QoS Optimization in Internet Gateway Discovery Proposal for MANETs

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Abstract— this paper presents the results of simulation work performed to enhance the Quality of Service (QoS) of WiFi Network using Internet Gateway Discovery.Ns2 has been used as the simulation tool with NAM support of animation and Tracegraph software to give the output results in the form of graphs. Simulation results show that the proposed scheme is having better quality of Service.

Key words: MANET, Internet Gateway Discovery, NS2, QoS

I. INTRODUCTION

NS2 generally is developed for execution on a Unix machine. Installing and running NS2 on windows machine is relatively difficult but most of the computers these days are windows based. The reason for this is that majority of text editing software and simulators available are windows based. In this simulation work NS2 was installed and run on a windows machine using cygwin environment. .NS2 has been used as the simulation tool with NAM support of animation and Tracegraph software to give the output results in the form of graphs. An attempt was made to enhance the Quality of Service (QoS) of WiFi Network using Internet Gateway Discovery. The graphs obtained show that the proposed scheme is having better quality of Service.

II. RELATED WORK

Zaman et al in their paper entitled "Mamdani Fuzzy Control based adaptive gateway discovery for ubiquitous Internet access in MANET" have described that Ubiquitous Internet access has become a reality with the proliferation of mobile devices. One of the architectures which has the potential to abet ubiquitous Internet access is the Integrated Internet MANET architecture, which is an interconnection of the wired Internet with wireless MANET. Gateway discovery and gateway load balancing are important issues in Integrated Internet-MANET and have been addressed separately in the literature. In this paper a new solution which addresses these two issues together is proposed. In the proposed mechanism, the problem of finding efficient values to gateway discovery parameters is treated as a control system which uses the Mamdani Architecture for Fuzzy Control. Gateway load balancing is achieved through the WLB-AODV routing protocol. The proposed protocol has been simulated in ns-2 network simulator. Simulation results show that the proposed protocol gives better packet delivery ratio and comparable end to end delay to the existing solution [1].

Zaman et al in their paper entitled "Load balanced fuzzy control based adaptive gateway discovery in Integrated Internet MANET" have described Integrated Internet-MANET (IIM) architecture which is a hybrid network and an interconnection of the wired Internet and wireless MANET. This interconnection is facilitated through gateways. Some of the important issues in this integration are gateway discovery and gateway load balancing. So far, these issues have been addressed separately in the literature. The issues of gateway load balancing and gateway discovery are inherently interrelated. In this paper, the issues of gateway load balancing and gateway discovery are addressed together. The proposed mechanism uses the WLB-AODV routing protocol for gateway load balancing and treats the problem of finding efficient values to gateway discovery parameters as a control system and uses the Mamdani Architecture for Fuzzy Control. The proposed protocol has been simulated in ns-2 network simulator. Simulation results show that the proposed protocol gives better performance than the existing solution in terms of packet delivery ratio, end-to-end delay and normalized routing load [2].

Manoharan et al in their paper entitled "A trust based Gateway selection scheme for integration of MANET with Internet" have stated that a lot of research has been carried out in the field of integrating MANET with Internet. The main challenge in this direction can be grouped into four categories: addressing, routing, gateway and mobility issues. Of these, the Gateway has grabbed the attention of most researchers as it is dual interfaced and serves as a liaison between the mobile node in the MANET and the fixed node in the internet. This paper focuses on a trust based Hybrid Gateway selection scheme. Several Gateway selection schemes were proposed that uses either single or multiple metrics that employs only the Gateway related metrics such as mobility, residual energy, etc. These schemes doesn't guarantee that the path established with the Gateway is secure as the path may include numerous malicious nodes or selfish nodes or even congested nodes that may drop the packets it receives without forwarding. To overcome this situation and provide an end-to-end security, it is necessary to select a Gateway that can be reached via trusted nodes and uncongested route. In this paper, the authors propose a Gateway Selection scheme that considers a normalized security metric employing multiple security parameters such as node trust, route trust and residual route load capacity to select an optimal Gateway candidate node. The precise estimation and Gateway selection employing this normalized security metric are detailed in this paper [3].

