Journal of the Nigerian Association of Mathematical Physics
Volume 32, (*November, 2015*), pp 263 – 268

Performance Analysis of WLANs under IEEE 802.11g and IEEE 802.11nCoexistence

Ibrahim Abubakar Alhaji

Department of Physics, Federal University, Kashere, P.M.B. 0182, Gombe Nigeria.

Abstract

The importance of IEEE 802.11 standard and its impact on wired local area networks (LANs) cannot be over-emphasized as it augments the LANs by allowing user mobility while still connected to the backbone network at good data rate and low cost. Demand for higher bandwidth for applications such video streaming requires some amendments to the standard. This gives birth to IEEE 802.11g first and then IEEE 802.11n with data rates of 54Mbpsand 600Mbps respectively. As the tradition demand, each new standard released has to have a backward compatibility feature enabling it to coexist with older technologies. Only 802.11a was exception to this rule. It is, however, noted that this feature brings about performance degradation or anomaly by slowing down and reducing the overall throughput of the wireless LAN (WLAN) when 802.11g and 802.11n nodes coexist. This work investigates this anomaly and seeks to enhance the network performance by increasing the total throughput and reducing the delay suffered by the network. The results of the simulations run suggest that the network performance could only improve if the 802.11n WLAN is operated in Greenfield mode or when the 802.11n nodes are enabled toutilized 40MHz channel in a mixed mode setting.

1.0 Introduction

IEEE 802.11[1] is a set of evolving specifications for wireless local area networks (WLANs) defined by Institute of Electrical and Electronics Engineers (IEEE) providing the highest transmission rate among standard-based wireless networking technologies[2].IEEE 802.11 typically provides access to Internet as a powerful supplement of cellular network cover agein various locations, including campus, enterprise, home and hot-spot environments, where one or more access points(APs) are deployed to provide the connection to the backbone network known as distribution system (DS). The DS is a wired technology such as Ethernet [3]. It also provides peer to peer networking where two more devices connect directly to one another without going through an AP. The focus of this paper is on an infrastructure network where APs are present.

The 802.11 devices, based on IEEE 802.11g[4] and 802.11n[5], provide transmission rates of up to 54 and 600Mbps respectively. The transmission range of a typical WLAN device is up to 100m, where its exact range varies depending on the transmission power, the surrounding environments and other factors [2]. The 802.11g devices operate in the unlicensed band at 2.4GHz while 802.11n devices utilize both 2.4 and 5GHz bands. As a result 802.11n devices have to co-exist with 802.11g devices at 2.4GHz.IEEE 802.11n has a backward compatibility with 802.11g as it operates in the 2.4 and 5GHz and transmits in a channel of 20MHz just like 802.11g, however, it can also utilizes 40MHz channels where two adjacent 20MHz channels are combined to form a single channel known as channel bonding[3]. The backward compatibility feature in 802.11n, even though useful in a mixed WLAN environment, is not without a setback. As the presence of at least a device with lower transmission rate or speed (802.11g highest rate is 54Mbps) in 802.11 cell (or BSS) results in the network being slowed down and lowered the overall performance of the 802.11 WLANs because the throughput (total data sent and delivered by WLAN nodes) of all devices transmitting at higher rate (802.11n highest rate is 600Mbps) is degraded by that slow rate device [6]. This anomaly is due to the primary access mechanism of 802.11 WLANs which guarantees that the probability of long term channel access for all devices is equal regardless of their distinct transmission speed.We intend to analyze the performance of WLANs under 802.11g and 802.11n coexistence and compare the performance metrics (Throughput and delay) of the networks under consideration.

Corresponding author: Ibrahim Abubakar Alhaji, E-mail: alhaji259@gmail.com, Tel.: +2348084998581