely across different number of nodes and node mobility speed in terms of QOS performance metrics such as average end to end delay, energy consumption key delivery ratio and packet drop ratio for secure communication. It is observed that the CBMT adapts
better in suitable conditions than the OMCT for three mobility models in such ad
hoc environments.

Thus this phase proposes the adaptability of CBMT with mobility aware
MDSDV under various mobility models in frequent membership dynamism with
varying number of nodes and speed of nodes. It presents the importance of
mobility patterns and illustrates the adaptability of CBMT with MDSDV for
different mobility models.

More frequent membership dynamism causes node failure, link failure,
power failure which leads to time delay in multicast transmission. The next phase
deals with failure of nodes and proposes an efficient approach for secure
multicast communication.

Publications of Phase IV:

• International Journals

1. “Impact of Mobility for QOS Based Secure MANET” in
   International journal on applications of graph theory in wireless ad hoc
   networks and sensor networks (GRAPH-HOC). ISSN 0975 – 7031
   Vol 2, No. 3, 46-57, Sept 2010

• International Conference

1. “Impact of Nodes Mobility on MANET Routing Protocol for Secure
   Multicast Communication” in International Conference on System on
   Chip in Association with International Journal of Computer Networks
   and Communications at SNR SONS College, Coimbatore on 13th
   March 2010.

- National Conference