Yonghang et al in their paper entitled “QoS-based gateway selection in MANET with Internet connectivity" have proposed a QoS-based gateway selection mechanism to select an appropriate gateway based on three QoS metrics: traffic load of gateway, path quality from MANET node to the gateway and hop count to the gateway for integrating MANET and the Internet. The Simple Additive Weighting method is used to combine these three QoS metrics to outrank the optimum gateway. Gateway with the smallest weight will be selected as a gateway. Simulation results show that the proposed scheme can improve packet delivery ratio and end to end delay [4].

Lacharite et al in their paper entitled "A Simplified Approach to Multicast Forwarding Gateways in MANET" have described that Simplified multicast forwarding (SMF) provides an optimized flooding mechanism in MANET environments to efficiently propagate multicast packets. The main difference between the SMF and traditional multicast routing is that no multicast tree is built and maintained, and no group membership management is needed. Therefore all the nodes in MANET receive the multicast information. However, a multicast border gateway is required in a MANET to interoperate with other multicast routing protocols in the wired domain as SMF does not make use of traditional multicast method. A MANET SMF gateway implementation solution addresses the issues encountered within the gateway configuration, such as interaction with the protocol independent multicast protocol (PIM). the results of a tested single-gateway MANET implementation have been presented, and a proposal for the multiplegateway scenario has been introduced. In the IETF MANET working group, the SMF design group also presents proposals for handling multiple gateways; they recommend to apply a <taggerID> to the multicast traffic when multiple gateways are injecting a flow into a MANET area. However this approach implies that equal multicast packets disseminated into the MANET by different gateways have different taggerlD, and hence these packets cannot be detected as duplicates. These approaches differs by preferring the use of hashing by the gateways for marking equal packets injected into the MANET, hence making these equal packets compliant for duplicate detection. This article demonstrates a successful implementation of the gateway functionality and extends its analysis by proposing a solution for the multiple-gateway configuration [5].

Yijun Mo et al in their paper entitled "Manet Node Based Mobile Gateway with Unspecific Manet Routing Protocol" have described that integrating mobile ad hoc network (Manet) with Internet will facilitate the trend to an all-IP wireless environment. In this paper, Yijun Mo et al propose a novel integration mechanism of Internet and Manet. In the architecture, Manet nodes (with or without mobile IP support) access the Internet using the mobile hosts with mobile IP as the gateways. It is superior to fixed gateway architecture. The mobile gateway registration, discovery, advertisement and invalidation algorithm have been developed in that infrastructure. The problem of load balance for multi-gateway can be alleviated with those algorithms. In addition, their technology does not rely on any specific Manet routing protocol [6].

Yi Fu et al in their paper entitled "Multi-Metric Gateway Discovery for MANET" have stated that Mobile ad hoc networks (MANETs) can be connected to the Internet via gateways to provide convenience of allowing mobile nodes in MANET to communicate with fixed nodes on the wired Internet. Current literature uses the number of physical hops to the gateway to decide which gateway the mobile node should connect to. However, gateway with shorter physical hops from mobile node may not necessarily be the ideal gateway, especially in a congested network with high channel contention. In this paper, physical hops, congestion level and contention level of route are combined as one single metric for gateway discovery. Using simulation, the performance of the combined metric for gateway discovery shows better performance compared to the current existing gateway discovery [7].

Matsuda et al in their paper entitled "On Gateway Selection Protocol for DYMO-Based MANET" have proposed that the coupling of mobile ad-hoc networks (MANETs) and the Internet is gaining attention by researchers working towards future ubiquitous computing environments. This work focuses on the situation that occurs when specialized, sensitive data are sent to the Internet from MANET nodes. These special data types are especially susceptible to security risks such as information leak and data falsification. Therefore, it is necessary for such special data to be forwarded by a secure/trusted gateway which is under control of a trusted network administrator. However, they assume there can be multiple gateways deployed in a MANET, where the cost ineffectiveness makes it difficult for a network administrator to simultaneously manage every gateway. Because of the risk of forwarding special data through an unmaintained gateway, Matsuda et al propose a routing protocol which allows a source node to have all data forwarded to the Internet through a trusted gateway. To achieve desirable performance, they improve upon one of the newest routing protocols, Dynamic MANET On-demand (DYMO). Through simulations, they evaluated their proposal in comparison with the conventional DYMO protocol. The results show that their proposal achieves performance allowing MANET source nodes to choose gateways for specific data [8].

