Mounting Eminence Of Services In Wireless Mesh Networks

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Abstract : Wireless networks evolve into next generation to provide faster and better services, a key technology Wireless mesh networks has emerged recently. A wireless mesh network comprised of radio nodes which a form of wireless ad hoc network. In wireless mesh network nodes are combination of mesh routers and mesh clients. Wireless mesh networking is a promising wireless technology for numerous applications and hence throughput drops significantly as number of nodes or hops increases. Hence we propose a novel method to increase throughput using tabu search optimization followed by centralized and distributed algorithms. Simulation results shows that using this approach number of hop by hop per packet transmission is reduced and so the throughput is increased by 40 percent inducing increase in all quality of services.

Key words :- Wireless mesh networks, tabu , greedy algorithm, distributed algorithm

1. Introduction

In WMN each node operates as a host and also as a router, forwarding packets on behalf of other nodes that are not in direct wireless transmission range of their destination. WMN is characterized by its dynamic features such as self organization, self configuration and self healing to enable faster deployment, easy maintenance, lower cost and trustable services for enhancing the network capacity, connectivity, resilience and robustness. WMN is becoming an important mode balancing to the infrastructure based wireless networks.

The rest of the paper is organized in the following manner, in section 2 we consider challenges faced in WMN. Section 3 deals all about tabu search optimization. Section 4 tells about centralized algorithms. Section 5 all deals about distributed algorithms. Section 6 we have simulations and results. Section 7 considers about conclusion and future enhancement.

2. Challenges Faced In WMN

WMN consists of two types of nodes mesh routers and mesh clients. The routing capability for gateway/ repeater functions as in a conventional wireless router, a wireless mesh router contains additional routing functions to support mesh routing. To further improve the flexibility of mesh networking, a mesh router is usually equipped with multiple wireless interfaces built on same or different wireless access technologies. Although mesh client act as a router gateways or bridges does not exist in these nodes. Mesh clients usually have only one wireless interface.

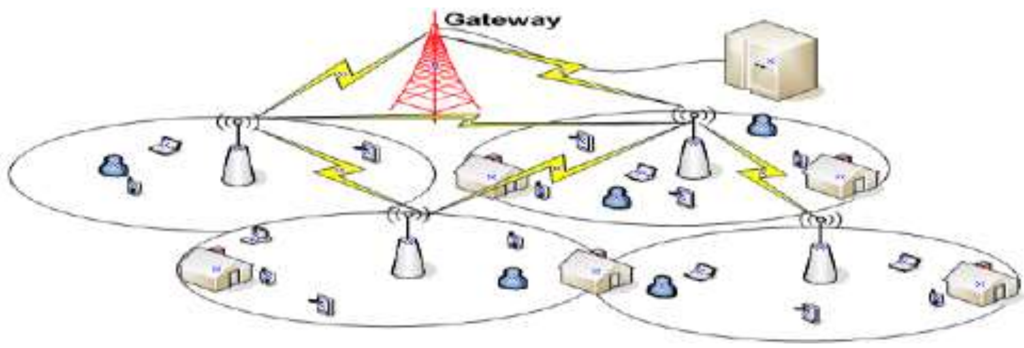

Figure 1.1 WMN Architecture

The characteristics of WMN are given as follows

- **Multihop Wireless Network**
- **Support for self forming self healing and self organization**
- **Compatibility and interoperability with existing wireless networks.**

3. Delay Minimization Using Tabu search optimization

We present Tabu search heuristic approach for delay minimization in mesh networks. Tabu search was introduced by Fred Glover as a high level of algorithm that uses precise heuristics to guide the search. The intention is to execute an intelligent exploration of search space that would ultimately shun getting fascinated into local optima. Tabu status is precise to solutions being visited. The imperative features of TS method are adaptive memory and responsive exploration. Adaptive memory takes intelligent decisions and responsive exploration is based on unsurpassed solutions in elongated time run in search space. TS method works both on short and long term reminiscences to administer tabu status and guide the search. For a given explanation s, the neighborhood of s, denoted by $\mathcal{N}(s)$, is defined as the set of realistic solutions accessible from s by applying

$$\mathcal{N}(s) = \{ \acute{s} | \acute{s} = m(s), m \in \mathcal{M}(s), \acute{s} \in S\} \quad \text{Eq(1)}$$

Where S is the resolution space, $\mathcal{M}(s)$ is set of association that can be generated from solution s and m denotes a movement to be applied to s.

