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# Reliable Time Slot Allocation Scheme among Mobile Nodes in MANET

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**ABSTRACT**

The broadcast protocol in MANET is less efficient and cannot guarantee collision free broadcasts due to high mobility of nodes. This article purposes a new slot allocation scheme between mobile nodes to control, collision; it requires 1-hop neighbour information and also the two-hop neighbor's coverage. Each node maintains a local topology of its 2-hop neighbourhood, and only a small subset of 1-hop neighbours forwards this message, which can reduce the possibility of collision, decrease the delay of the broadcast, and improve the throughput of the network. The subset of 1-hop neighbours selected should cover all the 2-hop nodes and it reduces the broadcast storm problem. Simulation results show that reliable time slot allocation among mobile node algorithm is efficient and reachability within the transmission range of the network. It is a collision free, reliable time slot allocation scheme among nodes and minimum time slot forward broadcast up to 2-hop nodes.

***Keywords:*** Broadcast Storm Problem, Slot Allocation, Throughput, Topology, Reachability.

## I. INTRODUCTION

In broadcasting, one node sends a packet to any or all other nodes within the network. Efficient broadcasting during a mobile unintended network focuses on selecting a small forward node set while ensuring broadcast coverage. Due to high mobility and dynamism in mobile ad hoc network, a collision occurs. Within the multi - hop environment, mobile nodes depend to each other's when they are transmitted. It is a distributed network, nodes frequent connectivity changes, due to mobility of nodes and high demand for channel access protocols. Mobile node's transmission on broadcast using omnidirectional antennas, then MAC protocols are required for transmissions between the mobile nodes to avoid multiple access interference. One type of MAC protocols used in ad hoc networks is called contention based protocols [7]. So this protocol leads to poor performance under heavy traffic loads, but unable to guarantee regular access to the channel. Another type of protocols to use on the channel for transmission is called transmission scheduling protocols [8], this protocol to make transmission schedules in which each mobile device is assigned transmission slots because to avoid contention for the channel and reach the intended receiver mobile host. It is possible in transmission scheduling protocols to guarantee of quality service channels because mobile nodes can reserve regularly assign time slots. So transmission scheduling protocols can provide contention free and link level, broadcast service available in mobile ad hoc network. The initial slot assignments between mobile nodes to make a frame schedule on that time collision occur, when new link detects for joining or removes the network in that case again the initial slot assignments. Many transmission scheduling protocols are proposed to improve the channel efficiency [3]. This research paper, we propose the Reliable Time Slot Allocation Among Mobile Nodes (RTSAAMN) algorithm using in Mobile Ad hoc Network. This algorithm involves a minimum time slot; it reduces collisions on the network and their network bandwidths of channels are properly utilized. The authors focus on avoiding collisions, but attention to reducing broadcast storm problems.

## II. EXITING RELATED WORK

The Transmission Scheduling Construction Protocol (TSCP) is used in mobile ad hoc networks. When a terminal boots and want to join in the network at that time no knowledge about a network's current state, the new terminals first detect the network, if the channel frees then the new terminal to join in the existing network and informs acknowledgement to other neighbours terminals of its presence and transmission for exchanging information with them. This process transmission it can make collision free broadcast transmissions. Transmission scheduling protocols make it possible to guarantee quality of service because when mobile nodes are transmitted on the channels, we first slot reservation between mobile nodes and using a First in First Out method. After reserving all slots of the frame to form a frame schedules in regularly process to avoid contention for the channels or information reach the intended receivers. The new terminals initially want to join in the network, no knowledge of its 1-hop neighbour or network timing [8]. The terminal can monitor the channel to detect the network timing of transmissions but we are still faced with a daunting task forming a new link requires not only terminals on both ends of the link to adjust their transmission. This algorithm is not effective, if we are increasing network size more collision will occur and there will be a time delay for slot allocation. The TSCP transmission range is constant and not a variable in the network and each terminal requires 1:15 slots for terminal convergence time slot allocation, so frame size is increased and some time slots are unused, more collision will occur due to high mobility of the nodes. If the degree of the nodes is increased, no traffic control is there and there is an increase in the network size. The channels are not properly utilized and efficiency decreases.

