A New Algorithm to Improve the Sharing of Bandwidth

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Abstract: *Infrastructure fewer networks of mobile devices, which are linked with wireless and also self-configured, are known as mobile ad-hoc network (Manet). Like several other techniques this also has some benefits as well as the challenges in it. As wireless ad-hoc networks is a collection of wireless nodes, so each node in it serves as a router and forwards packets to other nodes for communication. The flow is from source to the destination point. In this paper, the focus has been made on some new areas of research in the field of wireless, mobile ad-hoc networks. The proposed approach will be used to increase the utilization of bandwidth allocation with the priority with the zones in wireless network environment. This approach will be helpful to maximize the performance of the network and provide the best performance to the users under the wireless network. QoS for mobile users will be ensured for ad hoc networks. Demand of the mobile users will be according to the required bandwidth, and proposed bandwidth allocation protocol is zone based. The zone based bandwidth protocol may reduce the QoS degradation*

Keywords: Wireless Networks, Adhoc Bandwidth Allocation, Quality of Service

1. Introduction

Bandwidth Allocation Protocol (BAP) and Bandwidth Allocation Control Protocol (BACP) provide bandwidth on demand and also manage link utilization. At the start when connection is successfully built between peers using Bandwidth Allocation Control Protocol (BACP), now peer nodes can work through Bandwidth Allocation Protocol (BAP). Bandwidth Allocation Control Protocol (BACP) works over any physical line that must be able to PPP (point-to-point protocol) multilink with dial ability. In beginning, Bandwidth Allocation Control Protocol (BACP) works on ISDN (Integrated Services Digital Network) connections. When connection is build between peers successfully, Bandwidth Allocation Protocol (BAP) defines all the work like packets, parameters and the procedure of talk between two endpoints. It also adds and drops links from the bundle of multilink that allow the dynamic behavior of bandwidth allocation [1]. Bandwidth Allocation Control Protocol (BACP) is a protocol of internet for connection creation over ISDN (Integrated Services Digital Network). This protocol is also known as dial on demand (or bandwidth on demand). This is a useful technique for high traffic, videoconferencing and also for backup sessions [2].

Many of multilink bundles are managed by Bandwidth Allocation Protocol (BAP). It is the subset of Bandwidth Allocation Control Protocol (BACP). From multi link bundle, addition and removal process of a single link is defined by this protocol. It also tells that which peer is accountable for what decision. The implementation of Bandwidth Allocation Protocol (BAP) is performed as: Call request, Callback request and link drop query [3].

(Li) [4] proposed an algorithm in the research regarding "End-to-End Fair Bandwidth Allocation in Multi-hop Wireless Ad Hoc Networks". According to this work fair allocation of bandwidth is provided for getting the best performance, and desired results. As a result, the algorithm for bandwidth allocation in multi-hop wireless ad-hoc networks is capable to provide suitable resources in the network. Arora, Singh, and King used the ad hoc networks for the discovery of the distance vector routing protocol and route for the packets. Their work was used to enhance the protocol by finding the hidden terminals. They used the fair share bandwidth algorithm. The hidden terminals shared the resources when using the same bandwidth [5]. According to Valarmarthi and Malmurugan the wireless applications required the inflexible, audio, and video applications with the high speed. It is handy to tackle the proper usage of resources, and fair allocation of bandwidth to all connected nodes. Their proposed protocol known as "priority based bandwidth reservation protocol" was designed for wireless mesh network. This protocol consisted of two phases, the forward phase in which the message is forwarded for the data flow to the destination, while the reply phase sends the message back hop by hop to the correspondence node. The destination node reserves the bandwidth for requesting node on a priority basis [6].

2. Related Works

According to a research the new technique is suggested for bandwidth allocation protocol. The technique work with bandwidth allocation (DBASE) protocol it may be called as bandwidth sharing or bandwidth extension protocol [7]. Another work of a researcher is about the "Priority-based Bandwidth Allocation Protocols for Wireless Networks ". Research focuses on the limited resources given by working protocol. So as, a solution to this issue is given by using two protocols, a traffic-dependent (A1) and other is traffic-independent (A2). These protocols work according to priority assigned by limited bandwidth for active nodes. The simulation is made for the comparison purpose of these proposed protocols, and it is shown that technique has recognized among the super performance of traffic dependent protocol with normal bandwidth and good performance with traffic independent protocol [8].

