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A Competitive Performance Analysis Between Virtual Access Point and Traditional Access Point in Terms of Number of Clients

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Abstract

WiFi is becoming a very popular technology now a days as a means of broadband wireless access. Hotspots which are running on very typical Access Points are widely used in the whole world to fulfill the demand of modern civilization .A number of new ideas have already been developed to replace the traditional WiFi Access Points with new technologies. This paper presents a clear performance comparison between a traditional access point and a virtual access point in terms of data transfer rate with respect to number of clients. Experimental result shows that Virtual Access Point always provides a pretty better data rate for all cases of different numbers of users.

Keywords: WLAN, Wi-Fi, Virtual Access Point, Hotspot.

1. INTRODUCTION

Wi-Fi is a wireless standard for connecting electronic devices. A Wi-Fi enabled device such as a personal computer, video game console, smart phone, and digital audio player can connect to the Internet when these are within a range of a wireless network connected to the Internet. A single access point (or hotspot) has a range of about 20 meters for indoor. Wi-Fi has a greater range in outdoors and multiple overlapping access points can cover large areas."Wi-Fi" is a trademark of the Wi-Fi Alliance and the term was originally created as a simpler name for the "IEEE 802.11" standard [1].

The IEEE 802.11 standard has two basic modes of operation: ad hoc mode and infrastructure mode. In ad hoc mode, mobile units communicate directly with each other. In infrastructure mode, mobile units communicate through an access point [2].

If we are to compare ad hoc with infrastructure mode then infrastructure mode provides much more stability, scalability, ease of management and improved security. Ad hoc on the other hand does not provide security to that level and managing can be difficult in case of network growth. Performance suffers as we increase devices as well [3].

This work is conducted with infrastructure mode. A very typical approach of developing a Wi-Fi environment is to use a wireless access point. All users can get an internet access if the access point is connected to the internet through a router. Already a number of approaches have been designed as an alternative to this traditional approach and the basic philosophy of all these ideas is converting a PC or laptop into an access point. The documents available in different sources don't actually give a clear picture about its performance compared to the traditional system and it grounds the motivation of this research work. In fact this work is an extension of a previous work where a laptop was configured as an access point which can reduce the cost and make a very easy setup of a WLAN Hotspot. It showed the way of turning on a laptop into a virtual personal Wi-Fi hotspot and implementing it seamlessly in wireless home networking in few minutes. It also compared the performance of this approach with the traditional one in terms of data speed in different scenarios [7]. In the current work the data speed of the WiFi network is measured using both real access point and virtual access point. The performance is measured with the increment of number of clients.

2. WIRELESS ACCESS POINTS

An access point connects wireless clients (or stations) to the wired LAN. Client devices do not typically communicate directly with each other; they communicate with the AP. In essence, an access point converts the TCP/IP data packets from their 802.11 frame encapsulation format in the air to the 802.3 Ethernet frame format on the wired Ethernet network. In an infrastructure network, clients must associate with an access point to obtain network services. Association is the process by which a client joins an 802.11 network. An access point is a Layer 2 device that functions like an 802.3 Ethernet hub. RF is a shared medium and access points hear all radio traffic. Just as with 802.3 Ethernet, the devices that want to use the medium contend for it. Unlike Ethernet NICs, though, it is expensive to make wireless NICs that can transmit and receive at the same time, so radio devices do not detect collisions. Instead, WLAN devices are designed to avoid them [4].

3. CONCEPT OF VIRTUAL ACCESS POINT

A wireless access point (WAP) is a device that allows wireless devices to connect to a wired network using IEEE 802.11 Standards [5]. IEEE 802.11 is a set of standards for implementing wireless local area network (WLAN) computer communication in the 2.4, 3.6 and 5 GHz frequency bands [6]. Virtual Access Point is a laptop which acts as an access point.

