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Evaluation of Quality of Service Parameter in Ad Hoc Routing Networks based on a Queuing Network

Tanu Jain[1], Rupesh Dubey[2]
PG Scholar[1] *Department of Electronics and Communication, RGPV University Bhopal*
Associate Professor[2] *Department of Electronics and Communication, RGPV University Bhopal*
IES IPS Academy Indore
A.B Road, Rajendra Nagar, Indore (M.P) India
Corresponding author: Tanu Jain

--**ABSTRACT**--

In real-time transmission of multimedia information Ad Hoc faces challenges for the low bandwidth for transmission from source to destination and requires a considerable effort. So we proposed a queuing network model which is based on routing of Ad Hoc networks and analyze the delivery of multimedia packets which has low end-to-end delay and less bandwidth overhead between mobile nodes and which ensures high throughput. We also analyzed the queuing delay in regard of node behaviour of routing and MAC protocols. Here we simulate the parameters of Quality of Service i.e. end-to-end delay and expected hop count using Matlab, and compare the performance of Flooding and Adaptive gossiping method at low and high-traffic network and found that Adaptive-gossip routing algorithms has significantly less delay for voice traffic i.e. 52% less delay at small-traffic network and 47% less delay at large high-traffic network and also significantly less delay for video traffic 52% less delay at small-traffic and 54.5% less delay at large high-traffic network.

Keywords: *Wireless Ad Hoc networks; Routing of Ad Hoc networks; Networks based on Queuing*

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I. INTRODUCTION

A wireless network infrastructure is required for personal communication and mobile computing and these infrastructure is fast deployable and have possible multihop and capable of multimedia service support [1]. In multi-hop ad hoc networks which is a wireless network of special type and that does not support a infrastructure that is of wired type, communication between two nodes is not done by direct neighbors but instead the transfer of messages is done by intermediate node between them. In an ad hoc network basically every node act as a router and all set of networks have status which is equally assigned for all nodes on a network and where all nodes are freely moving with other ad hoc network devices and also each node act as a communication end-point. As compared to wireless managed networks, the networks based on Ad Hoc have more suitability for variety of applications for which the central nodes can't be relied on and also since wireless managed networks has theoretical and practical limitation, an ad hoc network are more useful in improving scalability and capacity of networks. The network based on an ad-hoc is made up of multiple nodes which is connected by links. In an Ad Hoc network the links are influenced by the Nodes resources which are basically a transmitter power, computing power and memory and also it depend on some of behavioural properties i.e. Reliability and also it is dependent on some of link properties which are length-of-link and signal loss, interference and noise problems. As in an Ad Hoc networks links can be connected or disconnected at any time so this functioning network should have capability to cope with this dynamic structuring in such a way that is becomes timely, efficient, reliable, robust and scalable. Sine in most ad hoc networks based on wireless technologies are free to move, here nodes has a collision interference problems.[2].So we have an recent technology which is an advancement in Wireless LAN (WLAN) i.e. called as an IEEE 802.11 standard [3], which has provided new opportunities in realistic environment for having a good platform for experimental set up and help in assessing this ad-hoc networks in transmission of multimedia information [4],[5]and this standard is defined as the carrier sense multiple access protocol combined with collision avoidance (CSMA/CA). An ad-hoc operation specifies a standard i.e. basic access protocol for a peer-to-peer multihop ad-hoc operation called Distributed Coordination Function (DCF). Many challenges are required for having transmission of multimedia information which includes voice and video packets for transmission form source to destination so that we can have low-bandwidth with limited resources and which has dynamic topology. Before the packets reach their destination they have to be forwarded to several intermediate nodes since there is limitation of transmission power of nodes and mobility and sharing capacity of wireless channel . There can be high end-to-end delay and packet loss problems which deteriorate network performance with fewer throughputs if the destination nodes are not directly in their transmission ranges and packets need for further transmission range since they mobile nodes leave or join this transmission range of packets. Thus, ad hoc nodes should be deployed densely to maintain a high degree of interaction between mobile nodes [6].Throughout this paper we have proposed many efficient protocols for quality of service (QoS) routing based on networks i.e. Ad Hoc and we have made our efforts on the optimization of one or more network layer metrics, such as throughput, delay, loss, or path correlation, which are termed as a network centric routing. It is important to consider the routing for multiple video sessions. This is required here since flow of video has a competition for having limitation in network resources and Such a interactions of flows make the performance of an individual flow with copulation with other flows. By jointly consideration the routing of concurrent sessions we can optimize the network resource allocation among all flows and maximize a common performance objective.