A) Tabu Status

The foremost use of tabu status is to avoid visiting solutions already visited during the search. A tabu list is thus valuable to break beforehand visiting solutions. Tabu status is a subject to restraining condition if unchanged over long duration of time. We define a set of admissible solutions which are the set of solutions of neighborhood by excluding Tabu are called aspiration criteria.

$$Admissible(s) = \{(\mathcal{N}(s) - \mathcal{T}(s)) \cup Aspiration(s)\}$$

Eq(2)

Where $\mathcal{T}(s)$ is the movement of Tabu reachable from s:

$$\mathcal{T}(s) = \{ \acute{s} | \acute{s} = m(s), s \in S, \acute{s} \in S, m \in \mathcal{M}(s), is_{tabu(\acute{s},m)} = true\}$$

Eq(3)

and we have aspiration(s) is set of tabu movements satisfying following criteria:

$$aspiration(s) = \{ \acute{s} | \acute{s} = m(s), s \in S, \acute{s} \in S, m \in M(s), is_{tabu(\acute{s},m)} = true, aspirate(\acute{s}, m) = true$$

Eq(4)

4. Centralized Algorithms

In multi hop networks such as WMN routing is one of the most important issues that has momentous brunt on network performance. There are lot of nodes in the WMN and so to increase throughput we must also find the shortest path for traversal from source node to destination node. There are several shortest path algorithms such as BFS, DFS, Dijkstra, Bellman Ford etc. All these algorithm solve shortest path in speculated polynomial time in fixed infrastructure WMN support both wired and wireless links. Therefore we introduce greedy algorithm in centralized algorithm to solve the shortest path in both wired and wireless network. The flows got optimized using tabu and now using Greedy algorithm technique we find the most suitable shortest path and traverse in that path.

Algorithm : TSO Greedy
Input: G = (V,E), path p, Source S, Destination D, flow f
$T \leftarrow \{S\}$
for all $i \in V$ do
    $route_i \leftarrow \Phi$
end for
for all $i,j \in E$ do
    $weight_{i,j} \leftarrow f_{i,j}$
end for
while $D \neq \Phi$
    for all $v \in D$ do
        find route(T,v) and weight(T,v)
    end for
find $v^* = \min_v weight(T,v)$
$T \leftarrow T + route(T,v^*)$
for all $(i,j) \in route(T,v^*)$ do
    $route_i \leftarrow route_i + \{j\}$
    for all $n \in N_i - route_i$ do
        $weight_{i,n} \leftarrow f_{i,route_i+(n)} - f_{i,route_i}$
    end for
end for

$D \leftarrow D - \{v^*\}$

end while

5. Distributed Algorithms

The main purpose of distributed algorithm is whenever a new node enters into the mesh network a path or channel must be assigned so that it can communicate easily with the other nodes. Moreover increase of new nodes reduces the capacity. The mesh network is a very large network, but we have centralized algorithms to find a shortest path and network flows are maintained by tabu. Now designing of distributed algorithm is to assign channel for the nodes. The output of centralized algorithm is input to distributed algorithm.

Algorithm Channel Assignment(node i)\

Set of nodes V, channel c_j and current channel c_i

Begin

For all m = 1,2… M

$f(m) \leftarrow \sum_{J \in Si} f(m, c_j)$

if $f(c_i) > f(m)$ for any m= 1,2…M then

$c_i \leftarrow m_{min}$

end for

end

Each node selects a minimum channel hence inference is minimized and throughput gets increased.

5.1 New Node Insertion

Wireless mesh networks compromises of many nodes both wired and wireless. Hence there will be a inclusion of new nodes all times throught the travel of the network. We use centralized algorithm to generate shortest path between source and destination. Though we form shortest path between source and destination there arises a probability of new nodes in the formation of the path since wireless mesh networks travels hop by hop. Therefore to overcome such difficulties we use distributed algorithm for insertion of a new node in wireless mesh networks.

Algorithm new node insertion

Set of nodes V, path p, source S, Destination D

If S exists then

New node $n \in p$

Check TSO Greedy(n)

If n is TRUE

$route_i \leftarrow n$

end if

end if

5.2 Repair Existing Node

When Wireless mesh networks travel in shortest path using centralized algorithms there me some node failure or path disclosures occurrences since nodes have mobility feature they can move from their position, inducing a path breakage or failure from source to destination. To avoid such confusions when there is node repair in our network we use distributed algorithms to find next nearest node.

Algorithm node repair

Set of nodes v, path p, source S, destination D

For all $i \in V$ do

If $Route_i \leftarrow$ Data not found

Find route(v_{+i}) and weight(v_{+i}) in path p

Find $v^* = \min$ weight(v_{+i})

End if

End for

6. Simulations And Results

The results are simulated using NS2 simulator with 50 nodes. Each nodes are uniformly distributed in a prescribed area of 2500m * 2500m. Each time packets are send from source to destination. The size of a multicast packet is 512 bytes. Each time the throughput gets increased.

6.1 Throughput Comparison

Throughput is defined as amount of data moved successfully from source to destination in a given period of time. We compare the throughput results with the EMTX multicast problem. We obtain that each time the throughput gets increased by 40 percent when compared with EMTX.