The latest research was made by (Yi-Ting Mai) for bandwidth allocation protocol in multi-hop wireless networks. The innovated protocol is based on the zone wise

bandwidth allocation for mobile user. The protocol proposed here provides the high quality of service (QoS) to mobile users. Bandwidth allocation protocol calculates the demand of mobile user and provides suitable bandwidth according to current station of user. The range of bandwidth which is provided to a mobile user is known as zone in this research, so the proposed solution is called as zone based bandwidth allocation protocol.
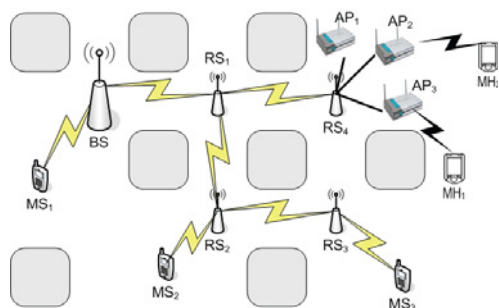

Figure 1: INTEGRATED WIRELESS NETWORK TOPOLOGY IN IEEE 802.16-MR NETWORK [9]

3. Notations and Ideas

The basic idea behind this motivation is to reserve the adequate bandwidth to all mobile users in all relay stations "in the network" and there is no need of reallocation of bandwidth among mobile users in relay stations for the same zone. Hop count is the size of the zone and relation from the initial station. The zone Size is the 'L' that has value between 0~~1, and zone includes as L = 0, for initial relay station; total relay stations are as L =1. The relay stations in an ad hoc network, which emerge out from the mobile stations and also serve as the relay stations for the ad hoc networks together. Relay stations act as the promising role for the extension of base station. The following illustration will be useful to understand the current proposed schema. This schema works efficiently in the circumstances as,

1. There are no chances for the two or more than two relay stations to have access of the medium at the same time, and also have the same sharing of a medium. There is no spatial reuse for relay stations.
2. Quality of Service (QoS) degradation is required to be reduced in the Zone based bandwidth protocol. The proposed approach will focus upon the performance maximization for the networks and allocation of bandwidth.
3. This proposed is also applicable to other types of topology, but here it considers the IEEE 802.16 network for bandwidth allocation.
4. Network modeling technique or user profile will determine the visibility probability of the RS.

5. Satisfaction rate for the purpose of the required bandwidth will be determined by ration between allocated bandwidth and required bandwidth.

Use of the proposed scheme is viable in the chessboard topology and other types of the topology.

4. Presentation of New Algorithm

Same medium will be used by all relay stations in the ad hoc network without any spatial reuse, i.e. no two or more same stations will use the medium at the same time. BAP will be in charge and responsible to allocate the bandwidth and use DL-MAP and UL-MAP. This proposed scheme is applicable to other types of typologies. Both network modeling techniques and user profile can be assumed at each relay station for the mobile user. P (RSi-j) denotes the probability of each mobile user at the given relay station RSi-j. The proposed schema will adopt the applications which are adaptable to adjustment for a bandwidth.

Summary of Notations used in the paper is given as,

S --- Satisfaction rate for users required bandwidth

L --- Size of Zone

HC --- Hop Count

P (RS i-j) ---- Visiting probability at location RS

P Zone (RS i-j) ----- Normalized probability visiting at location RS within a zone

BW ----- Data flow rate

RS initial ------- Initial RS in the zone for the allocation of bandwidth

S-TH ---------- Satisfaction rate at threshold

5. Calculation of Bandwidth Allocation

When flow rate, threshold at Satisfaction, size of Zone L, and initial mobile user's location, the allocated bandwidth is calculated as: RS (i-j) €Zone Rs initial, L,

The hop count between RS (initial) ≤ [HC MAX x L] and RS i-j. The visiting probability in the zone Pzone/RS (i-j) is given as following

Pzone/RS (i-j) = PRS (i-j)/∑ (RS in the Zone) PRS.

Satisfaction Rate S =∑ (RS in the Zone) [Min (N*BW/HCRS(i-j) * BW)]* PRS(i-j)   (1)

Where HCRS (i-j hop count between RS i-j and BS. It has become clear that satisfaction rate S calculated is no longer than value 1.