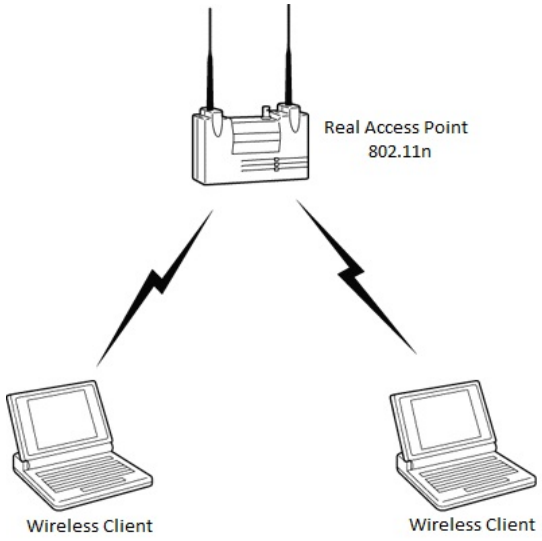

Fig. 1 Basic WLAN Architecture with Real Access Point

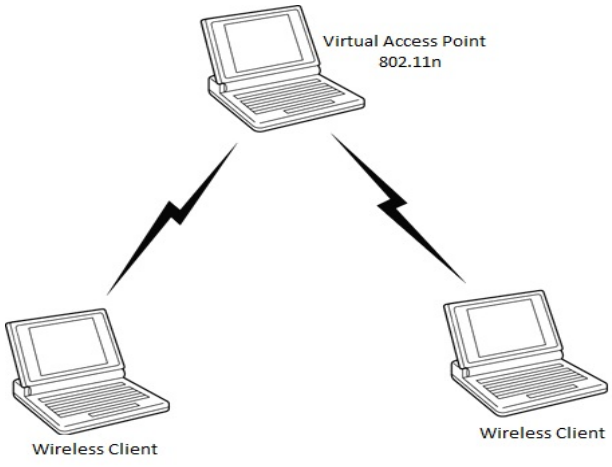

Fig. 2 Basic WLAN Architecture with Virtual Access Point

4. VIRTUAL ACCESS POINT SERVICES

Any client wireless device supports IEEE 802.11 standard can be connected to Virtual Access Point when it is activated for service. Virtual Access Point uses WPA2 security protocol which is most secured.

Clients can share data and files from their PC. A Client PC will find a Wi-Fi network and use internet through connecting Virtual Access Point. A picture [Fig.3] is given below which shows a Wi-Fi network from client PC.

Fig. 3 Client PC is connected to Virtual Access Point

5. EXPERIMENTAL INVESTIGATION FOR VIRTUAL ACCESS POINT AND REAL ACCESS POINT

5.1. Experimental Arrangement

For performance analysis, a TP-LINK TL-WA701ND Access Point has been used as Real Access Point and a Wireless Network Adapter of Key Technologies Ltd**.** has been used for Virtual Access Point. Both Access Points support IEEE 802.11n Standard and 150Mbps data transfer rate. The software tools Wireless Mon v4.0 and DU Meter v4.0 are used to collect data. During the data collection both the Real Access Point & Virtual Access Point were kept at the same distance from the client PC.

5.2. Data Collection Scenarios

To figure out a comparative picture of the performance of Virtual Access Point and Real Access Point, we have arranged some real life scenarios. The scenarios differ one from another in terms of the number of connected clients with the access points which are described below:

Scenario-1: One client PC is connected with the Access Points [Fig.4-5].