Zaman et al in their paper entitled "Path Load Balanced-Fuzzy Logic based Adaptive Gateway Discovery in integrated Internet-MANET" have described a modified form of the hybrid gateway discovery in integrated InternetMANET. A modified hybrid gateway discovery approach has been termed an adaptive gateway discovery mechanism. Three issues have been considered together in the proposed adaptive gateway discovery: the load balancing in routing of packets, the range, and periodicity of a gateway advertisement message. These three issues have been addressed by making use of existing approaches. Based on simulation studies, it has been shown that this new approach gives better results than the existing approach [9].

Setiawan et al in their paper entitled "An Optimum Multiple Metrics Gateway Selection Mechanism in MANET and Infrastructured Networks Integration" have described that an optimum mechanism to select appropriate gateway based on multiple node metrics: remaining energy, mobility, and number of hops, for interconnected mobile ad hoc network (MANET) with infrastructure network. To choose an optimum gateway node, this paper use the multiple criteria decision making (MCDM) method called simple additive weighting (SAW) to outrank the optimum gateway node. SAW method calculates the weights of gateway node by considering these three metrics. Node with the highest weight will be selected as a gateway. Simulation results show that their scheme can improve throughput performance, gateway lifetime, and packet delivery ratio of MANET and infrastructure network [10].

Zaman et al in their paper entitled "Path Load Balanced Adaptive Gateway Discovery in Integrated Internet-MANET" have stated that an interconnection of mobile ad hoc network and wired Internet is called Integrated Internet-MANET. This interconnection is

achieved through gateways. There are two very important issues in Integrated Internet-MANET. First, path load balancing in the communication of mobile nodes with gateways. Second, mobile nodes register with a gateway before communication begins. This registration is achieved through agent advertisement messages. The issue is, for how many hops these gateway advertisement messages must be forwarded. This paper proposes a gateway discovery algorithm which addresses the above issues. Simulation results show that their approach outperforms the existing approach [11].

Khan et al in their paper entitled "An Effective Gateway Discovery Mechanism in an Integrated Internet MANET (IIM)" have stated that he Integration of the MANETs and infrastructure networks such as Internet, known as heterogeneous network, extends the network coverage and increases the application domain of the MANET. Communication between a mobile device in an ad hoc network and a fixed device on the Internet is achieved using gateways, which acts as a bridge between them. The ad hoc routing protocol AODV is extended and used to achieve interconnection between a MANET and the Internet. In the existing approaches of gateway discovery either interface queue length or the minimum hop metric criteria or a combination is used for selecting the gateway by the mobile nodes. In the proposed approach, an efficient proactive gateway discovery algorithm is devised that takes into account the length of the routing queue in addition to the minimum hop count metric for selecting an efficient gateway and also selecting the routes to other mobile nodes. This is a novel strategy of gateway discovery. This approach is implemented by calculating the load along a path and updating the routing entry as the route requests are processed from one mobile node to the other. This allows usage of updated routes without waiting for the gateway advertisements for updating the routing entries. It also reduces the delay along the path for the packets traversing within the ad hoc network. The use of this concept increases the throughput by choosing the less congested paths and reduces the routing overhead. In this paper the impact of this new approach is investigated. Simulation results indicate that their protocol outperforms other approaches [12].

Changui Shin et al in their paper entitled "Stable Gateway Selection Scheme based on MANET with Internet" have described that with ubiquitous computing; the interconnection of Mobile Ad Hoc Networks (MANET) to Internet is becoming current topic. There are advantages that MANET could organize an independent network without infra-structures. Accordingly to increase of interests about this MANET, Internet Gateway which provides MANET with the internet services is entering the stage as a new challengeable area. Nodes in the overlapped area owned by different Internet Gateway should solve a problem of the selection which Internet Gateway is used to support the internet services. Some solutions related to this selection problem considering environment of the MANET are not satisfactory. An existing alternative based on only the hop counts to choose its gateway have the drawbacks of an exponential decrease of the throughput, because of the node mobility. In this paper they proposed new scheme considering the specific character of node mobility. This proposed scheme could increase throughput of the whole network [13].