In this paper we analyzed work done by [7] by setting different parameters in which we analyzed some of the important parameters of QoS (Quality of service) i.e. end-to-end delay which is queuing delay and The expected hop count which is a transmission between a random source and destination pair and which depend on no of nodes, the range of transmission range for a node, the traffic pattern of a network with the behavior of routing, and MAC protocols. Our primary goal in this study is to determine how we can deliver our packets between mobile nodes so that we have low end-to-end delay and less overhead of bandwidth such it meets our QoS requirements. Here we analyzed QoS Ad hoc routing methods: 1.Adapative-gossip routing and 2.Flooding routing and compares their results by proposing queuing network model and analyzed QoS parameters and accomplish our task by simulations and gave our effort so that we can satisfy our QoS requirements for voice/video communication.

II. RELATED WORK

N.Bisnik et al. [8] studied the most related work in the network based on queuing in order to study delay performance of multi-hop wireless network i.e. Ad Hoc network by using approximation in diffusion for estimation of average end-to-end delay. This study need to evaluate the packet drop probability since the approach used in above study was much based on theoretical concept and has some of the assumption that we have a system of queuing with infinite buffers; however the network based on an ad-hoc has a limitation in buffer capacity. R. Ell-Khoury et al.[9] has proposed a cross-layer scheme of network based on an ad-hoc for improving the end-to-end delay of real-time traffics and in order to study for real-time streaming media issues in ad hoc wireless network and where delay is improved by decreasing the packets that arrive after their schedule deadline. This study was much based on theoretical work. In order to reduce power consumption there are some more research work which is relevant our for study of conserving the network resources which can be found in the area of designing energy-efficient sensor networks by setting unused sensors to idle, by H. Jabbar et al. [10]. However, these efforts have much focused on features based on system and architectural view in order to improve the performance of sensor networks.

III. QUEUING SYSTEM MODEL

Here we have discussed about the model based on network including routing based on flooding and adaptive-gossiping methods and also a network based on queuing in an ad hoc wireless networks

3.1The Network Model

The network model is the network model which is denoted by G^2(N, ro(N)) and which consists of N nodes (1,2,…,N), such that nodes are placed independently randomly on a two dimensional area A so that it form an arbitrary “ad-hoc” network. Here we have assumed to have same transmission range for each node which is Each node is assumed to have the same transmission range denoted by ro(N). Here the rij denotes the distance between nodes i and j .If rij ≤ ro(N) than nodes i and j are said to be neighbours if they can directly communicate with each other. Hence there is an area of a circle πro^2(N)which is termed the "communication area" of a node. Here we have made an assumption for the number of nodes that are neighbours of node i and which lie on the communication area of πro^2 (N) in the node deploy area of two-dimension A for πro^2 (N) <<A. Also here we gave a definition of rectangular area which has size of a×b for a≥b and which is represented as A and also we have a density of node which is given by (1/A) N.The model of network topology as shown in Fig.1where nodes are randomly distributed in an area.

3.1.1Flooding based ad hoc routing

In order to find discovery of routes and operation for the maintenance the most ad hoc routing protocols utilize three types of control packets which is request, reply and failure request [11].Different broadcasting mechanisms may be used for broadcasting these routing control packets. The priori knowledge of network topology is not required by Flooding-based routing; it just makes a broadcast of packets to all of the nodes. For example, if we have to find a route from source to destination we just sends a request to all neighbours of nodes and when nodes receives the packet it does not reach to the destination but it simply rebroadcast the packet once to all its neighbors within its transmission area of πro^2 (N). In a flooding based ad hoc routing mechanism, the number of neighbors of a node which is expected

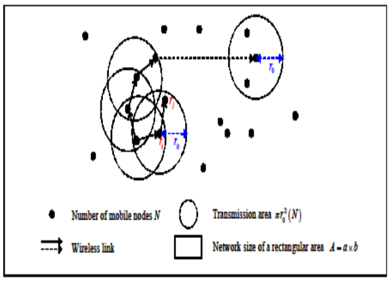

Fig. 1 Model of Network Topology in which nodes are randomly distributed in an area with radio transmission range r_o

has their transmission range of ro(N) so that it receives the packets and is given by this equation

$$E(n) = \frac{\pi r_o^2(\mathrm{N})}{A} \mathrm{N} = \ln(\mathrm{N}), \qquad (1)$$