(i) Real Access Point data

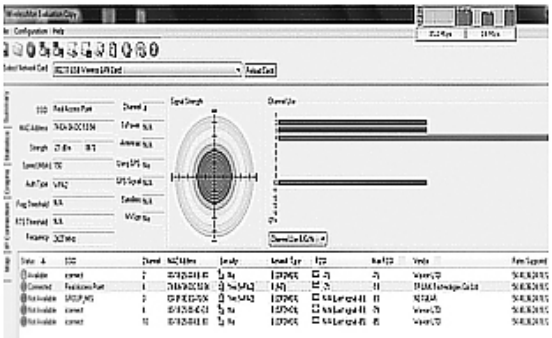

Fig. 4 One client PC is connected with Real Access Point

(ii) Virtual Access Point data

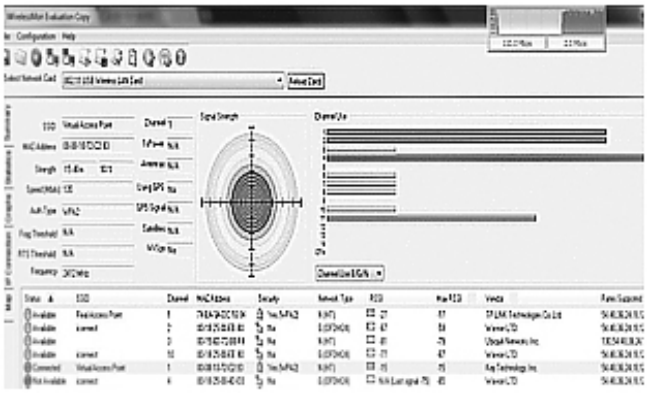

Fig. 5 One client PC is connected with Virtual Access Point

Scenario-2: Two client PCs are connected with the Access Points [Fig.6-7].

(i) Real Access Point data

Fig. 6 Two client PCs are connected with Real Access Point

(ii)Virtual Access Point data

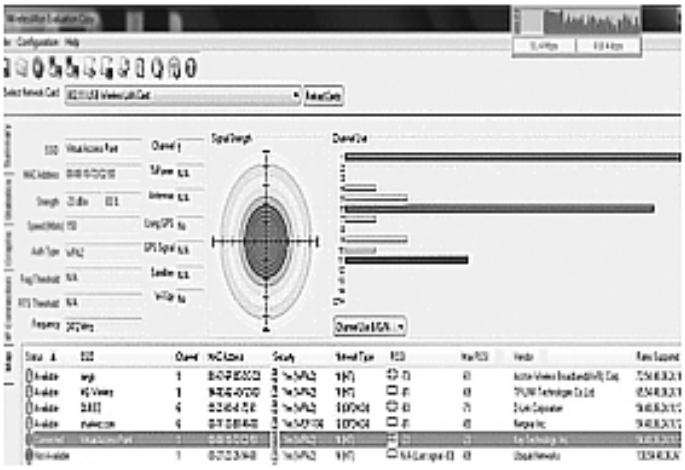

Fig. 7 Two client PCs are connected with Virtual Access Point

Scenario-3: Three client PCs are connected with the Access Points [Fig.8-9].