Pzone/RS (i-j) meant for the probability of visiting of user at the location (RS (i-j)) when user does not move outsize of given zone. The allocated bandwidth is assumed as BWxN. Satisfaction rate S given at each relation is calculated as BWxN/BW x HC rs (i-j).

The final allocated bandwidth's value calculated when minimum value of N takes the value of S which is larger or equal to that of Satisfaction threshold S-TH by Mai, Yang, and Chen [10].

6.   Principle of New Algorithm

The novel technique proposed by us is about the "Zone based priority of bandwidth allocation protocol for wireless networks and improving the QoS". Where zone is based on the range of wireless user and priority, is set through the demand of the network user. The required need of user within the range of zone bandwidth will be allocated to them accordingly. Resources are reallocated as and when required by other user demands in it. Many traditional schemes make the scale down of bandwidth rates of connected users, when a new user is added to the network. This approach will avoid such activity. As for solution of simulation results the good results are available from the research of conservative and adaptive quality of service (CAQoS) by Y.C.Yee [11]. So this could be embedded within this proposed technique. Bandwidth reallocation is one of the major concerns of bandwidth allocation protocol. A previous research has some resolution for the above matter. Under dynamic traffic load in wireless network adjustments are made for uplink and downlink and the decision is made for when and how this will work. The purpose is to increase the utilization of the bandwidth along with maintaining the quality of service [12]. For the validation of the proposed technique, a general simulation is performed. The current priority based quality of service protocols working in ad-hoc wireless network not take much attention upon the effect of mutual interfaces among routers working in the wireless medium. A research is made by Ueda, Roy, and Saha [13] to investigate the effect of mutual interfaces on the performance of routing in the wireless environment and searched the zone wise disjoint routers to avoid the problem of mutual interface, and this helped in improving the performance of the network. The proposed method of the work is related to the priority based quality of service with routing scheme that uses the zone wise disjoint routers [13].

7.   Evaluation of Performance

Simulation tool and environment (network simulator 2: NS2)

This part of study has been conducted for the evaluation of performance for given bandwidth management and improvement in QoS on zone-based. Network has the link capacity of 20Mbps, the correspondent node CN is outside of the user's network; the simulation has the same visiting probability in the network at all RSs. The criteria defined for the performance evaluation is given as following:

Average satisfaction: Allocated bandwidth over the user's required bandwidth is called as the average bandwidth.

Bandwidth Allocation: It is given in the unit called as Hop Count, and flow rate is with BW in simulation, and UGS is the flow in simulation.

Allocated bandwidth's fluctuation determines the deviation of satisfaction.

Reallocation Ratio of Bandwidth: it is triggered over the handoff's total number.

Handoff ratio is defined as the required bandwidth has not met after the handoff occurred.

Current study evaluates the management of the bandwidth in a Zone based environment. Different features of the MHs mobility are designed. Considering the movement of MHs behavior, we met four experiments such as MD_AwayFromBS, MD_Equal, MD_CloseToBS, and MD_CloseToCenter. Other than MD_Equal have 80% probability in moving the BS, center of mesh, and opposite of the BS [14].

8.   Evaluation of proposed technique

Maximum bandwidth services in a priority based zones will work by the proposed bandwidth management. By the use of access rules, bandwidth management could be enabling on a pre-interface basis. First In and First out (FIFO) scheme is followed for sending packets, which are queued.

Zone-based priority of bandwidth management can allocate a part of the available bandwidth with priority to all classes of network traffic. Priority is set as 0-7, where zero is the starting and seven is the highest. Class of traffic with zero bandwidth is allocated, and it effectively blocks the traffic except there is no higher priority on the network. When packet arrives it must contain source and destination information. Packet sending confirmation is done through normal transmission. The amount of bandwidth provided or guaranteed for class queues, and priority is assigned to a class queue. First-in, first-out procedure is applied within the class queue for packets. At maximum allocation point of class comes; packets from the next class are preceded in priority order. Normally each of the class on the available bandwidth is given a portion, and when this limit reaches at its maximum, no more traffic is forwarded through it. A class may temporarily get bandwidth if it not reaches at its limit and send traffic. Bit spare bandwidth is provided to the class with the highest priority.