Yuste et al in their paper entitled "An Adaptive Genetic Fuzzy Control Gateway Discovery to Interconnect Hybrid MANETs" have stated that in wireless communication, Mobile Ad Hoc Network (MANET) is a set of mobile nodes that are dynamically and randomly located in such a manner that the wireless link among nodes are often changing due to MANET dynamic features. In this MANET environment, if a device wants to connect to Internet, it must establish a communication with an Internet Gateway. The network performance between mobile nodes and Internet Gateway is affected by the stability, connectivity and network traffic load. The complex interactions among these parameters can be modelled using fuzzy set theory. This paper uses Artificial Intelligence (genetic algorithm and fuzzy system) to tune, adaptively, the control system that uses the gateway discovery schemes. The performance of fuzzy control is evaluated using simulation, and it is compared to others adaptive schemes explained in literature [14].

Majumder et al in their paper entitled "Implementation and performance analysis of the gateway discovery approaches in the integrated MANET-Internet scenario have stated that Most of the research in the field of ad hoc network is limited to stand-alone isolated networks. In order to facilitate the users with the huge pool of resources together with the global services available from the Internet and for widening the coverage area of the MANET there is a growing need to integrate these ad hoc networks to the Internet. For this purpose they need gateways which act as bridges between these two different protocol architectures. The gateway discovery in hybrid network is considered as a critical and challenging task and with decreasing pause time and greater number of sources it becomes even more complex. Due to the scarcity of network resources in MANET, the efficient discovery of the gateway becomes a key issue in the design and development of future hybrid networks. In this paper the AODV reactive routing protocol is extended to support the communication between the MANET and the Internet. Majumder et al have described the design and implementation of the various gateway discovery approaches and carried out a systematic simulation based performance evaluation of them using NS2 under different network scenarios. The performance differentials are analyzed on the basis of three metrics - packet delivery fraction, average end-to-end delay and normalized routing load [15].

Saltzman et al in their paper entitled "Optimal number of gateways for mobile ad-hoc networks (MANET) with two subnets" have described that early designs of mobile ad-hoc networks (MANETs) assumed they could be scaled to very large topologically flat networks where every node in the network has equal capability and access to the wireless channel. This assumption was called into question in 2000 by Gupta and Kumar who established an asymptotic theoretical limit for node capacity as the number of nodes in a single channel MANET becomes large. Recent field experiments have confirmed that this theoretical limit may be difficult to overcome. To address MANET scalability alternative MANET designs have been developed in which a wireless channel are shared by only a subset of the entire

collection of network nodes. Subnets are then linked by gateway nodes that operate on two or more channels and provide connectivity across the entire network. In these MANET designs gateway nodes transmit and receive on multiple subnets and can become bottlenecks in the network if there are too few gateways. On the other hand, if the network contains many gateways, then too much subnet bandwidth may be allocated to gateways and insufficient bandwidth allocated to single channel nodes. This paper examines the design of MANETs based on two subnets and determines the optimal number of gateway nodes which maximizes overall network performance for a uniform message traffic loading [16].

Khan et al in their paper entitled "An effective gateway discovery mechanism in an integrated Internet MANET (IIM)" have proposed that Ad hoc networking allows portable devices to establish communication independent of a central infrastructure. The Integration of the MANETs and infrastructure networks such as Internet extends the network coverage and increases the application domain of the MANET. Communication between a mobile device in an ad hoc network and a fixed device on the Internet is achieved using gateways, which acts as a bridge between them. The ad hoc routing protocol AODV is extended and used to achieve interconnection between a MANET and the Internet. In the existing approaches of gateway discovery either interface queue length or the minimum hop metric criteria or a combination is used for selecting the gateway by the mobile nodes. In the proposed approach, an efficient proactive gateway discovery algorithm is devised that takes into account the length of the routing queue in addition to the minimum hop count metric for selecting an efficient gateway and also selecting the routes to other mobile nodes. This is a novel strategy of gateway discovery. This approach is implemented by calculating the load along a path and updating the routing entry as the route requests are processed from one mobile node to the other. This allows usage of updated routes without waiting for the gateway advertisements for updating the routing entries. It also reduces the delay along the path for the packets traversing within the ad hoc network. The use of this concept increases the throughput by choosing the less congested paths and reduces the routing overhead. In this paper the impact of this new approach is investigated. Simulation results indicate that their protocol outperforms other approaches [17].