As a definition given by Penrose's for high connectivity of $\frac{\pi r_o^2(\mathrm{N})}{A}$ N which is expressed as ln(N) [12]. Hence, we can obtain the transmission range of a node which is critical and defined for flooding routing is derived from (1) and is given by

$$r_o(\mathrm{N}) = \sqrt{\frac{A \ln(N)}{\pi N}} \qquad (2)$$

3.1.2 Adaptive-Gossip based ad hoc routing

Hass et al [13] developed an adaptive-gossip algorithm based on GOSSIP3 with gossip probability p. By selecting affixed heuristic value (such as p=0.65) we have assigned probability p which is gossip probability and which is static in nature.. However, this algorithm of static-gossip ahs not considered the neighboring nodes such that nodes broadcast a message with a probability of p to its neighbors. For example, even with a good heuristic gossip probability p a node with too many neighbors could yield high overhead and collisions, while too few neighbors could result in network unreliability. So when nodes are densely deployed with independent and random distribution our static value of the gossip probability p might not improve overall performances in an ad hoc wireless network.

The essential part of gossiping which we have defined as an adaptive-gossip probability pn for determining a gossip probability value is a broadcasting mechanism where forwarding nodes are selected by a probability assigned to the number of neighbors of a node, instead of the gossiping with a static probability p as compared to flooding that simply broadcasts to all of its neighbors as probability 1is an important concept in an ad hoc routing. As an example of a route discovery, when each node receives a request packet from a source node, it broadcasts the packet to its neighbors with probability $p_n = \frac{1}{n}$ log(N) where n is its actual neighbor nodes and log(N) is the expected number of neighbors for n > log(N) , and discards the packet with probability $1-pn$. Thus, the expected number of neighbors of a node within its transmission range r0 (N) that receives the packet in the adaptive-gossiping mechanism is given by

$$E(n) = np_n = \frac{\pi r_o^2(\mathrm{N})}{A} \mathrm{N}\, p_n = \ln(\mathrm{N}), \qquad (3)$$

From (3), we can obtain the critical transmission range of a node in adaptive-gossiping with high connectivity, which is defined by

$$r_o(\mathrm{N}) = \sqrt{\frac{A \ln(N)}{\pi N p_n}} \qquad (4)$$

As derived by Ghose[4] in order to obtain the hop count for the distance L between a random source to destination pair, we used the method of Bettstetter et al.[14] and found the result of the probability distribution of the distance between two random points for the probability density function of the transition length L of nodes moving according to the random waypoint mobility model in a rectangular area of size $a \times b$ for $a \geq b$, and the expected distance within a rectangle of size of a×(a/2) yields E(L)=0.402×a in [13]. Therefore, H denotes the number of hop counts and the expected hop count between random source-destination pairs is defined by

$$E(H) = \frac{E(L)}{r_o(\mathrm{N})} \qquad (5)$$

3.2The Traffic Model

Based on Ad Hoc routing we have traffic model for ad hoc wireless network is described as follows. Each node could be a source, destination and intermediate node. An identically distributed Poisson process where each node is an independent and where each node generates packets on an average rate of λ packets/s .Here each data packet size equals L bits (e.g., 512 bytes × 8 bits) which is a constant value and that are longer than other packets such as routing control packets (about 32 bytes). Routing control packets are used before sending a data packet, a route from a source node to a destination node has to be established by a routing protocol. The higher priority is given to the priority scheduling policy as compared todata packets. As we route from source to destination we have connection in multi-hop networks.

3.3 The Queuing Network Model

We develop a queuing network model for ad hoc wireless networks with their underlying multi-hop packet forwarding. All the nodes in the network are corresponded by the stations of the queuing network. The forwarding probabilities in the queuing network, denoted by pij, correspond to the probability that a packet transmitted by node *i* enters node j's queue, and the pij can be defined as pij = $\frac{1}{N-1}$ (1-absorption probability). We apply an *M*/*M*/1/*B* queue to our queuing network model. Thus, we assume that each node has a finite buffer *B*, which means that packets are dropped when the buffer is full in the network. Nodes serve packets on the first-come first-serve (FCFS) basis. We assume that the number of hops is a geometric random variable. The following assumptions are expressed for the parameters of the queuing network model and are given as under.