The New Adaptive Broadcast Scheduling (NABS) algorithm, each node maintains the state information record. Every node makes this record by collecting information from its 1-hop, 2-hop neighbours. The nodes are highly mobile and it is 100%, reachable within transmission range of the network. The NABS algorithm uses the minimum frame length and maximum channel utilization for the network [3]. The purpose of the registration process is to make the new node known to all its 1-hop, 2-hop neighbours. If two or more nodes at a hop distance of one or two are willing to join the network, then just one of them succeeds through the registration process. Resolution is the process of collecting the local information, preparing a conflict-free schedule and run the schedule. In this algorithm, when slot allocation among the channels, it there small collision will occur within the transmission range of the network. In a network, if we increase the degree size and network size the result would be degraded. When more nodes are participating for slot allocation the delay occurs and it does not reduce redundancy, rebroadcast and broadcast latency. Finally, we focus on avoiding collisions and traffic control, but attention to reducing redundant, rebroadcasts and broadcasting latency problems.

## III. PROPOSE METHODOLOGY

When the master node assigns slot allocation to each 1-hop neighbor's node before it follows set covering scheme. When source node broadcast RTS (Request To Send), the control segment will be received by all of its 1-hop neighbours. However, it is not necessary for all 1-hop neighbours to forward RTS (Request To Send), so those nodes to cover all the 2-hop neighbours of the source node. The master nodes get CTS (Clear To Send) from 1-hop neighbours. In figure 1 where the node in layer 0 is that the source node S, nodes in layers 1 and 2 are the one-hop and two-hop neighbours of the source node S respectively. The set {a, c, e} in layer 1 is a minimum set covering all nodes in layer 2. Since nodes a, c and e have no common neighbours in layer 2, they can broadcast packets simultaneously without any collision occurring in layer 2 [2].

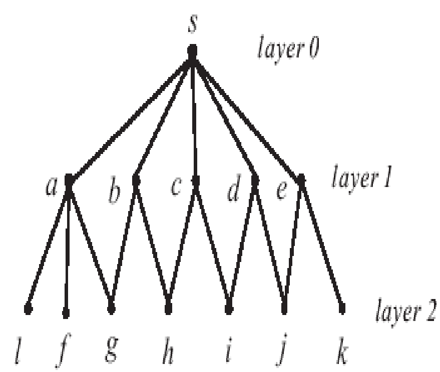


Figure 1: Three-layer graph of set covering scheme [2]

In figure 2 when nodes are sent in multi-hop network, nodes a, c and e transmits a packet simultaneously, collisions will occur at nodes g and that i. Therein case it uses independent-transmission-set (IT-set) scheme to arrange the transmission sequences of the nodes in layer 1 to avoid packet collisions in layer 2.

So in figure 2, the IT set are {*a*, *c*, *e*} and {*b*, *d*}, the packet is transferred from source node *S* in the network and collision is avoided at layer 2.

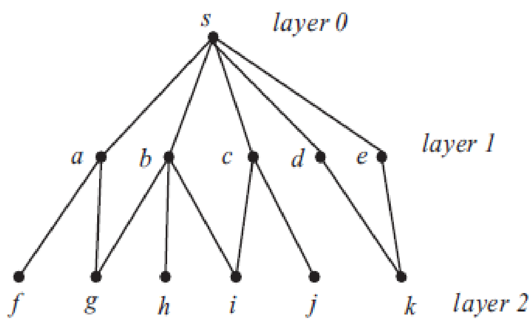


Figure 2: Three layer of IT set problems [2]

When the source of node S broadcasts a packet that time S=0, E is the set of 1-hop nodes from S and F is the set of 2-hop nodes from S, from begin the set coverage of 1-hop nodes is Set_Cover=0 and independent transmission set is Num_Of_ITS=0. If a 2-hop node contains in the network (F! =0) then select a node VϵE that the maximum size of |M(V)∩F| after that remove nodes ϵ M (V) from F and remove V from E. The node V adds to Set_Cover, there it iterates this process till F=0 then stop slot allocation. We get a minimum set of 1-hop nodes to coverage 2-hop nodes in the network. If no common neighbour 2-hop nodes, then the node V to add ITS (me), repeat this process until a common neighbour 2-hop node, an increase number of transmission set Num_Of_ITS = Num_Of_ITS+1, add V to the ITS (Num_of_ITS). The master node gets information from 1-hop nodes; those 1-hop neighbour nodes should have minimum set coverage with all the 2-hop nodes in the network. For each time slot, we choose the new forwarding nodes randomly. However, we can design some positive schemes to choose the forwarding nodes.

If 2-hop nodes (F! =0) then choose the node V in S. Repeat this process until there is no node in S. The choose node V in S if((|M(TU{V})|>|M(T)|)&&(|M(TU{V})|>=|M(TU{u})|)), Where M(T) = {Nodes of M2 collision freely covered by T} then M(T)=M(T)+1, M2 collision freely covered by T, S=S-V, T=TU{V}. When F=0 then stops slot allocation. If |M(TU{V})|>|M(T)| then H=HU{T}, M2=M2-M(T) repeat this process until there is no 2-hop nodes from S in the network otherwise stop slot allocation.

