IMPROVE ROUTING PROCESS WITH FEATURE BASED PACKET TRANSMISSION TECHNIQUE IN MANET USING GRBR ALGORITHM

T.Saranya,
M.Phil Scholar,
Department of Computer science and Application,
PGP College of Arts and Science,
Namakkal-637207, India

M.Preetha,
Assistant Professor,
Department of Computer science and Application,
PGP College of Arts and Science,
Namakkal-637207, India

Abstract: The rapid development of wireless networks has stimulated numerous wireless applications that have been used in wide areas such as commerce, emergency services and entertainment. The number of WiFi capable mobile devices including laptops and handheld devices has been increasing rapidly. As wireless communication gains popularity, significant research has been devoted to supporting real-time transmission with stringent Quality of Service (QoS) requirements for wireless applications. At the same time, a wireless hybrid network that integrates a mobile wireless ad hoc network (MANET) and a wireless infrastructure network has been proven to be a better alternative for the next generation wireless networks. The second algorithm implement to distributed packet scheduling algorithm to further reduce transmission delay, third algorithm implement to a mobility-based segment resizing algorithm that adaptively adjusts segment size according to node mobility in order to reduce transmission time, fourth algorithm implementation to a traffic redundant elimination algorithm to increase the transmission throughput, and last implementation to a data redundancy elimination-based transmission algorithm to eliminate the redundant data to further improve the transmission QoS.

Keywords: Hybrid wireless networks, multihop cellular networks, routing algorithms, quality of service

I. INTRODUCTION

Wireless Sensor Network (WSN) is an emerging technology that shows great promise for various futuristic applications both for mass public and military. The sensing technology combined with processing power and wireless communication makes it lucrative for being exploited in abundance in future. Wireless sensor networks are characterized by severely constrained computational and energy resources, and an ad hoc operational environment. Wireless sensor networks (WSN) are currently receiving significant attention due to their unlimited potential. However, it is still very early in the lifetime of such systems and many research challenges exist. In this thesis works the security aspects of these networks

Wireless Sensor Networks (WSN) are emerging as both an important new tier in the IT ecosystem and a rich domain of active research involving hardware and system design, networking, distributed Algorithms, programming models, data management, security and social factors. Wireless sensor network applications include ocean and wildlife monitoring, manufacturing machinery performance monitoring, building safety and earthquake monitoring, and many military applications.

An even wider spectrum of future applications is likely to follow, including the monitoring of highway traffic, pollution, wildfires, building security, water quality, and even people's heart rates. A major benefit of these systems is that they perform in-network processing to reduce large streams of raw data into useful aggregated information. Because sensor networks pose unique challenges, traditional security techniques used in traditional Networks cannot be applied directly.

First, to make sensor networks economically viable, sensor devices are limited in their energy, computation, and communication capabilities. Second, unlike traditional networks, sensor nodes are often deployed in accessible areas, presenting the added risk of physical attack. And third, sensor networks interact closely with their physical environments and with people, posing new security problems. Consequently, existing security mechanisms are inadequate, and new ideas are needed.

II. RELATED WORKS

Gautam Chakrabarti ET al [1] describes ensure uninterrupted communication in a mobile ad-hoc network, efficient route discovery is crucial when nodes move and/or fail. Hence, protocols such as Dynamic Stheirce Routing (DSR) pre compute alternate routes before a node moves and/or fails. In this paper [1], they modify the way these alternate routes are maintained and used in DSR, and show that these modifications permit more efficient route discovery when nodes move and/or fail. Their routing protocol also does load balancing among the number of alternate routes that are available. Their simulation results show that maintenance of these alternate routes (without affecting the route cache size at each router) increases the packet delivery ratio.

Maheshwari.D [2] describe the load balancing is a crucial problem in mobile ad hoc networks. Many conventional routing protocols that are developed are not having functionality of coping up load balancing. Hence several kinds of approaches are follotheyd in the design and development of load balancing routing protocols. This paper [2] aims to survey research articles pertaining to load balancing research problem in mobile ad hoc networks. Here various approaches are taken into account and literatures' key ideas are presented.

Mobile ad hoc network is a type of wireless network which contains of mobile nodes having the capability to deploy anytime anywhere without or minimum infrastructure. The applications for mobile ad hoc networks are wide open such as disaster management, emergency operations, rescue operations and many more. One of the major application outcomes of mobile ad hoc network is vehicular ad hoc network. Some important characteristics of mobile ad hoc networks are dynamic topology, peer-to-peer fashion during data transfer, mobility of nodes and in real-time such networks are heterogeneous.