(i) Real Access Point data

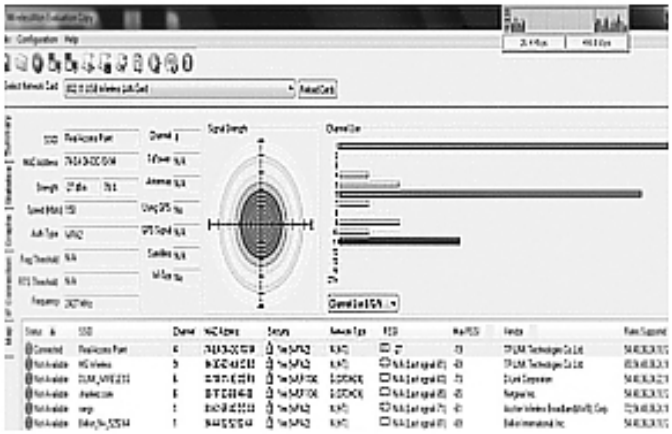

Fig. 8 Three client PCs are connected with Real Access Point

(ii) Virtual Access Point data

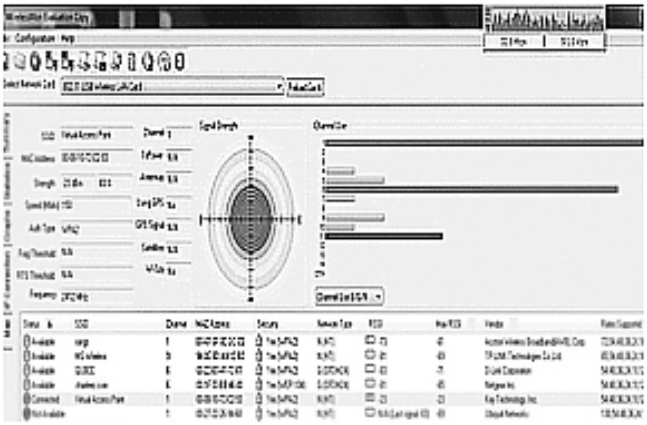

Fig. 9 Three client PCs are connected with Virtual Access Point

6. RESULTS AND ANALYSIS

6.1 Comparison between Virtual Access Point and Real Access Point

Data Transfer Rates of Virtual Access Point and Real Access Point are collected from the experimental investigation. A table is given below which shows Data Transfer Rate of both access points. Where 'X' represents **'**Number of Connected Clients', 'Y' represents 'Real Access Point Throughput' and 'Y/' represents 'Virtual Access Point Throughput'.

Table 1: Performance Comparison of Both Access Points in terms of Number of Connected Clients.

X=Number of Connected Clients	1	2	3
Y=Real Access Point Throughput	85 Mbps	43 Mbps	26.4 Mbps
Y/=Virtual Access Point Throughput	110 Mbps	51.4 Mbps	32.5 Mbps

From the data collected in different scenarios the table 1 is generated and a graph [Fig.10] is drawn which shows the comparison of Data Transfer Rate between Virtual Access Point and Traditional Access Point.

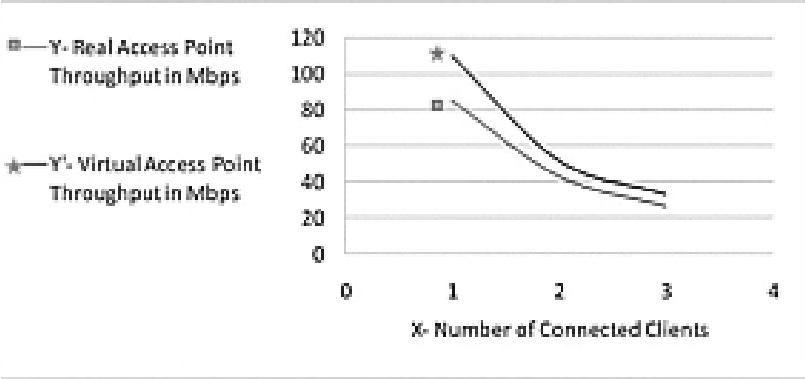

Fig.10 Comparison between Virtual Access Point and Real Access Point Data Transfer Rate

When one client PC is connected with the Access Points, we got 85 Mbps data speed for Real Access Point and 110 Mbps for Virtual Access Point. Here we see that data speed is remarkably better for Virtual Access Point. When two client PCs are connected with the Access Points with similar distance, we got 43 Mbps for Real Access Point and 51.4 Mbps for Virtual Access Point. In this case we also got better data transfer rate for Virtual Access Point. Finally, when three client PCs are connected with the Access Points, we got 26.4 Mbps for Real Access Point and 32.5 Mbps for Virtual Access Point. So, finally, again we got better data transfer rate for Virtual Access Point.

7. CONCLUSION

In this research work a laptop is configured as a Virtual Access Point and its performance has been compared with Real Access Point. All the comparisons are conducted in different scenarios in terms of data rate and number of users and in all the cases it was found that Virtual Access Point performs remarkably better than Real Access Point. Using a Virtual Access Point is a very economic idea as anyone can turn his/her laptop into Virtual Access Point without spending any extra money. It also supports WPA2 security protocol which is third generation highly secured security protocol. This security protocol is the latest security protocol in WLAN technology which means Virtual Access Point is also very strong option from the security perspective as well. So, it can be said that Virtual Access Point will be a very promising alternative for Traditional Access Point users in terms of QoS, Mobility and Money.

FUTURE SCOPES

In this research work, a single Virtual Access Point is configured and its performance is analyzed and compared with Traditional Access Point. If we want to extend Wi-Fi coverage area of Virtual Access Point then we need more than one Virtual Access Point. If we want to make large area coverage of WLAN then we need a series of Access Points in where one will be base Access Point and the other will act as repeaters. Although we did not implement it in this research, it can be tested in near future.

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