Yuste et al in their paper entitled "Improved Scheme for Adaptive Gateway Discovery in Hybrid MANET" have described that this paper presents an adaptive scheme for gateway discovery in MANETs connected to the Internet. Basically, the proposed scheme reduces the flooding processes related to gateway discovery. To do so, the algorithm dynamically adjusts the interval of emission of the gateway advertisement messages to the need for updated routes to the gateway. The tuning is supported by the analysis of the spatial distribution of nodes in the MANET and by the impact that the relative position of nodes has on the route lifetimes. The simulations show that the proposed adaptive mechanism outperforms the conventional schemes: it decreases network saturation while it achieves lower end-to-end delay and it minimizes the routing overhead [18].

Xu Zhanyang et al in their paper entitled "A Simplified Scheme of Internet Gateway Discovery and Selection for MANET" have stated that when the mobile ad hoc network (MANET) is connected to the Internet, it is important for the mobile nodes to detect available Internet gateway (IGW) providing access to the Internet. This paper proposes a new structure-virtual MANET (V_MANET) for MANET to connect with Internet. In the structure, the IGWs are seen as a fixed node in MANET and act as a proxy server in the local area network (LAN). At the same time, paper develop the IGWs discovery, deleting IGW, exchanging IGW INFO between two neighbour nodes and IGW selection algorithm applied in the V_MANET. The result of evaluation shows that their architecture and these algorithms can improve network performance and is more efficient [19].

Gupta et al in their paper entitled "A trust based secure gateway selection and authentication scheme in MANET" have proposed that Mobile Ad hoc Network (MANET) is a collection of self-configuring, infrastructure less mobile nodes that dynamically form a temporary network and capable of communicating each other without the use of network infrastructure. Due to the open medium, dynamic topology, distributed co-operation Ad hoc networks are vulnerable to many types of security attacks. An important concept in network security is trust; it is estimated as a relation among the entities that participate in various protocols. Trust relations are based on evidence related to the previous behaviour of entities within the protocol. In this paper, Gupta et al focus a trusted route selection value between mobile node and secure gateway which is based on trust values of nodes, trust value of route and residual route load capacity and they also focus mobile node and secure gateway authentication process which is based on pre-authentication technique. To provide a host-to-host security, it is important to evaluate secure trusted route towards the secure gateway and authenticate mobile node and secure gateway. It can be achieved in proposed scheme. Their proposed protocol provides better performance as compared to other protocols. The correctness of their proposed scheme is validated through simulation results and performance evaluation matrices [20].

Zaman et al in their paper entitled "A review of gateway load balancing strategies in Integrated Internet MANET" have described that interconnection of wired Internet and wireless mobile ad hoc networks, called Integrated Internet-MANET enables communication between wired and wireless peers. Many strategies exist which provide Internet connectivity to the mobile ad hoc network nodes through one or more Internet gateways. Mobile nodes need to be registered with an Internet gateway in order to communicate across the Internet. A key issue in such strategies is to distribute the Internet bound traffic across the Internet gateways evenly. The problem of Internet gateway load balancing has been addressed by researchers in interesting ways. In this paper, they present a review of the gateway load balancing solutions under common parameters. In the second part of the paper, a new gateway load balancing strategy based on a load balanced routing protocol called Modified AODV is proposed and is simulated using the ns-2 simulator [21].

Baniya et al in their paper entitled "Internet Gateway Routing for MANET" have described that much

QoS Optimization in Internet Gateway Discovery Proposal for MANETs attention is drawn for integrating MANET with Internet in order to extend network coverage and applications domain of ad hoc networks. In this paper, they propose a modified Dynamic Sequence Routing method for providing a route between MANET and Internet through a gateway. In the proposed scheme, they introduce a flag field in the packet to differentiate whether the packet is destined to MANET or to Internet. The gateway provides network address translation functionality by maintaining a table for mapping between the local and the global addresses. In order to verify the performance of their system they have run a set of computer simulations using the OPNET modeller. The performance in terms of through and delay are compared with those of the conventional method. The simulation results show that their method is superior to the conventional method [22].

