ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 2, Issue 12, June 2013

Packet Forwarding in Wireless Mesh Network Using IPT Scheme

K.Kumaravel, Ph.D Scholar, Govt, Arts College (Autonomous), Coimbatore, India
Dr.A.Marimuthu, Associate Professor, Govt, Arts College (Autonomous), Coimbatore, India
Mrs.N.Vanitha, M.Phil. Scholar, Dr.N.G.P. Arts & Science College, Coimbatore, India

Abstract: Wireless mesh Network (WMN) is a multi hop low cost, with easy maintenance robust network providing reliable service coverage. WMNs consist of mesh routers and mesh clients. In this architecture, while static mesh routers form the wireless backbone, mesh clients access the network through mesh routers as well as directly meshing with each other. Different from traditional wireless networks, WMN is dynamically self-organized and self configured. In other words, the nodes in the mesh network automatically establish and maintain network connectivity. We are using IPT, Intermittent Periodic Transmit, is a proprietary packet-forwarding scheme that is to reduce radio interference in the forwarding path of mesh networks. IPT forwarding eliminates packet collisions and therefore enables high throughput in long hop relays, permitting creation of a large scale mesh.

Index Terms—**Bandwidth, performance, wireless mesh network, Intermittent Periodic Transmit.**

I. INTRODUCTION

A wireless mesh Network (WMN) is a communication network made up of radio nodes organized in a mesh topology. Wireless mesh networks often consist of mesh clients, mesh routers and gateways. The mesh clients are often laptops, cell phones and other wireless devices. The mesh routers forward traffic to and from the gateways which may but need not be connected to the internet. The coverage area of the radio nodes working as a single network is a mesh cloud. In this paper we have enhanced performance of the mesh cloud by optimized the control packet. The nodes operate in WMN not only as a host but also a router, scheduling packet s on behalf of other nodes that may not only be within direct wireless transmission range of their destinations. The mesh routers have minimal mobility and form the backbone of the WMNs. It provides network accesses for the both mesh and conventional client's. The Mesh clients can be either stationary or mobile and can form a client mesh network among themselves with mesh routers. A wireless mesh network can be seen as a special type of wireless ad hoc network. It's virtually appeared that all nodes in a wireless mesh network are immobile but practically it is not true. Researchers have started to revisit the protocol design of existing wireless networks specially of IEEE802.11 networks, Ad hoc network and wireless sensor networks.IEEE802.11, IEEE802.15 and IEEE802.16[3,8, 9] all have established sub working groups to focus on new standard for WMNs. In IPT forwarding, source node intermittently sends packets with a certain time interval (IPT duration), and each intermediate relay node forwards the relay packet immediately after the reception of it. In this paper, we propose a new IPT duration setting protocol which employs training packets to search the optimum IPT durations for each slave node. With these IPT durations, the end to end throughputs for each slave node are maximized.

Intermittent Periodic Transmit (IPT) Forwarding Protocol

In this method, a source node intermittently sends source packets with some transmit period, and intermediate nodes forward each incoming packet immediately after the reception of it. Figure 4shows packet relays carried out by IPT in which two transmit periods, P_1 and P_2 are given. If the transmit period is greater than a certain threshold (critical limit), packet collisions due to interference are removed, hence collision free wireless multihop relay is realized. Ascertaining the reception states at the intermediate and destination nodes in Fig.4, throughput measured by the respective nodes is constant irrespective of hop counts which completely changed the old thought: the throughput is decreased as the hop nodes numbers is increased.

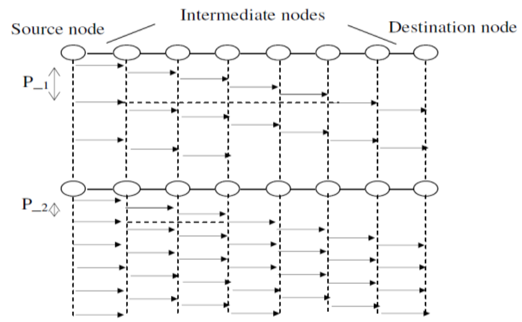

Fig 1. Packet relays by the IPT forwarding

Literature Survey:

The performance of any wireless system depends upon the selection of propagation mode for transferring control and data packets through multi hops [5]. In this paper they have focused how efficiently the minimum number of routers rebroadcast the hello or the beacon message. The router forwards the message that reaches all the nodes over the wireless mesh network. The packets are forwarded through the router nodes only. All the nodes apart from the router nodes are client nodes. Optimize flooding is done by minimizing the number of router nodes in the mess network in such a way that any client node can be reached through the least number of hops that passes through the least number of routers. In this

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 2, Issue 12, June 2013

paper we are using IPT, Intermittent Periodic Transmit, is a proprietary packet-forwarding scheme that is to reduce radio interference in the forwarding path of mesh networks. IPT forwarding eliminates packet collisions and therefore enables high throughput in long hop relays, permitting creation of a large scale mesh. The collision free IPT duration setting method proposed by [13] is also introduced. The structure of the paper organized as, section I contains Introduction, Section II contains the system model for the existing and proposed system. Section III presents the simulation environment for the proposed system. Section 1V presents the result and discussion. Section V presents Conclusion and remarks.

II. SYSTEM MODEL

EXISTING SYSTEM:

The system model develop to reduced the number of control packet and efficiently cover the mesh cloud. The router node can relay and retransmit the packets and the client node exchanges packets through the router nodes. We consider the packet exchange done by sharing of a common channel.

Let $V = \{V_i \mid n \in \square\}$ is the set of all types of nodes in the wireless mesh network.

Now $R \subset V$ be the sets of all routers in the wireless mesh network. In the proposed problem we consider The source { S} selects the nodes { R1, R2, R3}.These are the router nodes from the set R to relay the message. When a flood message can be retransmitted from the nodes {R1, R2, R3}. Any two hops neighbor must be covered by at least one node from the set R. The router forwards a flooding message with the following rule

i. The packet has not already been received.

ii. The router node is the last emitter.

that in the wireless mesh network, any 2 hops neighbor must be covered by at least one node

$R_j \in R$. Any node $R_i \in R$ forwards a flooding packet with the condition that the packet has not already been received and that the node is the last emitter. To minimize the number of packets in the wireless domain and send the packet through least hops the below cardinality condition holds true,

1) The cardinality of the set (R) < cardinality of set (V)

2) Cardinality of set R < cardinality of (V-R).

Now, Let S is the source node initiate a message such that message be reached every client node through the minimum number of hops comes from the source node S only for {R1, R2, R3} then the message. The message retransmitted follows this way. If the node A receives message from R2 for the first time then it will retransmit, if node A received from R1 for the first time it won't re-transmit that packet. No client node will be missed to receive the message. Any node C (say) neighbor of the node A is a 2 hop neighbor of R1. So any variable node which is at outer of the 2nd circle be covered by the 2 hops of any node $R_i \in R$.

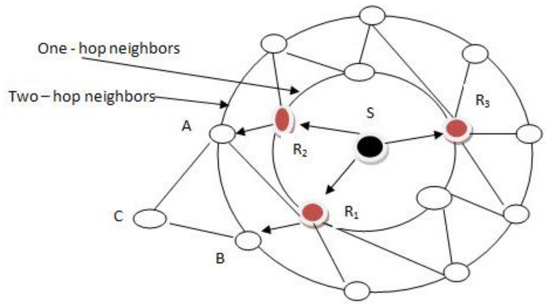

Fig 2. Architecture of the Distributed Nodes

We locally optimize the number of flooding packets. After that we proceed to optimize the flooding special packets by heuristic algorithms to cover the whole mesh network by transmitting minimum number of flooding packet. This is done to efficiently utilize the bandwidth of the wireless network and remarkably reduce the contention in the wireless domain. In this procedure we can reduce the race condition to occupy the sharable channel in the wireless domain. This procedure reduces the traffic load in the wireless domain. In wireless medium, random packet loss is a common issue due to random movement of the nodes in the wireless domain. The main disadvantage of the common proactive routing algorithms is the slow reaction on restructuring of the topology.

