

Designing of Wireless Distribution System Network (WDSN) Model

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Abstract

Wireless network offers convenience, cost effectiveness, and easiness of integration with other networks and network components without coursing much technical hitches, hence is easier to setup and maintain, in this paper Wireless Distribution System Network (WDSN) has been developed using Wireless Distribution System (WDS) to demonstrate bridging of Wireless Local Area Networks (WLANs). Optimized Network Engineering Tool (OPNET) was used to develop and simulate the model; the network was set to run web browsing, E-mail, audio streaming, and FTP (File Transfer Protocol). Simulation was run and the results obtain shows significant web page response time, media access delay and higher throughput that correspond with International Telecommunication Union (ITU) standard of 0 to 150 (ms)

1. Introduction

Wireless networking is quickly becoming the "defacto" standard in home and small business networking. There are more than a few reasons for this, but for the most part it is done because it is cheaper and easier to setup and maintain. The problem arises when you cannot cover the entire area you need to with a single wireless device. This requires setup a repeater in line from your source wireless device. With WDS you put multiple wireless devices into bridge mode, but without the need for wired connections between them, it was first introduced around 2005-2006 as an alternative to the standard repeater modes. [3]

In telecommunication networks, a bridge is a product that connects a local area network (LAN) to another local area network that uses the same protocol (for example, Ethernet or token ring). You can envision a bridge as being a device that decides whether a message from you to someone else is going to the local area network in your building or to someone on the local area network in the building across the street. A bridge examines each message on a LAN, "passing" those known to be within the same LAN, and forwarding those known to be on the other interconnected LAN (or LANs) [1], you can build large bridged wireless networks using Wireless Distribution System (WDS) . WDS allows access points to communicate with one another wirelessly in a standardized way [2]

WDS works well and require the use of MAC (Media Access Control) to establish the links in the WDS group. This brings the connectivity down to the Data link layer of the OSI model, which is one layer below traditional IP based connectivity (IP based communication is layer 3) [3]

OPNET's IT Guru provides a Virtual Network Environment that models the behavior of networks, including its routers, switches, protocols, servers, and individual applications. The Virtual Network Environment allows IT managers, network and system planners, and operation's staff to more effectively diagnose difficult problems, validate changes before they are implemented, and plan for future scenarios such as traffic growth and network failures [5].

You can do "what if" analyses (called scenarios in IT Guru) on network designs, just as you can on spread sheets with financial business models. However, instead of looking at "bottom line"

financial numbers, you will be looking at how response times, latency (delays) and other network performance measures will change under different network design approaches.

EOC5611P is a powerful, enhanced, enterprise scale product with 4+1 multi-functions Access Point, Access Point with WDS function, Client Bridge, WDS Bridge, and Client Router. EOC5611P is easily to install almost anywhere with Power over Ethernet for quick outdoor installation. EOC5611P can manage power level control, Narrow bandwidth selection, Traffic shaping and Real-time RSSI indicator. EOC5611P is fully support of security encryption including WI-Fi Protected Access (WPA-PSK/WPA2-PSK), 64/128/152-bit WEP Encryption and IEEE 802.1x with RADIUS accounting [4]

2. Methodology

To build a network model Optimized Network Engineering Tool (OPNET) has a workflow which is used to create network models, the workflow is in sequence as follows: create network model and configure, collect statistics, run simulation, view result and analyse

The WDS wireless model was designed using Engenius device (EOC5611P)

2.1 Preparation

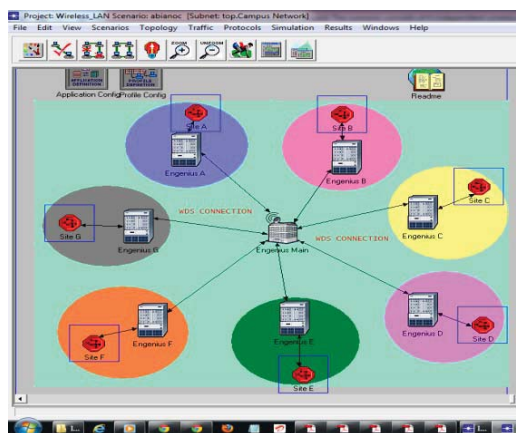
Start OPNET IT Guru Academic Edition. Guru Academic Edition, where x.x is the software version (e.g., 9.1).