Assumption 1 Here AP is the absorption probability which is defined as the probability that as we traverses through a number of hops from source to destination we have a destination is defined as a node of the packet, and is given by

$$\text{AP}=\frac{1}{\text{The expected number of hop count}} \quad (6)$$

$$=\frac{1}{E(H)},$$

Here, the expected hop count between a random source and destination pair is defined by E(H).

Assumption 2 pij is the forwarding probability which is defined as the probability that a packet is forwarded from node i to node j, and is given by

$$\text{pij}=\begin{cases}\frac{1}{N-1}(1-AP) & i \neq j \\ 0 & i = j\end{cases} \quad (7)$$

the sum of queuing, transmission and propagation delay is the end-to-end delay in an ad hoc wireless network from source to destination node including all the intermediation nodes. It is denoted by D that is accumulated as

$$\text{D} = D_Q + D_T + D_P \quad (8)$$

We denote DQ as a sum of time needed to wait at a source node and intermediate nodes; DT is denoted as sum of required time needed to push all of bits of packets into the link as we transmit packets from source to destination due to the route establishment and network congestion, such that L bits is if the length of a packet and rate of transmission of a link is given by R bits/s , then for one hop DT = L/R ; and the delay of propagation where the sum of time needed as we propagate a packets on each link by transferring packets from a source to destination node is given by Dp and hence for one hop Dp = d/s , where the distance between node i and node j is denoted by d, and the propagation speed of the link is denoted by s. As compared to other delays in network system our propagation delay is about 1μs which is insignificant. We have ignored transmission delay which is constant in our analysis of delay .We have found other delays and found that our queuing delay is different and vary from no of nodes , the range of transmission of nodes , the traffic pattern of network with the behavior of routing and protocols of MAC layers. In the next section we have considered the queuing analysis in order to estimate accurate rate of average end-to-end delay.

IV. ANALYSIS OF END-TO-END DELAY

4.1Packet Service Rate

Through the Medium Access Control (MAC)/Physical (PHY) layer the packets which arrived in the queue are forwarded to next hop. We have chosen the widely adopted WLAN technology i.e. IEEE 802.11b MAC layer in order to find rate of source of a node in regard of lower cost and bandwidth value required in network of ad hoc wireless networks and also this WLAN provided medium connectivity of wireless bandwidth which is well suitable for variety of types of traffic and which include distribution of multimedia communication [15].In order to access the medium, Distributed Coordination Function (DCF) is introduced by IEEE 802.11b MAC as a standard mechanism .In order to transmit packets of data DCF uses Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) by accessing method used in the Request-To-Send RTS and Clear-To-Send (CTS)[16]. If we have a period of DIFS our node transmit packets as if it sense channel idle in MAC layer model used in accessing and until an idle DIFS is detected the channel is sense busy and its node is defined in its transmission and later it generate a random backoff interval before transmitting. The number of failed transmissions for a packet is dependent on value of contention window CW. For each packet transmitted successfully we initially set to CWmin and when a transmission becomes unsuccessful m times the value of CW becomes doubled to a maximum value such as CWmax=2^mCWmin. As long as we sense channel idle we decreases the backoff time counter is decreased by one at each time slot. For higher value of DIFS the backoff time counter stops when it sense the busyness of channel ans it resumes when it sense it as idle again. When the backoff timer reaches zero, a node transmit a packet which is short RTS by using RTS/CTS mechanism instead of transmitting a data packet. After a Short Inter Frame Space (SIFS) time interval, the receiving node responds with a CTS packet time interval. When sender receives valid CTS then only it is allowed to transmit the data packets and when the data packet is successfully received the receiver sends an ACK by transmitting it. Our data packet is assumed as a lost and we have to retransmit it when transmitting node does not receive an ACK. Here we have used the models by Bianchi [17] and Carvalho et al. [18] since we have to determine the average virtual slot and also since it needs to identify a service rate of packet which is average is μ. Due to successful transmission for which the channel sense busy we have average time which is denoted by Ts, and the time which is average for which we sense our channel is busy due to collisions is denoted by Tc. In [18], the packet transmission time Ts is given by