Tsung-Chuan Huang et al in their paper entitled "Hybrid routing protocol using Core Gateway Relay in MANETs" have described that a MANET (Mobile Ad hoc Network) is a network with the features of infrastructure less, multi-hop, self-configuring, and distributed-routing, which are quite different from a traditional wired network. Since nodes in a MANET are free to move, causing the topology of the MANET to change frequently, a routing protocol able to accommodate the rapidly changed topology is required. The MANET routing protocols can be classified into three categories based on routing information update mechanism: (1) proactive/table-driven protocol (2) reactive/on-demand protocol (3) hybrid protocol. Each category has its own advantages and disadvantages. Among these, the hybrid protocol tries to combine the advantages of proactive and reactive ones. This work presents a novel hybrid routing protocol - CG2R (Core Gateway Relay Routing Protocol). The CG2R partitions a network into several regions called zones. The proactive mechanism is used within the zone, while the reactive one is applied outside the zone. Each zone contains at least one core gateway. The core gateway covers more cells and manages more nodes than the general gateway to reduce the possibility for a node moving out the zone. Based on this feature, the core gateways hereby constitute the backbone of the routing path. Unlike conventional cluster-based routing protocols which rely on the algorithm using certain factor such as ID number or Weight to elect cluster heads, in CG2R, the node itself can decide it is a core gateway or not by using the algorithm they devise. The simulation results reveal that CG2R is more scalable and efficient than CGSR and AODV protocols [23].

Xin Li et al in their paper entitled "A Gateway Discovery Method for MANET Accessing Internet Based on Overhead Control" have stated that looking for usable gateway is a process, which brings the biggest overhead, in MANET accessing Internet. For controlling the routing overhead effectively, a gateway discovery method for MANET accessing Internet based on overhead control, which is according to the similar between ant searching path and mobile node searching gateway, is proposed in this paper. By simulating the pheromone's update process in ant colony algorithm, this method uses information carried in route reply packet to update gateway pheromone. According to the pheromone density on the link, link bandwidth and delay, the node computes transmission probability and transmits the route request packet. This method is simulated by NS2.29. The test result indicates that though it increases average delay appreciably, it reduces normalized routing overhead effectively and increases packet delivery radio. The validity of the method is validated [24].

Bagwari et al in their paper entitled "Enhancing the MANET Nodes of Hierarchical Architecture for Communication between Mobile Ad Hoc Network and Internet Using Cluster Head Gateway," have proposed that Mobile Ad hoc network their Nodes are highly mobile. They move around the Network. Due to this network topology and number of neighbouring nodes in each node frequently change. Movement of nodes from one to another network also affect to the communication between them. To connect the wired and wireless networks particularly the Mobile ad hoc Network is very interesting in real world situations due to its popularity and usefulness. As in paper, given and explained a approach in which cluster head and gateway will be same and that node is known as cluster head gateway (CHG), in which all the responsibilities of cluster head and gateway will be perform by the CHG and introduces the prediction table concepts and discusses a mechanism for selecting an alternate route in case if the CHG is unable to forward the packets to the destination, This approach providing Bi-directional connectivity between MANET and wired Nodes. In this paper extending the network coverage and the performance measured with other large N/w's. Finally, this paper conducts simulation experiments in the conditions where they connecting MANET nodes to the wired nodes using different networks [25].

Morgan et al in their paper entitled "A design framework for wireless MANET QoS gateway" have stated that the peculiar nature of the mobile ad-hoc networks (MANET) imposes several challenges when designing quality of service solutions. Traffic travelling on a MANET network can be local traffic arriving from and targeting a node within the ad-hoc network. Traffic that is not local to MANET is likely to travel over fixed topology networks that employ, typically, DiffServ. This paper proposes employing a new framework at the gateway between the ad-hoc domain and the DiffServ access domain. The proposed framework facilitates a homogeneous seamless QoS interaction between both networks built over heterogeneous components. The objective is to achieve a high level of performance and autonomy with a lightweight implementation, if any, on mobile nodes. In this paper they propose the framework solution to the cross-domain QoS problem and use the aggregate resource reservation (ARSVP) for collective resource reservations, combined with a simple sponsorship mechanism [26].

Saluja et al in their paper entitled "A scenario based approach for gateway discovery using Manet routing protocol" have described that the mobile adhoc networks have become a major component of the future network development due to their ease of deployment, self configurability, flexibility and independence on any existing network infrastructure Mobile ad-hoc network have the attributes such as wireless connection, continuously changing topology, distributed operation and ease of deployment. Saluja et al present a design space analysis of the problem of providing Internet connectivity for mobile ad

hoc networks (MANETs). Currently there are a plethora of proposals to solve this problem in the research community. However, they argue that many of the existing designs suffer from complexity and design solutions that have not been properly evaluated. One reason for this is the lack of implementations. For widening the coverage area of the MANET there is a growing need to integrate these ad hoc networks to the Internet. For this purpose they need gateways which act as bridges between these two different protocol architectures. The gateway discovery in hybrid network is considered as a critical and challenging task. In this paper the AODV reactive routing protocol is extended to support the communication between the MANET and the Internet. Saluja et al have carried out a systematic simulation based performance evaluation of the different gateway discovery approaches using NS2 under different network scenarios. The performance differentials are analyzed on the basis of three metrics - packet delivery fraction, average end-to-end delay and normalized routing load [27].