PROPOSES SYSTEM:

Collision free IPT duration

As discussed earlier, in order to achieve optimal performance node should set an adequate IPT duration for each slave node. However, the optimum IPT duration for each slave node depends on many environmental factors such as channel characteristics node placements, antenna directions and so on. To make IPT forwarding method protocol been proposed to automatically find IPT durations for each node in [13]practical, an automatic IPT duration setting method is required. To this problem, a collision free protocol has been proposed to automatically find IPT duration for each node in [13].

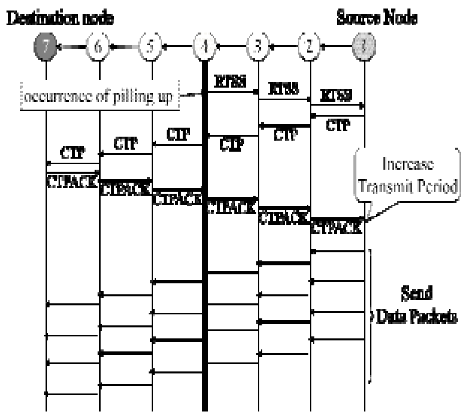

Fig 3.Collision Free IPT duration setting.

Three new MAC layer packets (Request to Stop Sending) packet CTP (Clear to Pilling UP) packet CTPACK (CTP Acknowledgement) packet, are defined in [13] shaking algorithm is employed to find the IPT duration for each node As shown in Fig. 5, when the IPT duration setting started the source node (node 1) continuously sends data packets to the destination node (node 7) with certain IPT duration. If a data packet transmission fails in an intermediate node (e.g. node 4 in Fig. interference, the node sends a RTSS packet to the source node to stop ending data packets. The source node suspends the sending of data packets immediately after reception of the RTSS packet and sends a CTP packet to the destination node. The CTP packet is relay same way as that for data packet and therefore the destination node can know that all the relaying data packets are cleared out from the system by reception of the CTP packet. The destination node immediately sends a CTPACK packet to the source node on reception of the CTP packet. After receiving the CTPACK packet, the source node increases the IPT duration by one step and resumes the sending of data packets. This process repeats until no data packet forwarding failure occurs in the relaying route. System throughput is not guaranteed to be maximized by applying the IPT durations attained by the method.

Throughput maximization IPT duration setting protocol

We propose a new training based IPT duration setting protocol which maximizes the end to end throughput for each slave node. The proposed protocol employs some training packets and performs a series of training process to search the optimum IPT duration for each slave node. During the training process, core node continuously sends a number of training packets to each slave with an IPT duration which increases gradually until the end to end throughput from the core node to the slave node reaches the maximum value.

Variables and parameters

We defined the following variables and parameters in the new protocol.

1) Training packet
2) Number of training packets: N
3) Training time for each node: T
4) Training metric for each node: TM
5) IPT duration for each node: D (micro second)
6) Training Step in the process: Δ(micro second)

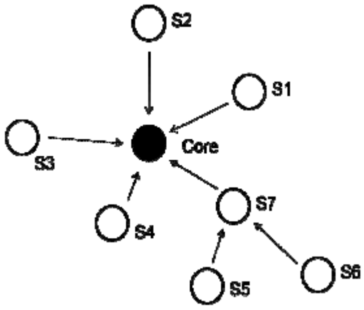

Fig 4.Mesh Cluster

In these variables, the training packet is defined as OSI link layer's data packet with the length of 1450 Byte and identified by sequence number. The parameters TM and D are initialized whenever new training begins for a new slave node. The training metric TM, which is described latter in detail is used as the criterion for the training process. Now let us consider a mesh cluster with a core node C and a set of slave nodes {S1, S2, …, Sn}. For each slave node S ∈ {S1, S2, …, Sn}, the following process is executed .

Step1: The core node C initializes the training metric TM as -1.0 and initialize D as D0 for the slave node D0 is a small non-negative value.

Step2: The core node C sends packets which have the sequence number of 1, 2,…, N to the slave node S continuously with the IPT duration

Step3: Whenever the slave node receives a training packet which is destined to it, S records the sequence number and the packet reception time.

Step4: If the reception of training packets destined to itself is finished, the slave node S sends a report packet to the core node C which contains the sequence number and reception time (Seq1, T of the first training packet it received and the sequence number and reception time (Seq2, T2) of the last training packet it received. The number of training packets received without duplication, Num, is also included in the report packet.