$$T_s = \frac{RTS}{R} + \frac{CTS}{R} + 3SIFS + \frac{ACK}{R} + \frac{L}{R} + DIFS \qquad (9)$$

and the collision time of packet which is Tc is given by

$$T_c = \frac{RTS}{R} + DIFS \qquad (10)$$

The packet size of data is represented by L(bits) and the link rate of transmission is represented by R(bits/s). Here δ is assumed as a fixed duration when we have an empty slot time and its value is 20μs. The probability so that we have only one transmission is considered in a slot time is represented as Ptr, and the probability such that we have only successful transmission in a channel is represented as Ps. Thus in [19], the probability Ptr so that our N nodes are found in a channel and every node transmit with a probability of τ is represented as

$$P_{tr} = 1 - (1-\tau)^N \qquad (11)$$

The probability Ps such we have a condition that only one node transmits such that we have transmitted packet on node over the channel is represented as

$$P_s = \frac{N\tau(1-\tau)^{N-1}}{1-(1-\tau)^N} \qquad (12)$$

As we provided two equations we obtained the value of τ. First, the probability τ such that our transfer of node attempts by choosing a randomly slot time is represented as

$$\tau = \frac{2(1-2p)}{(1-2p)(CW_{min}+1)+pCW_{min}(1-(2p)^m)} \qquad (13)$$

When the packet used for transmitting encounters a collision such that we have only one (N-1) remaining nodes left for transmission in a given slot time then p is given as a function of the conditional collision probability. If all nodes transmit with probability τ, the collision probability p is given by

$$p = 1 - (1-\tau)^{N-1} \qquad (14)$$

We have solved value of p from two unknowns of τ and p from (13) and (14) respectively in [15] is represented as

$$p = \frac{2CW_{min}(N-1)}{(CW_{min}+1)^2+2CW_{min}(N-1)} \qquad (15)$$

In [15],a single-hop wireless network the length of a slot time which is average in IEEE 802.11b is represented as

$$E(Slot) = (1-P_{tr})\delta + P_{tr}P_sT_s + P_{tr}(1-P_s)T_c \qquad (16)$$

So we obtained the service rate of packets for all randomly nodes which is distributed in a network is μ is represented as

$$\mu = \frac{1}{E(Slot)} \qquad (17)$$

4.2 Packet Arrival Rate

In ad hoc networks where the mobile nodes are randomly and independently deployed can be applied to the network by Jackson [20] by having following assumptions. We have packets which are from node i which proceed to every arbitrary node and every new packets join nodes from outside networks. We have queue which single server and has an exponential service rate μi consists of *i*th node (i=1,…,N) where N denotes as a number of nodes. We have Poisson process where arrival of packets from outside network at node i with a rate of λi, and these packets arrived is independent. After we have received packet which serviced in ith node they proceed to j node by having a forwarding probability of pij. In accordance with independent Poisson process we considered the ith node where packets arrive in a system of queuing of node i at rate of λi. In this network we have λi which is generation of packet rate at the layer of application of node i.. Also the arrival of packets at this node from the other node of network is called internal arrivals. Let bi represent the rate of internal arrivals at node i. Then, for each node i, the total arrival rate at node i is represented by ai, given by

$$a_i = \lambda_i + b_i , \quad 1 \le i \le N \qquad (18)$$

Since the nodes which serves has stability, the departure rate of packets from j node is given by aj which is same as arrival rate of packet at node j. And since a fraction pij of these departing packets go to node i. The internal packet arrival at a rate as it move from node i to node j is given as aj pji, so that $\sum_{j=1}^{N} pji \le 1$, and 1-$\sum_{j=1}^{N} pji$ represent as the probability such that we have departure of packet when they are being served by node i .Thus, the internal arrival rate at node i from all the nodes in the network is given by

$$b_i = \sum_{j=1}^{N} a_{j\, p_{ji}} \quad 1 \le i \le N \qquad (19)$$

As we substitute the value in previous equation we get the total arrival rate of packets at node is represented as

$$a_i = \lambda_i + \sum_{j=1}^{N} a_{j\, p_{ji}} , \quad 1 \le i \le N \qquad (20)$$