Chessboard topology

In the chessboard topology the average visibility of the MHs on the each RS is obtained. Size for the Chessboard topology is the $(2n-1) * (2n-1)$. MH probability is denoted by PM, location (l.f) and p for the probability. Movement probability of MH in a neighbor network is PM-(l,f). $\frac{1}{2} * \frac{1}{4n^2 - 6n + 2}$

It is the probability for the MH visiting to a neighbor, and second category occurs at the edge of the topology. Every node meets with other three nodes and MH visiting probability becomes $\frac{3}{4} * \frac{1}{2} * \frac{1}{4n^2 - 6n + 2}$
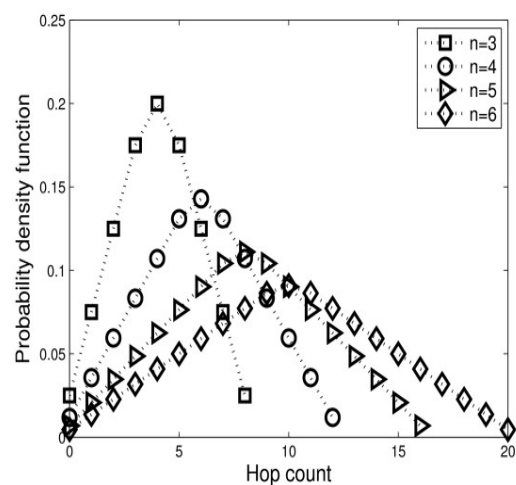

Figure 2: HOP COUNT FOR P.D.F [14]

This figure shows the hop count from BS the Chessboard topology with size (n =3-6). It also offers the distribution behavior that is adequate for the bandwidth management as compared to other topology types. Thus, chessboard was the main focus for the simulation.

Scenario as an Example

When they want to create outbound mail traffic, simple mail transfer protocol (SMTP) accesses rule and permits the bandwidth management with the following parameters:

- Assured bandwidth of 20 percent
- Maximum bandwidth of 40 percent
- Priority of 0 (zero)

Use of access rules increases the priority in bandwidth management than without using access rules it must be low. As far as an example is concerned the outbound Small mail transfer protocol SMTP traffic is sure of 20 percent within the allocated bandwidth. It has the maximum limit of 40 available bandwidths. If the access rules are not applicable with bandwidth management, it may reduce the priority but use of the access rules increases the priority.

The finding of minimum N, that satisfies the given criteria, and satisfaction S become equal or larger than Satisfaction parameters of users. The hop count HC is the length for allocation bandwidth to the CN. When bandwidth of BW*N is reserved the N represents that satisfaction S is larger or equal to that of user parameters S-TH. For the mobile hosts MHs is BWxN is the bandwidth [10].

9. Results

 The results from simulation of the proposed technique show that zone-based bandwidth allocation can increase the quality of service (QoS) and also reduces the reallocation overhead of bandwidth. Qicheng Ma addressed the problem of maximizing total user utilization in wireless network with bandwidth allocation and link scheduling. There is no use of any artificial metrics for increasing the throughput. The aim for this work is to optimize the actual utility. For this purpose, scheduling algorithm is introduced which is centralized in nature. The values of all nodes in objective functions can be measured through this algorithm. It gave the better results. The scheduling is of utility based it is applied in different scenarios for getting the optimal utility. From the derived algorithm, the simulation gives very optimistic results. Bandwidth Allocation is impacted by threshold satisfaction rate as more than 90% and L the size of zone reserves bandwidth in a large. The bandwidth can be reduced to 60% when fewer than 90% satisfaction rate is accepted. Zone based schema is used to achieve the user' requirements as threshold satisfaction S-TH = 0.9. Standard deviation of the satisfaction S increased by a large size of zone as MHs movement will be frequent in a large area of roaming. It can be summarized that Handoff degradation ration will be reduced by the larger zone, and ratio of Reallocation will

depend upon the Bandwidth Allocation cost. Rise in standard deviation in a satisfaction will inevitably enlarge the zone size [14]. Handoff Call (Degradation ratio) reduces with an increase of zone size, and fails to manage the load as it increases as shown in figure 3. In summary the increase in zone size will raise the Standard deviation of satisfaction.
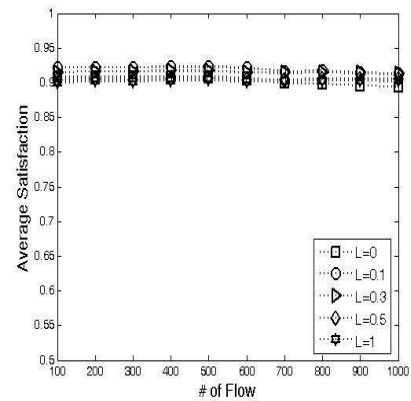

