Abstract- The deployment of Wireless Mesh Networks (WMN) results in different topologies and node locations. These two factors affect the performance of the network. A review of the literature has shown that the impact of node location in the network has received relatively little attention so far. Nodes in the network may experience huge gaps in utility according to their location in the network topology. Although there is research done, there is still much to be done in evaluating the effect of the nodes in the network. In this paper we propose to study the effect of node location relative to the Internet Gateways in different types of traffic distribution, experienced on different types of Quality of Services (QoS) mechanisms. The evaluations will be done through simulation. The remainder of the paper aims to provide an outline of the research being conducted to further investigate the effect of node’s location in Infrastructure Wireless Mesh Networks.

Index Terms - QoS, Routing Protocols, Transport Layer Protocols, Internet Gateways, Node Location

I. INTRODUCTION

Wireless mesh networks is a developing wireless technology which has the potential to change the way wireless communication services are delivered [1]. Wireless mesh networks can provide unbroken broadband connectivity to network users with low setup and maintenance costs, to sustain next generation applications with real-time requirements. However, these networks must provide improved quality of service guarantees. A network of mesh routers can be used to provide infrastructure/backbone services to mesh clients. Such a network is called an Infrastructure WMN [2]. See Figure 1.

The mesh routers form a mesh of self-configuring, self-healing links among themselves. This feature brings many benefits for the end-users, such as low up-front cost, easy network maintenance, robustness, and reliable service coverage.

One of the challenges in WMN is Quality of service (QoS) provisioning. Delivering QoS requires effective Routing Protocols and Transport Layer Protocols. The nodes in the network must maintain mesh connectivity. Research [3][4] has shown that there is a relationship between QoS and node location. In this research, however we assess the effect of node location relative to the Internet Gateway on QoS mechanisms. This study will use both the uniform and non-uniform node distributions.

Figure 1 Infrastructure/backbone WMNs [2]

II. LITERATURE REVIEW

Some research has studied the effect of the node location in the network, but the studies were done in different network domains [3], [4]. The studies in [3] and [4] looked at the impact of the node relative to the center of the network. The study in [3] showed that the nodes at the center of the network are much heavily-loaded than the nodes at the edge of network. To evaluate the performance of the nodes, only two types of routing protocols were used: proactive: Optimized Link State Routing (OLSR) and the reactive: On-demand Distance Vector (AODV). They also used uniform node distribution evaluated under different QoS mechanisms. Load-balancing mechanism was proposed that will help push the traffic away from the center of the network [3].

The study in [4] also showed that the nodes at the center of the network uses smaller transceiver power compared to the nodes at the network edge. Plain TC-scheme was proposed in study [4], this scheme was able to maintain the network connectivity, achieve transceiver power savings and reduce MAC-level contention.

Though studies have been done to evaluate the effect of the node relative to the center of the network; there are short-comings in the work done. Further investigation is warranted to determine the actual extent of the influence of the node to the Internet gateway on QoS experienced, and the evaluation to be done in different traffic distribution. The
QoS mechanisms being considered include routing protocols (reactive, proactive and hybrid) and transport layer protocols (TCP Variants, UDP Variants, Hybrid Transport Layer Protocols, and Entirely New Transport Layer Protocols).

III. PERFORMANCE EVALUATION
A. EXPERIMENTAL SETUP
In this research we will use Network Simulator-2 (ns-2) version 3.4 running on Linux Ubuntu 9.10. This simulator was chosen because it supports networking research and education. It is also suitable for designing new protocols, comparing different protocols and traffic evaluations. A large amount of institutes and people in development and research use, maintain and develop NS-2.

The QoS mechanisms to be evaluated will be
1. Routing Protocols
The goal of a routing protocol is to find a routing path for any source-destination pair but also to achieve the best performance. The following protocols will be evaluated:
   a. Proactive – OLSR
   b. Reactive – AODV
   c. Hybrid – WMNP

2. Transport Layer Protocols
Transport layer protocol transport data traffic over a network. The following protocols will be evaluated:
   a. TCP Variants
   b. UDP Variants
   c. Hybrid TLPs
   d. Entirely New TLP

The following parameters will be varied to gain a comprehensive analysis:
   a. Node distribution
   b. Transmission rate
   c. Distance from the center of the network
   d. Traffic Overhead

B. PERFORMANCE METRICS
In our simulation we will use the following metrics for comparison:
   a. *End-to-end delay* - an expression of how much of time it takes for a data packet to get from the source to the intended destination.
   b. *Packet delivery fraction* – is the fraction of successfully sent and delivered packets.
   c. *Packet loss ratio* – is the percentage number of sent packet that never reached the intended destination.
   d. *Throughput* – indicate how many packets can be transferred and delivered successfully at a given amount of time.

This study will be looking at the following scenarios: 1) Uniform node distribution with one Internet Gateway, 2) Uniform node distribution with multiple Internet Gateways, 3) Non-Uniform node distribution with one Internet Gateway, 4) Non-Uniform node distribution with multiple Internet Gateways.

IV. CONCLUSION
Prior investigation has been conducted on the evaluation of the effect of a node location relative to the center of the network. The study in [3] has looked at Load-Balancing mechanisms. The study in [4] has looked at the Topology Control scheme. This study proposes to evaluate the effect of the distance of a node location relative to the Internet Gateway, where the majority of the network traffic is either to or from the Internet Gateway.

REFERENCES

*Nombuso Sibeko* received her Honors degree in 2005 from the University of Zululand and is presently studying towards her Master of Science degree at the same institution. Her research interests encompasses Quality of Service in WMN.