Since node j is not the destination and we have pij as forwarding probability by assumption 2. We have also considered an additional condition for $j \neq i$, which is represented as

$$a_i = \lambda_i + \sum_{\substack{j=1 \\ j \neq i}}^{N} a_{j \frac{1}{N-1}(1-AP)} \qquad 1 \le i \le N \qquad (21)$$

We have AP $=\frac{1}{E(H)}$ as a absorption probability from Assumption 1,

$$a_i = \lambda_i + \sum_{\substack{j=1 \\ j \neq i}}^{N} a_{j \frac{1}{N-1}\left(1-\frac{1}{E(H)}\right)} \qquad 1 \le i \le N \qquad (22)$$

Where node i is not destination we have $\frac{1}{N-1}$ as the probability of packets which is forwarded to node j and we have (1- $\frac{1}{E(H)}$) as the probability when we pick randomly a node and i is not represented as destination node. In an ad hoc wireless network end-to-end delay is the sum of delay at queuing and at transmission as we transmit a packet form source to destination nodes. Due to realistically, we have a capacity which is limited since we have finite buffer size B in such a sense that we have to move B packets in the system at any time so if packet that arrived finds that there are already B packets present they does not enter in queue and is considered as lost packets. Hence by formula definition of a single-server exponential queuing system which has finite capacity we have Pk for $0 \le k \le B$; which denote the probability such that there are k packets in the queue [21],

$$P_k = \frac{(\frac{a}{\mu})^k}{\sum_{k=0}^{B}(\frac{a}{\mu})^k} = \frac{\left(\frac{a}{\mu}\right)^k (1-\frac{a}{\mu})}{1-(\frac{a}{\mu})^{B+1}} \qquad (23)$$

Since we have finite buffer size B at node the average number of packets in a queue is given by

$$\overline{Q} = \sum_{k=0}^{B} k\, P_k = a \frac{[1+B(\frac{a}{\mu})^{B+1}-(B+1)\left(\frac{a}{\mu}\right)^B]}{(\mu-a)\,(1-(\frac{a}{\mu})^{B+1})} \qquad (24)$$

By symmetry, we have same average delay at queuing at all the stations and such a delay at node is given by

$$\overline{W}=\frac{\overline{Q}}{a} \qquad (25)$$

Therefore, the delay which is expected so that packet waits for transmission in the entire network as we transmit packets form source to destination is given by

$$E(D_Q)=\overline{W}E(H)=\frac{1}{a}\,\overline{Q}E(H) \qquad (26)$$

Where the arrival rate is given by a, the mean number of packets in the queue of nodes is given by $\overline{Q}$ and the expected hop count between a random source and destination pair is given by E(H).

4.3Packet Drop Probability

P(drop) is the Packet Drop Probability in which we have single queue of buffer size B and where the queue of node is full and which is served in FCFS fashion and when an arriving packet sees that queue is full it is given with the probability P_B which is dropped and is represented as

$$P(drop)=P_B=\frac{\left(\frac{a}{\mu}\right)^B (1-\frac{a}{\mu})}{(1-(\frac{a}{\mu})^{B+1})} \qquad (27)$$

The assumption of the number of hop counts H between random source and destination pair is made, which is geometric random variable with expectation E(H) and follows that the parameter p of this geometric random variable is $\frac{1}{E(H)}$. If the number of hop counts H equals to k, it is necessary and sufficient that the first k–1 trials is failures and the kth trial a success with parameter p, expressed as:

$$P\ (H = k) = (1 - p)^{k-1}\, p \qquad (28)$$

Now we consider probability of no packet drop i.e. there is no packet drop between source and destination at any node in the network and is given as:

$$\overline{P}\ (\text{no drop}) = E\left[\prod_{i=1}^{H} (1 - P_i)\right] = \sum_{k=1}^{\infty} (1 - P_i)^k\, P\ (H=k) \qquad (29)$$

$$= \sum_{k=1}^{\infty} (1 - (P(drop))^k \left(1 - \frac{1}{E(H)}\right)^{k-1} \frac{1}{E(H)} \qquad (30)$$

$$= \frac{1 - P\ (drop)}{E(H)P(drop) - P\ (drop) + 1} \qquad (31)$$

Hence, the expected end-to-end delay

$$E\ (D) = [E\ (D_Q) + D_T\, E(H) + D_P\, E(H)]\ \frac{1}{\overline{P}(\text{no drop})} \qquad (32)$$

Where E (DQ) is again defined as the queuing delay; D_T E(H) $= \frac{L}{R}$ E(H) is the transmission delay; and the propagation delay from source to destination is denoted by D_pE(H) $= \frac{d}{s}$ E(H).