Ranveer Chandra et al [3] describe a number of applications of ad-hoc networks have been proposed. Many of them are based on the availability of a robust and reliable multicast protocol. In this paper [51], they address the issue of reliability and propose a scalable method to improve packet delivery of multicast routing protocols and decrease the variation in the number of packets received by different nodes. The proposed protocol works in two phases. In the first phase, any suitable protocol is used to multicast a message to the group, while in the second concurrent phase; the gossip protocol tries to recover lost messages. Their proposed gossip protocol is called Anonymous Gossip(AG) since nodes need not know the other group members for gossip to be successful. This is extremely desirable for mobile nodes that have limited restheirces, and where the knowledge of group membership is difficult to obtain. As a first step, anonymous gossip is implemented over MAODV without much overhead and its performance is studied. Simulations show that the packet delivery of MAODV is significantly improved and the variation in number of packets delivered is decreased.

III. EXISTING METHODOLOGY

The QoS support reduces end- to-end transmission delay and enhances throughput to guarantee the seamless communication between mobile devices and wireless infrastructures. At the same time, hybrid wireless networks (i.e., multi- hop cellular networks) have been proven to be a better network structure for the next generation wireless networks and can help to tackle the stringent end-to- end QoS requirements of different applications. Hybrid networks synergistically combine infrastructure networks and MANETs to leverage each other. Specifically, infra-structure networks improve the scalability of MANETs, while MANETs automatically establish self-organizing networks, extending the coverage of the infrastructure networks.

Direct adoption of the QoS routing techniques in MANETs into hybrid networks inherits their drawbacks. In this project, a QoS-oriented distributed routing protocol (QOD) for hybrid networks to provide QoS services in a highly dynamic scenario. Taking advantage of the unique features of hybrid networks, i.e., anycast transmission and short transmission hops, QOD transforms the packet routing problem to a packet scheduling problem. In QOD, a source node directly transmits packets to an AP if the direct transmission can guarantee the QoS of the traffic. Otherwise, the source node schedules the packets to a number of qualified neighbor nodes. Specifically, QOD incorporates five algorithms. The QoS-guaranteed neighbor selection algorithm chooses qualified neighbors for packet forwarding. The distributed packet scheduling algorithm schedules the packet transmission to further reduce the packet transmission time.

The main problem of the QOS routing protocol is attempts to directly adapt the QoS solutions for infrastructure networks to MANETs generally do not have great success. Numerous reservation-based QoS routing protocols have been proposed for MANETs that create routes formed by nodes and links that reserve their resources to fulfill QoS requirements. Although these protocols can increase the QoS of the MANETs to a certain extent, they suffer from invalid reservation and race condition problems. Invalid reservation problem means that the reserved resources become useless if the data transmission path between a source node and a destination node breaks. Due this problem the qualified neighbor nodes identification is tough in worst case scenario (where number of nodes is very large). To overcome the problem, an application is required and it should be capable of implementing the neighbor nodes identification efficiently. On this basis, a slicing based approach is selected to filter the neighbor nodes through which the next hop transmission occurs. And also the unnecessary transmission is avoided.

- To implement the slice based approach for filtering the neighbor nodes.
- To qualify the neighbor node even in worst case scenario.
- To implement the quality testing in real time bed.
- To increase the transmission time and increase network capacity.
- Qualified neighbor nodes identification is easy even in worst case scenario (where number of nodes is very large).
- Implementation is made in real test bed.
- Unnecessary transmission is not occurred.

IV. PROPOSED METHODOLOGY

Hybrid wireless networks are networks in which any mobile node in a wireless network may have connectivity, either directly or via a gateway node, to an infrastructure network. This latter network may be an IP network as the Internet, a 3G wide area wireless network, or an 802.11 local area wireless network. Actually, any other network technology may be considered. In this context, the notion of Intra technology and Inter technology appears. If a mobile node communicates with another network of similar technology, this can be seen as Intra technology hybrid wireless network. On the other hand, if a mobile node communicates with another network of different technology, this can be seen as Inter technology hybrid wireless network.

Hybrid wireless sensor networks consist of wireless networks (such as cellular network) and wireless sensor networks and such network is important to overcome the limitations of conventional sensor network where transmission range and data rate are quite limited. The focus of this special issue is on the hybrid wireless sensor network formed by wireless sensor nodes and base stations (cellular networks). Wireless sensor network without support from the fixed infrastructure is known as ad hoc sensor networks. Due to the lack of infrastructure, the data is forwarded to the destination via a multihop fashion. In other scenarios, a set of base stations are connected by wired links and placed within the ad hoc sensor networks to form a wired infrastructure, aiming to enhance the whole network performance. This resulting network is referred to as a hybrid wireless sensor network. A typical application scenario includes large area monitoring where traditional wireless sensor network is too limited, for example, highway traffic surveillance and real-time online inquiry across Texas.