## IV. PSEUDO CODE OF RELIABLE TIME SLOT ALLOCATION AMONG MOBILE NODES (RTSAAMN) ALGORITHM

**Input:** Source node S, the sets E, F of 1-hop and 2-hop neighbors of S respectively.

**Output:** H= {E1, E2, E3, E4, E5, ……… , En}

**Step-1:** M1=E, M2=F, H=Nil, S=M1, J=0, Set_Cover=0, Num_OF_ITS=0;
**Step-2:** WHILE F is not empty select a node VϵE that maximizes the size of |M(V) ∩F|;
Remove nodes ϵ M(V) from F;
Remove V from E add V to Set_Cover;
END WHILE
**Step-3:** Let V be the first node listed in Set_Cover;
For i= 1 to H
If V and every node in H(i) share no common neighbor in layer 2 then add V to ITS(i)
GOTO step 4;
ELSE
Num_OF_ITS=Num_OF_ITS+1;
Add V to ITS(Num_OF_ITS) GOTO step 4
END IF
**Step-4:** WHILE (|M2|! =0)
{
T= nil, j++, K=0;
Repeat
{
(a) K++;
(b) choose the node V in S, satisfying |M(TU{V})|>|M(T)| and for all uϵS |M(TU{V})|>=|M(TU{u})|
Where M(T) = {Nodes of M2 collision freely covered by T}
(c) S=S-V, T=TU{V};
}
**Step-5:** Until there is no node in S such that |M(TU{V})|>|M(T)|
H=HU{T}, M2=M2-M(T);
}
**Step-6:** Return (H);

## V. SIMULATION RESULTS ANALYSIS

In the simulation we have compared the simulation results of RTSAAMN, TSCP and NABS protocols using in GloMoSim v2. 03 simulators, configuration setting, we have taken the physical terrain area is 2000 * 2000 m2, the simulation time period is 600 seconds and seed value is assigned 1. The number of nodes varies in between 50 to 150 nodes and transmission range varies from 50m to 300m. The node position is in use as UNIFORM, where the physical terrain is separated into a number of cells within each cell the nodes are placed randomly. Mobility parameter is taken as dynamic and the nodes are free to move in the physical area of the network [14].

In this form a node arbitrarily selects a destination from the physical terrain, and then moves in the direction of the destination at a speed regularly chosen between MOBILITY-WP-MIN-SPEED (0) and MOBILITY-WP-MAX-SPEED (30) parameters. For the Path - loss model we have in use PROPOGATION-PATHLOSS TWO-RAY model for open space near earth and place path loss. TEMPRATURE is kept at 290.0, NOISE-FIGURE is 10.0 and RADIO-BANDWIDTH is 2mb/s, edge is 500m. To transmit and receive packets the RADIO-ACCNOISE normal radio model was taken into consideration. Radio packet reception model is taken as SNR-BOUNDED that is the Signal to Noise Ratio (SNR) is more than the RADIO-RX-SNR-THRESHOLD which is taken as 10.0 (in dB); It receives the signal with no error. Each node radio transmission power is defined at 10.0 dbm. Medium Access Protocol (MAC-PROTOCOL) is 802.11 and set PROMISCUOUS-MODE is set as "NO". For NETWORK-PROTOCOL the only at present existing default value is 'IP'.

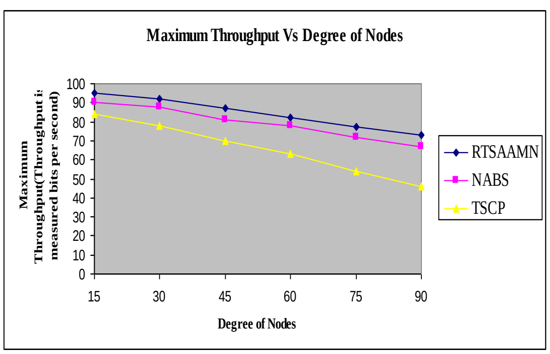


Figure 3: Maximum Throughput Vs Degree of Nodes
(Number of nodes is 150 and mobility of nodes 30m/s)

In figure 3 the simulation result shows that network size with a number of 150 nodes, increasing the degree of nodes from 15 to 90 and mobility of nodes is 30m/s, RTSAAMN algorithm has a maximum throughput as compared to NABS and TSCP algorithm results. If we regularly increase the degree of nodes of three algorithms the throughput of network decreases. From figure 3 it is seen that the NABS algorithm's result is slightly less than the RTSAAMN algorithm and greater than the TSCP algorithm as compare on increasing the degree of node size. If we regularly increase the degree of nodes and network size, the throughput of the network decreases due to more number of interference nodes.