TABLE I

Parameter	**Value**
Packet size	32(voice) and 512(video) bytes
PHY header	34 bytes
RTS	20 bytes
CTS	14 bytes
ACK	14 bytes
Slot time,δ	20μs
SIFS	10 μs
DIFS	50 μs
ACK- timeout	212 μs
CTS-timeout	348 μs
Initial backoff window(C W_{min})	32
Max backoff window(CW_{max})	1024
Back off stages, m	7
Max channel bit rate(bandwidth)	11.0 Mbit/s
Propagation delay	1 μs

Table 1 Physical Layer Parameters: Protocol and channel parameters are specified by the IEEE 802.11 DCF standard with Direct-Sequence Spread Spectrum (DSSS) [15].

V. SIMULATION SET UP

Let us consider a topology of network which has N nodes between (200 to 1000) which is distributed randomly over the two-dimensional area of (1000*700) m^2.Each node generates packets of size L= 32 bytes for voice traffic and size L = 512 bytes for video traffic at the rate of λ packets/s increasing from 1 to 100 packets per second and other basic parameters are according to Table1.Now we simulate the parameters using Matlab and found results for Flooding and Adaptive-gossiping routing method and compare them and found result as given under:

5.1Expected hop count

As we previously defined the parameters to calculate the expected hop count between a random source and estimation pair by equation (5) where H denotes the number of hop counts. The Figure FIG2 shows the comparison for Flooding and Adaptive gossiping routing and found that we have less expected number of hop count in small-size network and large-size network in adaptive- gossiping as compared to flooding routing algorithm.

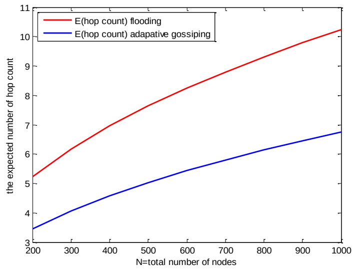

Fig. 2 The expected hop count between a random source and destination pair. The analysis results are compared with flooding and adaptive-gossiping according to equation (5) in a given network size of (1000×700) $m^2$with the total number of nodes from 200 to 1000.

5.2The Expected end-to-end delay E(D)

As we previously defined the parameters so that we can calculate the Expected end-to-end delay E(D) in transmission from source to destination is given by equation (31).The FIG 3,4,5,6 shows the results for flooding and Adaptive-gossiping routing algorithms in which we found that the packet size (32) bytes which is for voice traffic : the E(D) is between .0044 s and .8105s and the E(D) is between .0021s and .4338s for 200 nodes which represents a network with small low-traffic with a value of with λ =1. and 1000 nodes which represents a network with large high-traffic network with a value of which λ=100 and the packet size (512) bytes which is for video traffic: The E(D) is between.0499s and11.8184s and the E(D) is between .0235s and 5.3689s for 200 nodes with λ=1 representing a small low-traffic network and 1000 nodes with λ=100 representing large high-traffic network for Flooding and Adaptive-gossiping routing algorithms. Our Adaptive-gossiping has significantly less delay for voice traffic 52% lesser delay at small-traffic network than flooding and 47% lesser delay at large high-traffic network than flooding . Second our Adaptive-gossiping has significantly less delay for video traffic 52 %lesser delay at small –traffic network than flooding and 54.5% lesser delay at large high-traffic network than flooding.

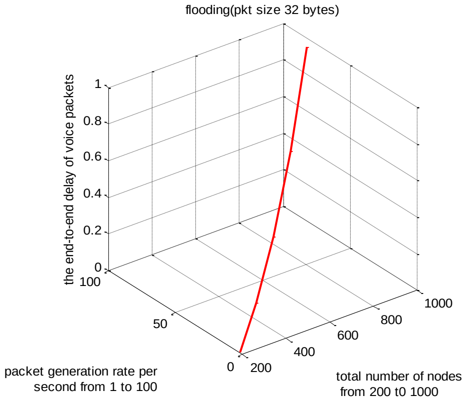

Fig. 3 flooding (pkt size 32 bytes)