Jieying Zhou et al in their paper entitled "Cluster Based Gateway-Aided Multicast Routing Protocol in MANET" have described that MANET is a special wireless network with a great capability in multicasting because of its physical broadcasting feature. There appear several multicast routing protocols which perform well enough in small- scale networks, but the performance of such protocols becomes poorer as the network scale gets larger and the mobility of nodes increases. Based on the analysis of popular multicast protocols for MANET and the study of the features of large-scale ones, this paper proposed a new multicast routing protocol aiming at networks of many nodes: CGMRP, Cluster-based Gateway-aided Multicast Routing Protocol in MANET. In CGMRP, gateways can share some multicast routing task from the cluster heads in order to reduce the risk of single point issue of the leader nodes. CGMRP has been simulated on OPNET Modeller for its overall performance evaluation. Simulation results show that CGMRP is able to work well for the multicast routing in large-scale MANET [28].

Xu Zhanyang et al in their paper entitled "A Scheme of Multipath Gateway Discovery and Selection for MANET Using Multi-Metric" have stated that when the mobile ad hoc network (MANET) is connected to the Internet, it is important for the mobile nodes to detect available Internet gateway (IGW) providing access to the Internet. They propose a new approach of IGW discovery and selection for MANET to connect with Internet. In the scheme, the multi-path is used to find all paths to IGW by source node in MANET, and multi-metric is used to select the optimum path to IGW. The result of evaluation shows that performance of the new approach is better than others' [29].

III. SIMULATION SETUP

Two simulation models were constructed. First model was without the internet Gateway A screenshot of the simulation scenario is shown in Figure 1.

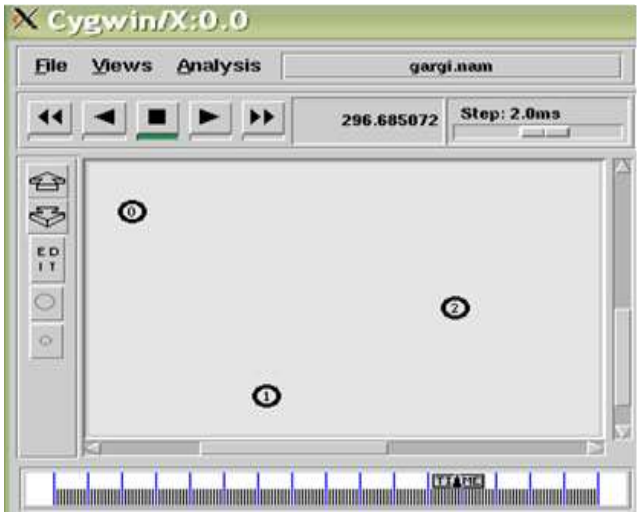

Fig. 1: Screenshot of the simulation scenario for simple wireless.

The second simulation model incorporated Internet Discovery Gateway and a screenshot of the simulation scenario is shown in Fig. 2.

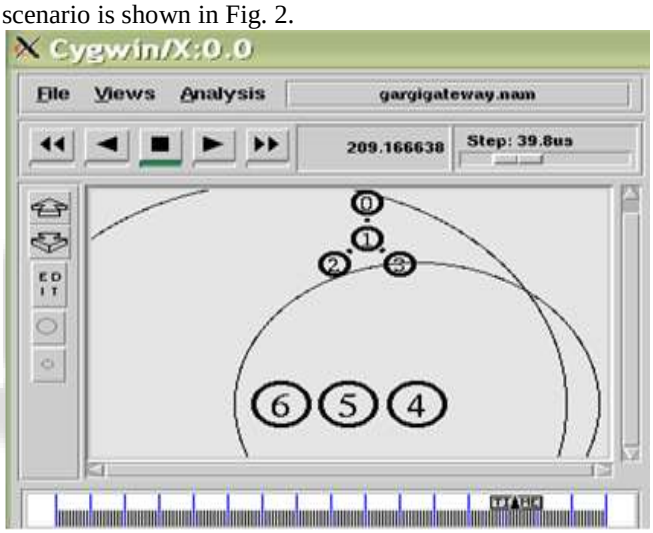

Fig. 2: Screenshot of the simulation scenario for wireless with gateway.