Step5: When the core node C receives report packet from the slave node S, it estimates actual training time spent for S as below

$$\sigma \overset{\text{def}}{=} (T_2 - T_1) \,/\, (Seq2 - Seq1)$$

$$T_{start} = T_1 - \delta * (Seq1 - 1)$$

$$T_{end} = T_2 + \delta * (N - Seq2)$$

$$T = T_{end} - T_{start}$$

According to the estimated training time T, a new training metric is calculated as below.

$$New\_TM = \frac{Num}{T}$$

After the computation of new training metric, the training process branches into two cases based on the value of TM.

a) If New_TM<TM the core node C finishes the training for S the IPT duration of S as (D- Δ) and move to the training of next slave node.

b) If New_TM>TM, the core node C increases the IPT duration D by Δ, replace the training metric New_TM and repeats the above Step2~Step5.

Step6: The core node C repeats the above Step2~Step5 until the training for all the slave nodes is finished.

Performance metrics Of IPT

$$\text{Aggregated end-to-end throughput} = \frac{N_s \times (DataSize)}{SimulationPeriod}$$

$$\text{Average delay} = \frac{1}{N_S} \sum_{i=1}^{N_S} D_i$$

$$\text{Packet loss rate} = \frac{N_D}{N_S + N_D} \times 100$$

Ns : The number of packets received successfully by destination nodes.
ND *:* The number of discarded packets due to exceeding a retry limit.
Di : The period from the instant the packet occurs at a source node to the instant a destination node completes reception of the packet.

III. SIMULATION ENVIRONMENT

Ns2.35 was used to build the simulation model. All the operations have done by NS NAM.

Simulation parameters for IPT

Number of node: 1 Core node, 23 Base nodes
Channel model: A path loss coefficient of 2 up to 5 m and of 3.5 beyond 5m
Shadowing : -12dB per a wall
Fading : None
Routing scheme : Minimum path loss routing
Wireless IF : IEEE802.11a
Transmit power : 20dBm
Data packet size: 1500bytes
Traffic model : The Poisson origination is employed. The number of data packets per session is randomly determined by the log-normal distribution. Mean of them is 20 for downlink and 2 for uplink. The ratio of the total offered load of downlink to uplink is 10:1.
Simulation period: 1 min

IV. RESULT AND DISCUSSIONS

In the first, we measured the end to end throughput from core node to each slave node with different IPT durations in the two simulation scenarios using the following formula

$$Th = \frac{Nr \times PL}{Tm}$$

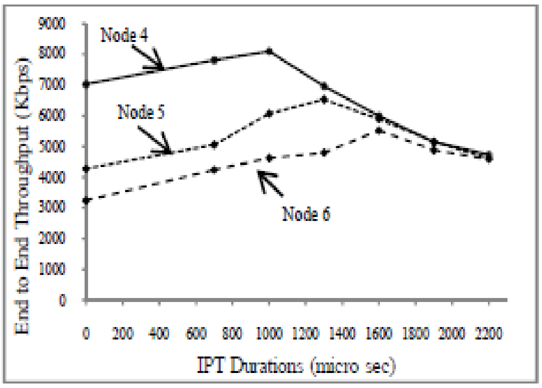

Fig 5.IPT Durations and End To End Throughput for Node 4, 5, 6 In Simulation Scenario 1.

The simulation figure clearly represents how the traffic load decreases inside the mesh network. Simulation results ensure that the IPT forwarding achieves higher throughput, lower average delay and a comparable packet loss rate in comparison with the conventional packet forwarding method.

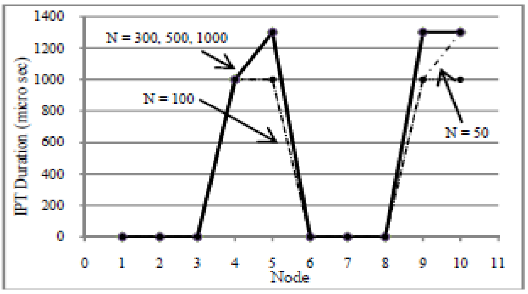

Fig 6. Automatically Calculated IPT Durations

V. CONCLUSION

In the Existing work they have used a novel approach to reduce the traffic load in the wireless mesh network. To minimize the traffic load they try to minimize the number of the routers in the wireless mesh network. For finding the router nodes they have proposed a heuristic algorithm. The router nodes are eventually used to relay the control packet or rebroadcast the control packet. The time complexity of the heuristic algorithm is O (n2). Here we are using IPT, Intermittent Periodic Transmit, is a proprietary packet-forwarding scheme that is designed to reduce radio interference in the forwarding path of mesh networks. IPT forwarding eliminates packet collisions and therefore enables high throughput in long hop relays, permitting creation of a large scale mesh.