In hybrid wireless sensor networks, the nodes exchange information over a common wireless channel. Under different traffic scenarios and different constraints, e.g., bandwidth and power, the amount of data exchanged among these nodes may vary. Under such challenges, new theory and design should be studied for hybrid wireless sensor networks with different network setup and different channel conditions.

The goal of the special issue is to publish the most recent results in the theory and design of hybrid wireless sensor networks. Researchers and practitioners working in this area are expected to take this opportunity to discuss and express their views on the current trends, challenges, and state-of-the-art solutions addressing various issues in the theory and design of hybrid wireless and sensor networks. Original and review papers on this topic are welcome. Potential topics include, but are not limited to:

- Capacity in hybrid wireless sensor networks
- Network information theory for hybrid wireless sensor networks
- Multiple access techniques in hybrid wireless sensor networks
- Power and bandwidth allocation in hybrid wireless sensor networks
- Routing in hybrid wireless sensor networks
- MAC design in hybrid wireless sensor networks
- Radio propagation aspects in hybrid wireless sensor networks
- Antenna design for hybrid wireless sensor networks
- Cross layer design in hybrid wireless sensor networks

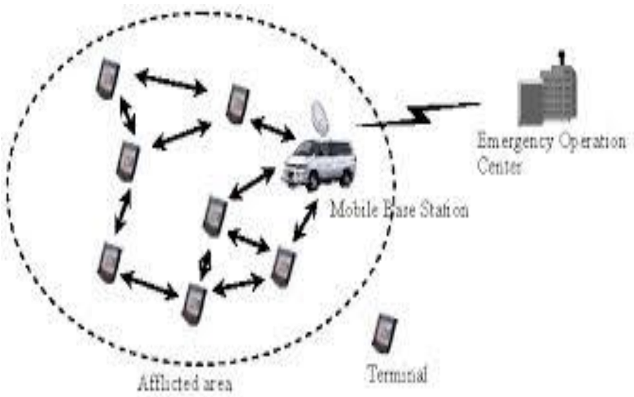


Figure 1 : Hybrid Wireless Network

QoS-Oriented Distributed routing protocol (QOD). Usually, a hybrid network has widespread base stations. The data transmission in hybrid networks has two features. First, an AP can be a source or a destination to any mobile node. Second, the number of transmission hops between a mobile node and an AP is small. The first feature allows a stream to have anycast transmission along multiple transmission paths to its destination through base stations, and the second feature enables a source node to connect to an AP through an intermediate node. Taking full advantage of the two features, QOD transforms the packet routing problem into a dynamic resource scheduling problem.

Specifically, in QOD, if a source node is not within the transmission range of the AP, a source node selects nearby neighbors that can provide QoS services to forward its packets to base stations in a distributed manner. The source node schedules the packet streams to neighbors based on their queuing condition, channel condition, and mobility, aiming to reduce transmission time and increase network capacity. The neighbors then forward packets to base stations, which further forward packets to the destination.
The proposed system is focus on the neighbor node selection for QoS-guaranteed transmission. QOD is the first work for QoS routing in hybrid networks. This thesis work makes five contributions.

- QoS-guaranteed neighbor selection algorithm. The algorithm selects qualified neighbors and employs deadline-driven scheduling mechanism to guarantee QoS routing.
    - Distributed packet scheduling algorithm. After qualified neighbors are identified, this algorithm schedules packet routing. It assigns earlier generated packets to forwarders with higher queuing delays, while assigns more recently generated packets to forwarders with lower queuing delays to reduce total transmission delay.

- Mobility-based segment resizing algorithm. The source node adaptively resizes each packet in its packet stream for each neighbor node according to the neighbor's mobility in order to increase the scheduling feasibility of the packets from the source node.
- Soft-deadline based forwarding scheduling algorithm. In this algorithm, an intermediate node first forwards the packet with the least time allowed to wait before being forwarded out to achieve fairness in packet forwarding.
- Data redundancy elimination based transmission. Due to the broadcasting feature of the wireless networks, the APs and mobile nodes can overhear and cache packets. This algorithm eliminates the redundant data to improve the QoS of the packet transmission.