Throughput calculated as:
*R(m)*= Number of packets received
*T(m)*= total packets transmission
Throughput = *R(m))*/ *T(m)* ----------(1)

Finally, we conclude that RTSAAMN is better than of other two algorithms.

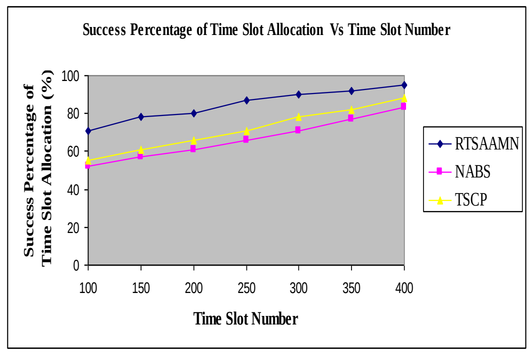


Figure 4: Success Percentage of Time Slot Allocation Vs Time Slot Number
(Traffic load is 1/120 and Mobility of nodes is 20 m/s)

The above figure-4 simulation result shows that RTSAAMN algorithm is better than the other two algorithms. We perform the slot allocation between mobile nodes through RTSAAMN, NABS and TSCP algorithms to make time slot allocation in the frame. The RTSAAMN time slot allocation success percentage is very high. In figure 4 it is seen that traffic load is 1/120 and the speed of the nodes is 20m/s, if we increase time slot numbers, then the success percentage of time slot allocation is increased in case of RTSAAMN, NABS and TSCP algorithms which means interference of nodes is decreased in the network. It is reliably of other two algorithms and hence reduces collision.

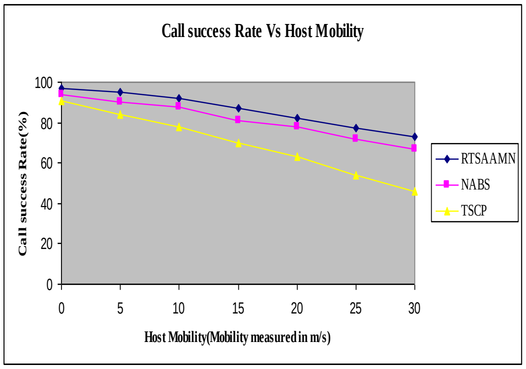


Figure 5: Call Success Rate Vs Host Mobility

The figure 5 results show that RTSAAMN is better than the NABS and TSCP algorithms. When we increase speed (5ms to 30 ms) of the mobile nodes, then the three algorithm's call success rate decreases. The NABS algorithms result slightly less than the RTSAAMN algorithm and greater than the TSCP algorithm. The RTSAAMN has a higher call success rate than the other two algorithms.

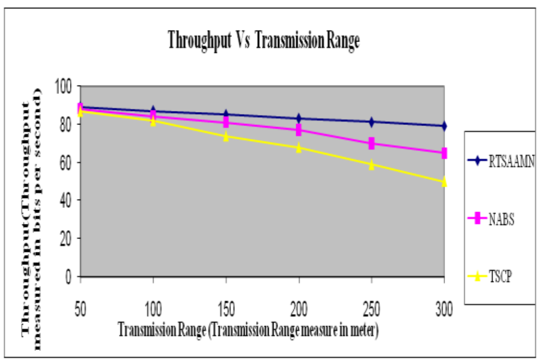


Figure 6: Throughput Vs Transmission Range

In figure-6 result shows that the RTSAAMN algorithm is better performance than other exiting two algorithms. If we are regularly increasing transmission ranges, then throughput of the simulation results is degraded.

## VI. CONCLUSION

This paper we have compared the results of the RTSAAMN algorithm with existing TSCP and NABS algorithms. In our simulation we have tested by varying node mobility, degree of nodes and number of time slots, transmission range. We have evaluated the context of success percentage of time slot allocation, call success rate and throughput of the three protocols. The results show that the RTSAAMN algorithm is better than the other two protocols in different host mobility, degree of nodes and number of time slots. It is a collision free, reliable time slot allocation scheme among nodes and reliable minimum time slot forward broadcast up to 2-hop nodes. This algorithm provides low power conservation and low broadcast latency; it might reduce rebroadcast and redundancy. Nodes have 100% reachability within the transmission range of the network. Finally, we conclude that RTSAAMN algorithm is better than the TSCP and NABS algorithms.