IV. SIMULATION RESULTS

A. *End-to-end Delay:*

The graphs given below give the comparison of QoS of wireless simulation models using Internet Discovery Gateway and without incorporating the Gateway.

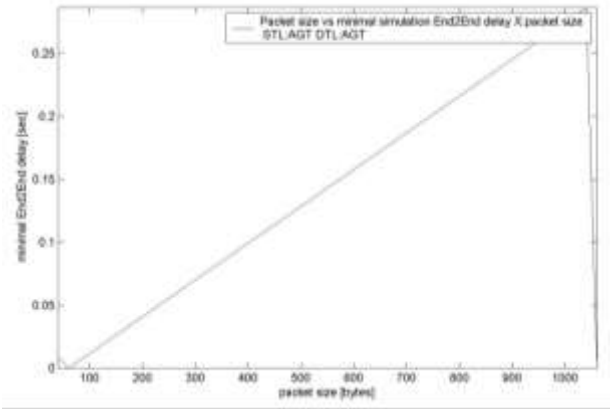

Fig. 3: simulation End-to-end Delay of wireless with getaway.

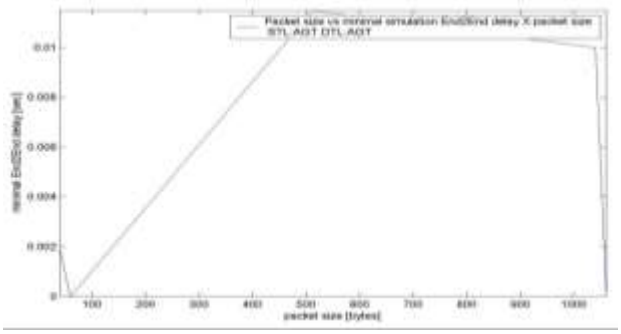

Fig.. 4: simulation End-to-end Delay without gateway.

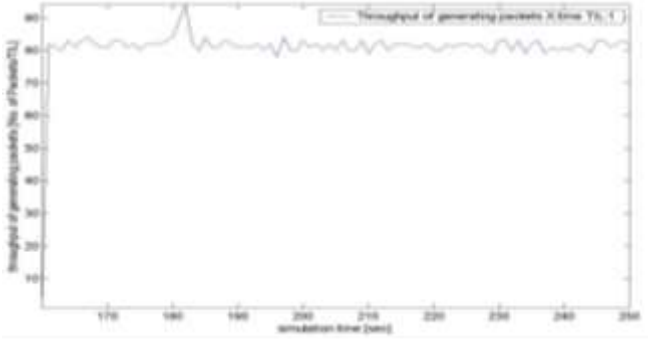

Fig .5: throughput of generating packets for wireless with gateway.

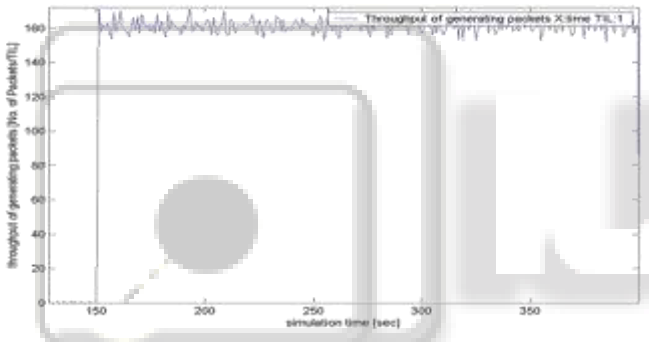

Fig. 6: throughput of generating packets for simple wireless.

V. Conclusion & Future Scope

It is evident from the graphs that there is a significant difference in the QoS of WiFi Network with Internet Discovery Gateway and without the Internet Discovery Gateway. In this work two parameters of QoS have been compared. This work can be extended to show the results of packet loss. Moreover in this paper only the WiFi network has been considered but in future simulation studies can be performed to study other networks like WiMax and WSN.

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