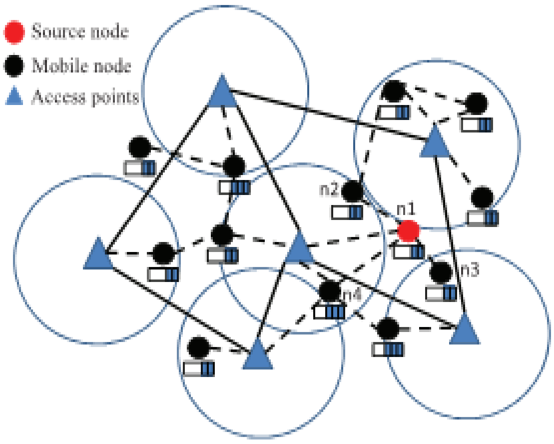


Figure 2: Network Model of the Hybrid Networks

ALGORITHM FOR QOD ROUTING PROTOCOL

if receive a packet forwarding request from a source node then
if this. Space Utility < threshold then
Reply to the source node.
end if
end if
if receive forwarding request replies for neighbor nodes then
Determine the packet size Sp(i) to each neighbor I based on

$$S_p(new) = \frac{\gamma}{v_i} S_p(unit),$$

Estimate the queuing delay Tw for the packet for each neighbor based on

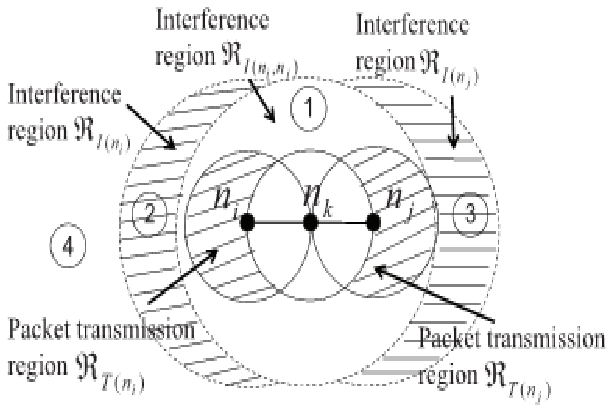
$$T_w^{(x)} = \sum_{j=1}^{x-1} \left(T_{I\to D}^{(j)} \cdot \lceil T_w^{(x)}/T_a^{(j)} \rceil\right)(0 < j < x)$$

Determine the qualified neighbors that can satisfy the deadline requirements based on Tw
Sort the qualified nodes in descending order of Tw
Allocate workload rate Ai for each node based on

$$\mathbf{A} = \begin{cases} W_g = \sum_{i=1}^{N_g} A_i \\ A_i \le U_{as}(i) * W_i. \end{cases}$$

for each intermediate node ni in the sorted list do
Send packets to ni with transmission interval Sp(i) / Ai.
end for
end if

Figure 3: QOS-Distributed Routing Protocol



MODULE DESCRIPTION

The following modules are present in the project.

1. Configuration network
   - Add access point
   - Add mobile nodes
   - Assign access point/mobile nodes
   - Show network
   - Select source node
2. Qos-oriented distributed routing protocol (qod)
3. Implementation of proposed slice-based selection algorithm

1. CONFIGURATION NETWORK

ADD ACCESS POINT

- In this module, the access point node id, name, IP address details are added and saved in 'AP' table.

ADD MOBILE NODES

In this module, the mobile node id, name, IP address and the initial location details are added and saved in 'Nodes' table.

ASSIGN ACCESS POINT/MOBILE NODES

In this module, the mobile node is assigned with its nearest access point. The details are fetched from 'AP' and 'Nodes' table and saved in 'APNodes' table.

SHOW NETWORK

In this module, the Access Point and nodes are displayed with their current assigned details. The records are fetched from 'AP' and 'Nodes' table.

SELECT SOURCE NODE

In this module, the Source mobile node is selected from 'Nodes' List. The records are fetched from 'Nodes' table.

2. QOS-ORIENTED DISTRIBUTED ROUTING PROTOCOL (QOD)

This module enhances the QoS support capability of hybrid networks. Taking advantage of fewer transmission hops and anycast transmission features of the hybrid networks, QOD transforms the packet routing problem to a resource scheduling problem. QOD incorporates five algorithms:

- QoS-guaranteed neighbor selection algorithm to meet the transmission delay requirement
- Distributed packet scheduling algorithm to further reduce transmission delay,
- Mobility-based segment resizing algorithm that adaptively adjusts segment size according to node mobility in order to reduce transmission time.
- Traffic redundant elimination algorithm to increase the transmission throughput.
- Data redundancy elimination-based transmission algorithm to eliminate the redundant data to further improve the transmission QoS. The algorithm for above processes is listed below.

