ANALYSIS AND COMPARISON OF DIFFERENT IEEE802.11 PROTOCOLS

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Abstract

Statement of the Problem: Today with the increasing number of wireless LANs, the demand for high data rates with an improved level of security is a huge demand. This research involves analysis and comparison of different IEEE802.11 standards and the security protocols using practical application scenarios. The main purpose of this work is to reflect the collected data measurements of IEEE 802.11g and IEEE802.11n standards in terms of bandwidth and data throughput. IEEE 802.11 is a protocol family that enable wireless communication by the means of AP (Access Point) or ad-hoc (Sangolli.S, Jayavignesh.T, 2015). The results clearly showed us that there is a noticeable difference between the actual throughput and the expected bandwidth and in practice the maximum data rate can only reach one third of the channel bit rate. This research will be of a great importance to researchers and also specialists for further development of WLAN operations in the future.

Methodology: Lab experiments were carried out to measure and compare the actual values of IEEE standards using TCP and UDP traffic protocols. Specifically, the author collected throughput using IEEE802.11g and IEEE802.1n standards in terms of the following scenarios:
1. No security- no wireless security protocol was used to send and receive the data
2. WEP (Wired Equivalent Privacy)- a wireless encryption protocol that uses RC4 stream cipher
3. WPA2(Wi-Fi Protected Access Version 2)- an enhanced version of WEP.

IPERF was used as a tool that measures the network bandwidth. Both TCP and UDP data stream capacities were tested. To collect the data performance for each of the 802.11 standards (g and n), TP-LINK TL-WN722N and Linux OS were utilized. In total, 12 experiments have been carried out to compare the IEEE802.11g and IEEE802.11n data performance in 'no security/WEP/WPA2' environments. For each of the experiment, 5 consecutive tests were carried out and the average was calculated.

Findings: Theoretically, IEEE802.11g and IEEE802.11n standards support maximum network bandwidth of 54 Mbps and 300 Mbps respectively (Abdelahman et al.,2015). However, the experiment results showed that the maximum throughput gained was10.6 Mbps in TCP traffic, which is not even the half of the expected value. Similarly, the maximum throughput for IEE802.11n was 13.3 Mbps in the experiment that makes only 4,43% of the

theoretical value. The experiments proved that using different security encryptions for the connection gives different results. The author has found that using WPA2 which is the most secured encryption standard reduced the bandwidth of the wireless connection to twice. The main reason for this is WPA2 uses TKIP/AES algorithms for encryption which is safer than WEP but have a negative impact on the actual throughput. When adding extra security protocols like WEP and WPA2, it led to 5%-30% decrease on the network performance.

Conclusion & Significance: The experiment results prove that the actual throughput values of IEEE802.11g and n are highly dependent on the configuration and the environment it uses. The high interference including physical and electronic objects, the improper channel configuration, the high number of devices connected to the same router, usage of much secured security protocols has a negative impact on the throughput. Testing the performance using different traffic streams resulted in different values. This was because that TCP uses three-way handshake that causes traffic delay and packet losses. It was concluded that achieving the same theoretical bandwidth reported on the IEEE802.11 documentations is impossible and requires 'perfect scenarios' that are not easy to configure in daily lives.

References:

1. Sangolli.S, Jayavignesh.T.(2015, August). "TCP Throughput Measurement and Comparison of IEEE 802.11 Legacy, IEEE 802.11n and IEEE 802.11ac Standards". Indian Journal of Science and Technology [online]. vol.8. Available:
2. www.indjst.org/index.php/indjst/article/download/.../64944
3. Abdelahman. M, Bakiber. A, Mustafa. A, Osman. A. (2015, October). "A Comparison between IEEE 802.11a, b, g, n and ac Standards. IOSR Journal of Computer Engineering (IOSR-JCE) [online]. vol.8. Available: www.iosrjournals.org/iosr-jce/papers/...3/D017532629.pdf.