## REFERENCES

[1] Li Hongyan Shahrokh Valaee (2004) "*An Efficient Algorithm for Time Slot Assignment in Ad Hoc Networks*", Automatic Control Department, Xidian University, and Xi' an, 710071, China, Department of Electrical and Computer Engineering University of Toronto Canada In: 22 Biennial Symposium on communications.

[2] Pei-Kai Hung, Jang-Ping Sheu and Chin-Shun Hsu (2002) "*Scheduling of Broadcasts in Multi-hop Wireless Networks*", Dept. of Computer Science and Information Engineering, National Central University Chung-Li, 320 Taiwan, R.O.C., European Wireless.

[3] Research Scholar S. Madhavi and Professor I.Ramesh Babu (2008) "*A New Method for Adaptive Broadcast Scheduling in Mobile Ad hoc Networks*", Department of Computer Science and Engineering, Acharya Nagarjuna University Guntur, A.P., India, IJCSNS International Journal of Computer Science and Network Security , Vol.8 No.3.

[4] B. Williams and T.Camp (2002) "*Comparison of Broadcasting Techniques for Mobile Ad hoc Networks*", Department of Math and Computer Science , Colorado, School of Mines Golden, CO 80401, In Proceedings of the ACM Symposium on Mobile Ad Hoc Networking and Computing (Mobihoc 02),194-205.

[5] S.Ni, Y.Tseng, Y.Chen and J.Sheu (1999) "*The Broadcast Storm Problem in a Mobile Ad hoc Network*", Proceedings of ACM/IEEE Mobicom 99, pages 151-162.

[6] Demetres Kouvatsos and Is-Haka Mkwawa

(2009) "*Broadcasting Methods in Mobile Ad hoc Networks: An Overview*", Department of Computing, University of Bradford, UK, Department of Computer Science , University College Dublin, Ireland.

[10] Alireza Keshavarz Haddad, Vinay Ribeiro and Rudolf Riedi (2006) " *Broadcast Capacity in Multi-hop Wireless Networks*", Department of Electrical and Computer Engineering and Department of Statistics , Rice University, 6100 Main Street Houston, TX 77005,USA, MOBICOM.

[11] Brian J.Wolf, Joseph L.Hammond, Daniel L.Noneaker and Harlan B.Russell (2007) " *Distributed Formation of Broadcast Transmission Schedules for Mobile Ad hoc Networks*", Department of Electrical and Computer Engineering, Clemson University Clemson , SC,IEEE Volume 6.

[12] S.Ramanathan and E.L. Lloyd (1993) "*Scheduling Algorithms for Multi Hop Radio Networks*", IEEE/ACM Transactions on Networking, 1:166-177.

[13] J.Jetcheva, Y.Hu, D.Maltz and D.Johnson (2001) "A *Simple Protocol for Multicast and Broadcast in Mobile Ad hoc Networks*", Internet Draft, Draft-IETF-MANET simplembcast-01.

[14] J.Sucec and I.Marsic (2000) "*An Efficient Distributed Network-Wide Broadcast Algorithm for Mobile Ad hoc Networks*", CAIP Center, Rutgers University Piscataway, NJ08854, CAIP Technical Report 248-Rutgers University.

[15] Alpr Jttner and Dm Magi (2004) "Tree *Based Broadcast in Ad hoc Networks*", MONET Issue on WLAN Optimization at the MAC and Network levels.

[16] Zygmunt.J.Haas and B.Liang (1999) " *Ad hoc Mobility Management with Randomized Database groups*", 323 Frank Rhodes Hall, School of Electrical Engineering Cornel University, lthaca, NY 14853 Proceedings of the IEEE International Conference on communications 1756-1762.

[17] GloMoSim: "*Global Mobile Information Systems Simulation Library*",http://pcl.cs.ucla.edu/projects/glo -mosim.

[18] Mario Gerla Lokesh Bajaj, Mineo Takai, Rajat Ahuja, Rajive Bagrodia (1999) "*GloMoSim: A Scalable Network Simulation Environment*", Technical Report 990027, University of California.

[19] Richard A.Meyer and Rajive Bagrodia (1999) "*PARSEC USER MANUAL for PARSEC. Release 1.1*", Revised in September 1999.

[20] Karuturi Satish, K. Ramesh et al., "Intrusion Determent using Dempster-Shafer Theory in MANET Routing", (IJCSIT) International Journal of Computer Science and Information Technologies, vol. 6, no. 1, pp. 37-41, 2015.

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