Algorithm 1. Pseudocode for the QOD routing protocol executed by a source node.

if receive a packet forwarding request from a source node then

f this. SpaceUtility < threshold then

Reply to the source node.

end if

end if

if receive forwarding request replies for neighbor nodes then

Determine the packet size Sp(i) to each neighbor I based on Equation **(3)**.

Estimate the queuing delay Tw for the packet for each neighbor based on Equation **(2)**.

Determine the qualified neighbors that can satisfy the deadline requirements based on Tw

Sort the qualified nodes in descending order of Tw

Allocate workload rate Ai for each node based on Equation **(1)**.

for each intermediate node ni in the sorted list do

Send packets to ni with transmission interval Sp(i)/ Ai.

end for

end if

3. IMPLEMENTATION OF PROPOSED SLICE-BASED SELECTION ALGORITHM

This module shows the proposed slice-based selection algorithm. Suppose that node N_A uses the proposed algorithm to select the forwarding nodes from its neighbors. Let us assume that N_A stores all of its neighbors' IDs and locations in an array of length n, where n is the number of neighbors. The algorithm selects the first node N_{S1} randomly from the array. The first node can also be selected deterministically by, for example, selecting the node that is the farthest away from N_A. Let $LB_A(P)$ and $RB_A(P)$ denote the left bulged slice and right bulged slice of P around A respectively. Suppose that N_{Si} is the last node selected by the algorithm. To select the next node, the algorithm iterates through the array and selects the node N_{Si+1} such that it is inside the slice $LB_A(Si)$, $\square_A(LB_A(Si), LB_A(Si+1)) \;\square\; 0$, and

. N_B inside $LB_A(Si)$:

$\square_A(LB_A(Si), \boldsymbol{L}B_A(B)) \;\square\; \square_A(LB_A(Si), \boldsymbol{R}B_A(S_{i+1}))$

If there is no such node, the algorithm selects N_{Si+1} such that

. N_B inside $C_{A,R}$:

$\square_A(LB_A(Si), \boldsymbol{R}B_A(S_{i+1})) \;\square\; \square_A(LB_A(Si), \boldsymbol{R}B_A(B))$

The algorithm terminates by selecting the last node N_{Sm} if N_{Sm} is inside $LB_A(Si)$, or $N_{S1}$is inside $LB_A(S_m)$, or S_{m+1} $= S_l$.

This module proves that the proposed slice-based selection algorithm will select at most 11 nodes.

V. CONCLUSION

This study makes five contributions. QoS-guaranteed neighbor selection algorithm. The algorithm selects qualified neighbors and employs deadline-driven scheduling mechanism to guarantee QoS routing- Distributed packet scheduling algorithm. After qualified neighbors are identified, this algorithm schedules packet routing. It assigns earlier generated packets to forward with higher queuing delays, while assigns more recently generated packets to forward with lower queuing delays to reduce total transmission delay.

Mobility-based segment resizing algorithm is a source node adaptively resizes each packet in its packet stream for each neighbor node according to the neighbor's mobility in order to increase the scheduling feasibility of the packets from the source node. Soft-deadline based forwarding scheduling algorithm. In this algorithm, an intermediate node first forwards the packet with the least time allowed to wait before being forwarded out to achieve fairness in packet forwarding. Data redundancy elimination based transmission. Due to the broadcasting feature of the wireless networks, the APs and mobile nodes can overhear and cache packets. This algorithm eliminates the redundant data to improve the QoS of the packet transmission.

VI. SCOPE FOR FUTURE ENHANCEMENT

In this thesis propose a QoS oriented distributed routing protocol (QOD) for hybrid networks to provide QoS services in a highly dynamic scenario. Taking advantage of the unique features of hybrid networks, i.e., anycast transmission and short transmission hops, QOD transforms the packet routing problem to a packet scheduling problem. In QOD, a source node directly transmits packets to an AP if the direct transmission can guarantee the QoS of the traffic. Otherwise, the source node schedules the packets to a number of qualified neighbor nodes. Specifically, QOD incorporates five algorithms.

The QoS-guaranteed neighbor selection algorithm chooses qualified neighbors for packet forwarding. The distributed packet scheduling algorithm schedules the packet transmission to further reduce the packet transmission time. The mobility-based packet resizing algorithm resizes packets and assigns smaller packets to nodes with faster mobility to guarantee the routing QoS in a highly mobile environment.

The traffic redundant elimination-based transmission algorithm can further increase the transmission throughput. The soft-deadline-based forwarding scheduling achieves fair-ness in packet forwarding scheduling when some packets are not scheduling feasible. Experimental results show that QOD can achieve high mobility-resilience, scalability, and contention reduction. In the future, we plan to evaluate the performance of QOD based on the real tested.

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