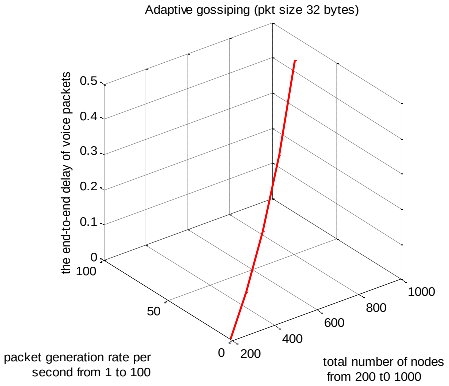

Fig. 4 Adaptive-gossiping (pkt size 32 bytes)

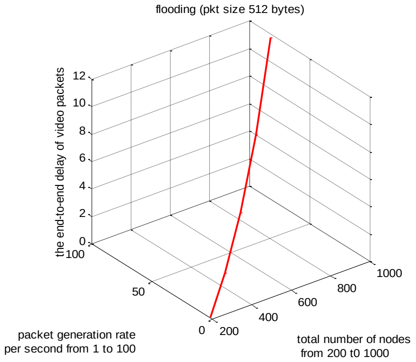

Fig. 5 flooding (pkt size 512 bytes)

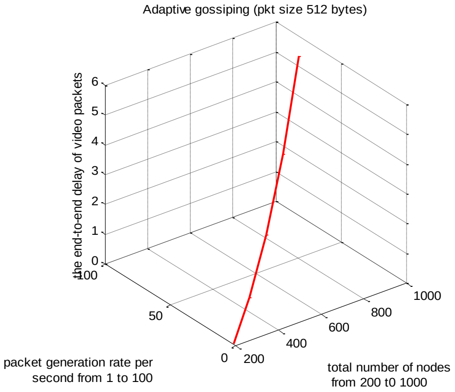

Fig. 6 Adaptive-gossiping (pkt size 512 bytes)

VI. CONCLUSIONS

We have proposed the queuing network model based on our Ad –hoc routing algorithm so that we can analyze low end-to-end delay and less overhead for bandwidth so that it can achieve maximum throughput for network based on ad-hoc in multimedia communication and also we have evaluated the performances of ad hoc routing protocols for algorithm based on adaptive-gossiping and flooding. Here our principal method in network based on queuing is the absorption probability which is defined by the transmission range of adaptive-gossiping for a high connectivity which is critical and which has probability pn, and which is improved in adaptive-gossiping as a routing performance with fewer hop-counts as a transmission node from source to destination as compared to flooding-based routing. The results of both analysis and simulation tests are based on the IEEE 802.11b since we have limited resources and have lower cost in networking of ad hoc wireless networks. As compared to flooding-routing problems we have made an important observation that results with adaptive-gossiping probability is reduced with routing overheads such that we have less end-to-end delay and less loss in packets transmission. All performance metrics suggest that our adaptive-gossip routing protocol can be sufficient to satisfy QoS requirements for voice/video communication as compared to flooding. This shows that QoS factors improve by using adaptive-gossiping method as compared to flooding so that can optimize the allocation in network resources among all flows and maximize a common performance objective for multimedia communication.

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AUTHORS:

Tanu Jain (F'24), is a Post Graduate Scholar, in Department of EC, IES IPS Academy, Indore, RGPV University Bhopal. She has received BE Degree in Electronics and Communication Engineering, from IET DAVV Indore in 2011. She was Lecturer in Truba Engineering College Indore in 2011. Her research interests are in Digital Communication, Wireless Communication, VHDL and Computer Network.

E-mail: tanu8smart@gmail.com

Rupesh Dubey (M'34), member of IETE New Delhi, did his BE Degree from RGPV University, Bhopal, in 2003 and received ME Degree from SGSITS Indore (An Autonomous body) all in Electronics and Telecommunication Engineering. He is currently serving on the post of Associate Professor in Dept of Electronics and Communication Engineering at IES Engineering College IPS Academy Indore, (RGPV University, Bhopal) where he teaches Analog and Digital Communication, Satellite Communication, Cellular and Mobile Communication and DSP. His Research interests are in Signal Classifications, Wavelet Transform, Computer Networking, MIMO Systems Higher Order Statistical Analysis etc.

E-mail:rupesh_dubey7@yahoo.co.in

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