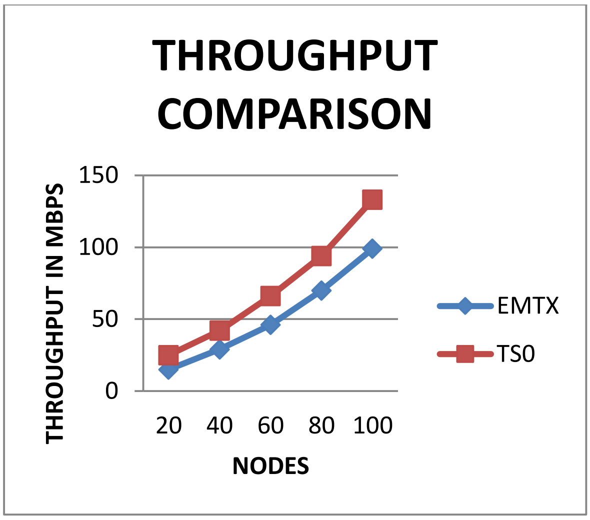

Fig 1.3 Comparison of throughput of EMTX and TSO

6.2 Error Rate Comparison

Error rate describes the degree of errors encountered during data transmission from source to destination. We compare the error rate with EMTX multicast problem. Each time the error rate gets highly reduced. Lesser the error rate is the efficiency of the data transferred.

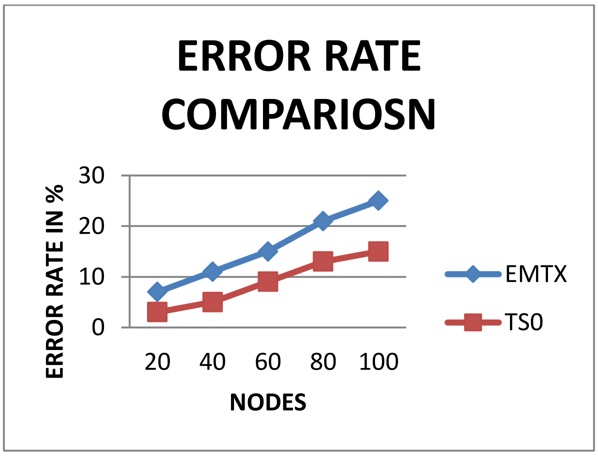

Fig 1.4 Comparison of error rate with EMTX and MMF

6.3 Packet Delivery Ratio

Packet delivery ratio is the number of successful packets delivered to the destination when compared with number of packets sent by sender. When compared with EMTS every time TSO shows higher packet del;ivery ratio.

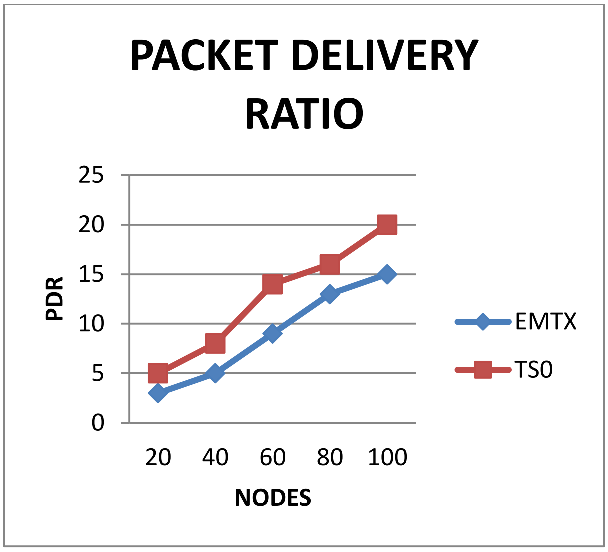

FIG 1.5 COMPARISON OF PDR OF TSO AND EMTX

6.4 Energy Level

Energy level determines the lifetime of a node in the network. Each time of comparison between EMTX and TSO, the nodes in TSO shows higher energy level.

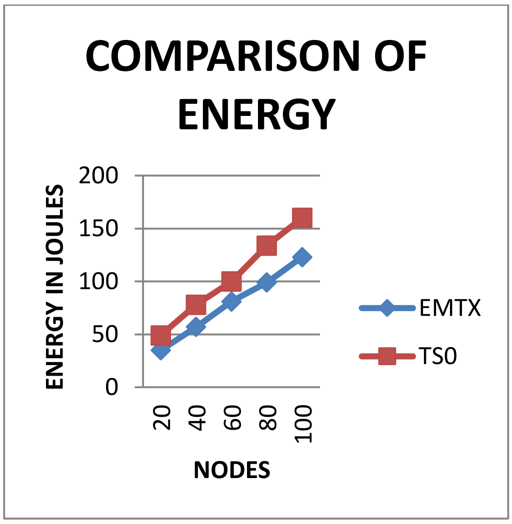

Fig 1.6 Comparison of Energy level in TSO with EMTX

7. Conclusion and future enhancement'

We develop high throughput in mutltihop mesh networks. We use all techniques such as TSO, centralized algorithms and distributed algorithms and increase throughput. We can also increase the node values and implement the same scheme to increase the throughput. Also we try to increase many quality of services such as error control, jitter etc

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