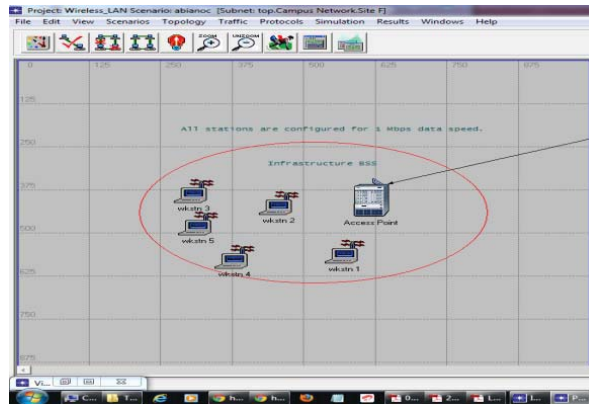
Source: OPNET IT guru

2.2 WDSN Model

To create a network model, you specify the nodes (computers, switches, routers, etc.)



The model consist of seven different wireless LANs (WLANs) located apart from each other, the WLANs were linked using WDS with Engenius device (EOC5611P).



2.3 Wireless Local Area Network (WLAN)

The WLAN is made up of access point (AP) connected to EOC5611P, WIFI devices in turn connect to the AP, The model was set to run, web browsing, E-mail, audio streaming, and FTP (file transfer protocol).

With WDS Bridge Mode, the EOC5611P can wirelessly connect different LANs by just simply configure each other's MAC Address and Security Settings. This mode is used when two wired LANs locate in small distance and want to communicate each other. WDS Bridge Mode can establish 16 WDS links [9].

The connection diagram is like a Star



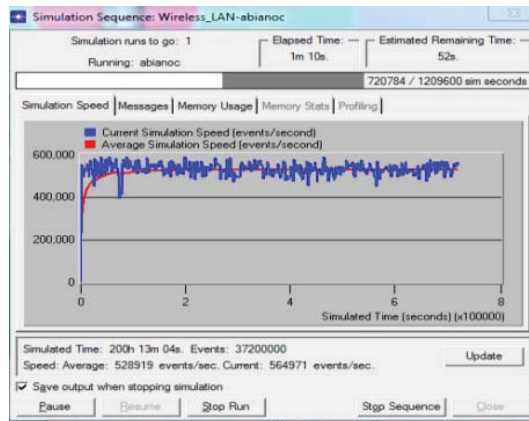
Source: <http://www.senao.com>

2.4 Statistics

The following statistics were collected on the model; pages respond time (sec), the throughput that is (bytes/sec), to determine how many bytes-per-sec can be transferred from one node on the wireless network to another, HTTP response time (sec)

2.5 Simulation

The simulation was run with respect to the statistics mentioned above, below is the simulation sequence dialog box showing the simulation progress of the model:



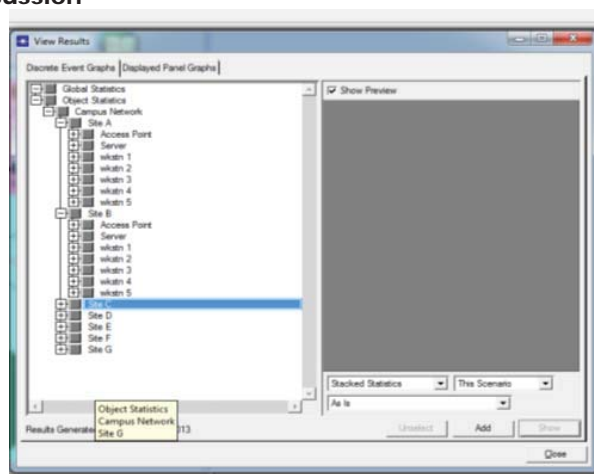
3. Response Time Benchmark

When you design networks that transport voice over packet, frame, or cell infrastructures, it is important to understand and account for the response time delay in the network. If you account correctly for all potential delays, it ensures that overall network performance is acceptable. The International Telecommunication Union (ITU) considers network response time delay in Recommendation G.114. This recommendation defines three bands of one-way delay shown in Table 5.1 (CISCO, 2006) [6].

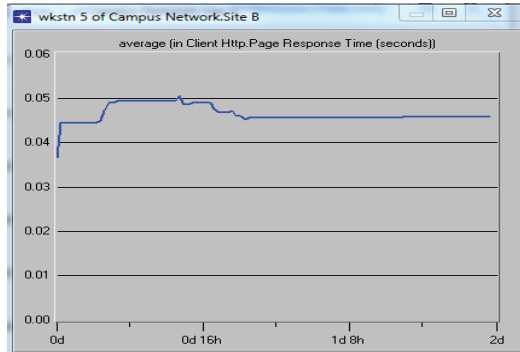
Range in Milliseconds	Description
0-150	Acceptable for most user applications.
150-400	Acceptable provided that administrators are aware of the transmission time and the impact it has on the transmission quality of user applications.
Above 400	Unacceptable for general network planning purposes. However, it is recognized that in some exceptional cases this limit is exceeded.

Table 1. Delay Specifications

4. Results and Discussion

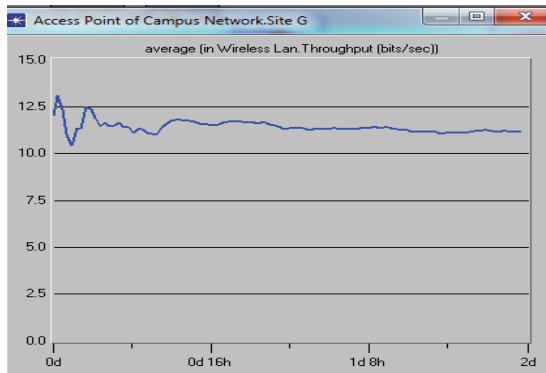


4.1 Page Response Time Results



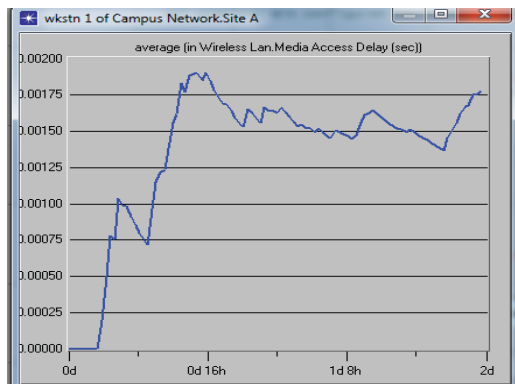
The average page response time obtained is 46.4 (ms) and this shows a significant response time, hence is within the International Telecommunication Union (ITU) standard of 0-150 (ms)

4.2 Wireless LAN throughput



The average throughput obtained is 12.21 (bits/sec), this gives a throughput that is significant WDS devices

4.3 Media Access delay



The average media access delay of the model obtained was 0.001348 (ms), the results shows marginal media access delay on the network.

5. Conclusion

In this paper Wireless Distribution System Network (WDSN) has been developed using Wireless Distribution System (WDS), the paper discuss the benefits of wireless Distributed System technology and demonstrated the methodology of bridging Wireless Local Area Networks (WLANs). The WDSN network was designed and simulated using OPNET IT Guru and was set to run web browsing, E-mail, audio streaming, and FTP (File Transfer Protocol). The results obtained shows significant web page response time, media access delay and higher throughput.

Reference

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