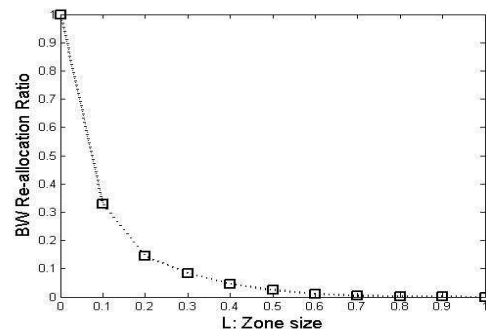Figure 3: AVERAGE SATISFACTION WHEN S-TH BECOMES EQUAL 0.9[10**]**

Figure 4: RATIO OF BANDWIDTH REALLOCATION [10]

Standard deviation does not exceed than 0.15, and proposed Zone based satisfy the needs. It also achieves the lower variation in mobility of MH [14].

10. Discussion

The new mobile user demand for the bandwidth can be simply checked either provider bandwidth is enough for the user. When idea of the zone is introduced the two types (inter-zone handoff and intra-zone handoff) between the relay stations need to be known. The Bandwidth Reallocation Ratio gives the representation of the mobile

host's handoff cost. The zone size L determines traffic load. In the proposed schema, the larger zone size L will give seamless handoffs and higher quality with the mobile host. The handoff call degradation ratio and Call Blocking Probability having the threshold satisfaction S-TH = 0.9, because larger L size will have lower bandwidth utilization as reservation of bandwidth assists the Intra-Zone handoff. It has been noted that with the increase in number of flows the Handoff call degradation, Call Blocking probability and mobile host blocking also rise. In Handoff calls, the zone size L affects obviously, the zone size L increases as degradation ration decreases. However, when zone size L = 1, that has particular characteristics and gives the degradation ration = 0. There are no chances for mobile host MH occurring of inter-zone handoff.

11. Comments on the Results

From the results, standard deviation and average satisfaction rate can be interpreted as the moving trend of the mobile host has been identified. It demonstrated that user's required bandwidth S-TH = 0.9 achieved through the use of the Zone Based Schema for every kind of distribution of mobility. Standard deviation of satisfaction did not exceed than 0.15 and satisfaction variation was controlled very well. It can be viewed that bandwidth allocation protocol based upon the Zone Based Schema satisfies the mobile host requirements and also achieves the mobile host's mobility with a low variation [15]. It has become a good idea to allocate or reserve the bandwidth according to users' requirements and then achieve their satisfactions. To get the satisfaction at a large extent, the large zone size L requires the more bandwidth. Satisfaction of 90%, or lower than 90% is needed then hop count reserved lower than 60% in wireless networks. It reduces the mobile host request of bandwidth and efficiently uses the more bandwidth.

12. Conclusion and Future Work

As this research concludes on the introduction of some new fields in wireless, mobile ad-hoc networks, these areas are open for further exploration. As a result, this paper will give good ideas about the future research inside the inner areas of

this field. In this paper, the conclusion of the proposed approach is to increase the utilization of bandwidth allocation with the priority with the zones in wireless network environment. The approach is helpful to maximize the performance of the network and provide the best performance to the users under the wireless network. Based on this Zone based protocol the users can get their satisfaction and requirements in wireless networks. It has been proved that users with different mobility behavior, the proposed schema meet the user's requirements. In recent years the Wireless Network technology has been the important research area, which provided the wider access to wireless and fast radio coverage. Quality of control is the main role playing factor to assess the technology. In this research paper the proposed bandwidth allocation protocol works on zone based. Mobile user can select the adequate zone size to get maximum satisfaction. Results from simulation demonstrated that proposed protocol will meet the requirements of mobile users. The QoS degradation and reallocation of bandwidth is reduced by the larger zone size L, and decrease the utilization of bandwidth. In the future, the researchers should work on the adoptive zone size and select the adequate zone size for users with different characteristics of mobility distribution and movement.

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