REFERENCES

[1] M.Siraj, Soumen Kanrar "Performance of modeling wireless networks in realistic environment" IJCN- Vol -2 ISSUE-1.

[2] FEBA: A Bandwidth Allocation Algorithm for Service Differentiation in IEEE 802.16 Mesh Networks IEEE/ACM TRANSACTIONS ON NETWORKING, VOL. 17, NO. 3, JUNE 2009.

[3] V. Mhatre, K.Papagiannaki, Using mart triggers for improved user performance in 802.11 Wireless networks, in Proceedings of ACM MobiSys, June2006, pp.246-259.

[4] S.Vasudevan, K. Papagiannaki, C.Diot, J.Kurose, D.Towsley, Facilitating access point selection in IEEE802.11 wireless networks, In Proceedings of USENIX Internet Measurement Conference (IMC'05), 2005, pp.293–298.

[5] H.Lee, S.Kim, O.Lee, S.Choi, S.J.Lee, Available bandwidth based association in IEEE802.11Wirelelans, in: Proceedings of the 11th International Symposium on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWiM), October2008, pp.132- 139.

[6] A.J.Nicholson, Y.Chawathe, M.Y.Chen, Improved access point selection, in: Proceedings of ACM Mobi- Sys, June2006, pp.233– 245.

[7] G.Athanasiou, T.Korakis, O.Ercetin, L.Tassiulas, dynamic cross layer association in 802.11 based mesh networks in: Proceedings of IEEE Infocom, May2007, pp.2090–2098.

[8] V.Lenders, J.Wagner, M. May, Measurements from an 802.11b mobile adhoc network, in: 2006 International

Symposium on World of Wireless Mobile and Multimedia Networks IEEE Computer Society.

[9] L.M.Feeney, An energy consumption model for performance analysis of routing protocols of mobile Adhoc networks, Model Networks and Applications 6(3)(2001)239-249.

[10] Y. HIGA, H. Furukawa, “Experimental Evaluation of Wireless Multihop Networks Associated with Intermittent Periodic Transmit,” IEICE Trans. Comm., vol. E90- B, no.11, November 2007.

[11] E. M. Mohamed, D. Kinoshita, K. Mitsunaga, Y. HIGA and H. Furukawa, "An Efficient Wireless Backhaul Utilizing MIMO Transmission and IPT Forwarding", International Journal of Computer Networks, IJCN, vol. 2, No. 1, pp.34-46, March 2010.

[12] Guangri Jin, Ximing Huang, Hiroshi Furukawa, “Performance Enhancement of IPT forwarding for Wireless Backhaul by Fixed Directional Antennas”, Proc. IEEE APWCS 2011, Aug. 2011, Singapore.

[13] Y. HIGA and H. Furukawa, “Time Interval Adjustment Protocol for the New Wireless multihop Relay with Intermittent Periodic Transmit.” IEICE 2004, B-5-180, September 2004.

AUTHOR’S PROFILE

K.Kumaravel MCA., M.Phil., CCNA. Serving as a Asst. Professor in Computer Science, Dr.N.G.P. Arts and Science College, Coimbatore. He has presented many papers in various conferences and published referred journals. He is pursuing Ph.D programme in computer science. He has more experience in teaching and research for 10 years.

Dr.A.Marimuthu Serving as Govt. Arts College (Autonomous) coimbatore He as presented many research papers in international Seminars & published many papers & published books in his research. He has more than two decades of Research.

Mrs.N.Vanitha MCA., Serving as a Asst.Professor in Computer Science, Dr.N.G.P. Arts & Science College, Coimbatore. She has presented many papers in various conferences. She is pursuing M.Phil, programme in computer science.