IMPROVING THE VOICE TRAFFIC IN WLAN NETWORK

ПОДОБРЯВАНЕ НА ГЛАСОВИЯ ТРАФИК В БЕЗЖИЧНА ЛОКАЛНА МРЕЖА

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Резюме – В статията се изследва симулационен модел на безжична локална мрежа работеща по стандарт IEEE 802.11n (2.4 GHz) и пропускателна способност 7.2 Mbps. В нея се изследва предаването на гласов трафик, кодиран чрез G.711 при битова скорост 64 kbps и експоненциално нарастващ HTTP трафик, преминаващи през една и съща точка за достъп (Access Point). Подобряването на гласовия трафик и производителността на мрежата се осъществява чрез конфигуриране на QoS приоритетите на MAC слоя от WLAN архитектурата за различните типове трафик (Voice и HTTP) и коригиране на EDCA 802.11e параметрите спрямо тези по подразбиране, въз основа на натоварването и топологичните условия в мрежата.

Abstract – This article examines the simulation model of a wireless local area network working on IEEE 802.11n standard (2.4 GHz) and a bandwidth of 7.2 Mbps. It explores the transmission of voice traffic encoded with G.711 at 64 kbps as well as the exponentially growing HTTP traffic both of which passing through the same Access Point (AC). The improvement of voice traffic and network performance is achieved by way of configuring QoS priorities for the MAC layer of the WLAN architecture for different types of traffic (Voice and HTTP) and by adjusting the Enhanced Distributed Channel Access (EDCA) 802.11e parameters compared to its default settings, based on the network load as well as the topological conditions of the network.

1. INTRODUCTION

IEEE 802.11-based wireless local area networks (WLANs) represent the most widely deployed wireless networking technology. With the migration of critical applications onto data networks, and the emergence of multimedia applications, such as digital audio/video and multimedia games, the success of IEEE 802.11 depends critically on its ability to provide quality of service (QoS). A lot of research is focused on equipping IEEE 802.11 WLANs with features to support QoS [1].

The work in this paper is dedicated to the IEEE 802.11e standard, which provides MAC layer enhancements for QoS, that incorporates traffic priority and queueing to enable service differentiation among the flows [2].

2. NETWORK CONFIGURATION

The network is composed of 8 workstations (WS) placing calls to 5 WS as voice destinations („voice_src3_dest" is configured as a voice source, but also as a voice destination). The entire voice traffic flows through the Access Point (AP). The voice application is configured to generate G.711 encoded voice traffic at 64 kbps.

There are 4 workstations placing exponentially growing HTTP traffic (stations with "voice http" perform voice and HTTP applications). HTTP clients are connected to the server thought the AP.

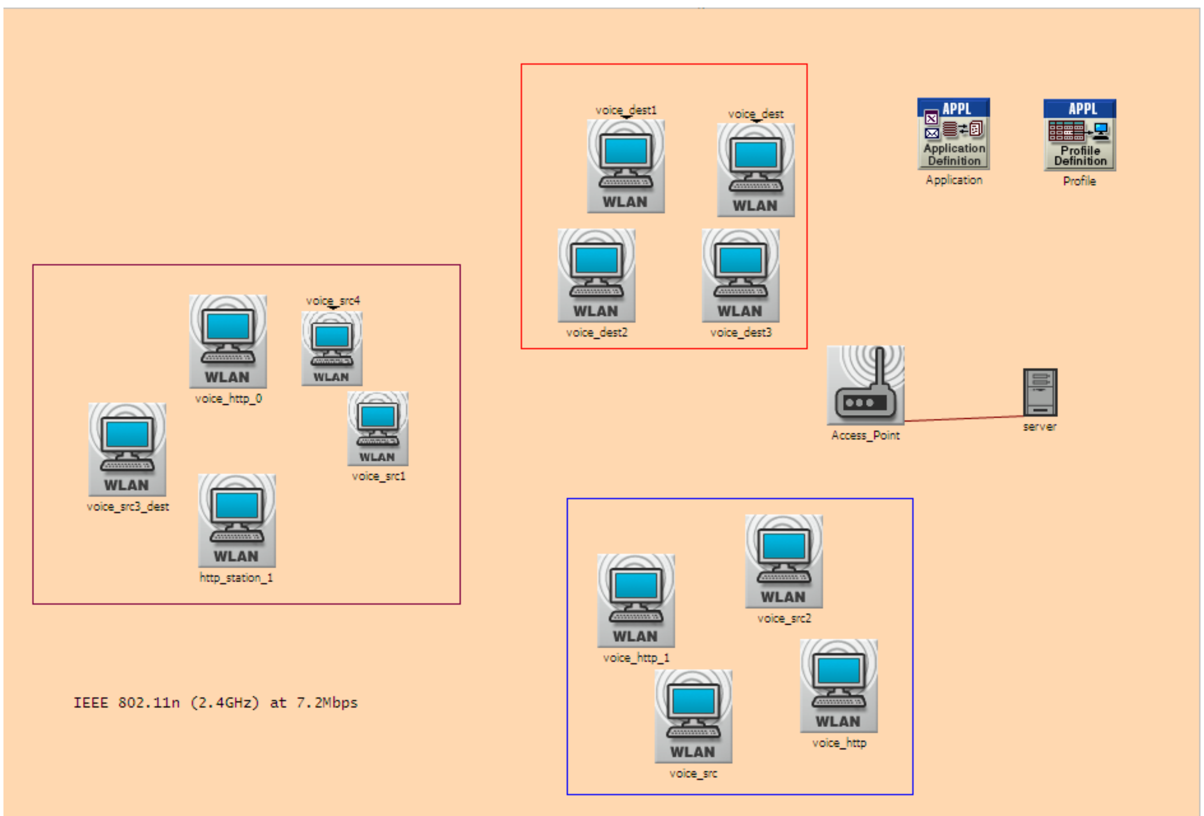

Fig. 1. IEEE 802.11n 2.4 GHz at 7,2 Mbps Network

All nodes are configured with HT PHY 2.4GHz (802.11n) and data transfer „6.5 Mbps (base) / 60 Mbps (max)". The Number of Special Stream is 1.40MHz and Operation Parameters are not enabled. The Guard Interval is Short (400ns).

Wireless LAN Parameters / HCF Parameters are set to default (QAP). All WAN nodes in the network are 802.11e so that they can work to Enhanced Distributed Channel Access (EDCA) rules and parameters that are set to default values.

In the first scenario the HTTP traffic is configured with Type of Service (ToS) "Best Effort" (0) and the voice application is configured with ToS "Interactive Voice" (6).

In the second scenario the corresponding parameters of EDCA are regulated based on network and traffic conditions and then they are compared to the first scenario with the default settings.

Again, for the second scenario the AP is configured to use bigger CWmax for Voice traffic "15". This setting is made for all WS (see Fig. 2).

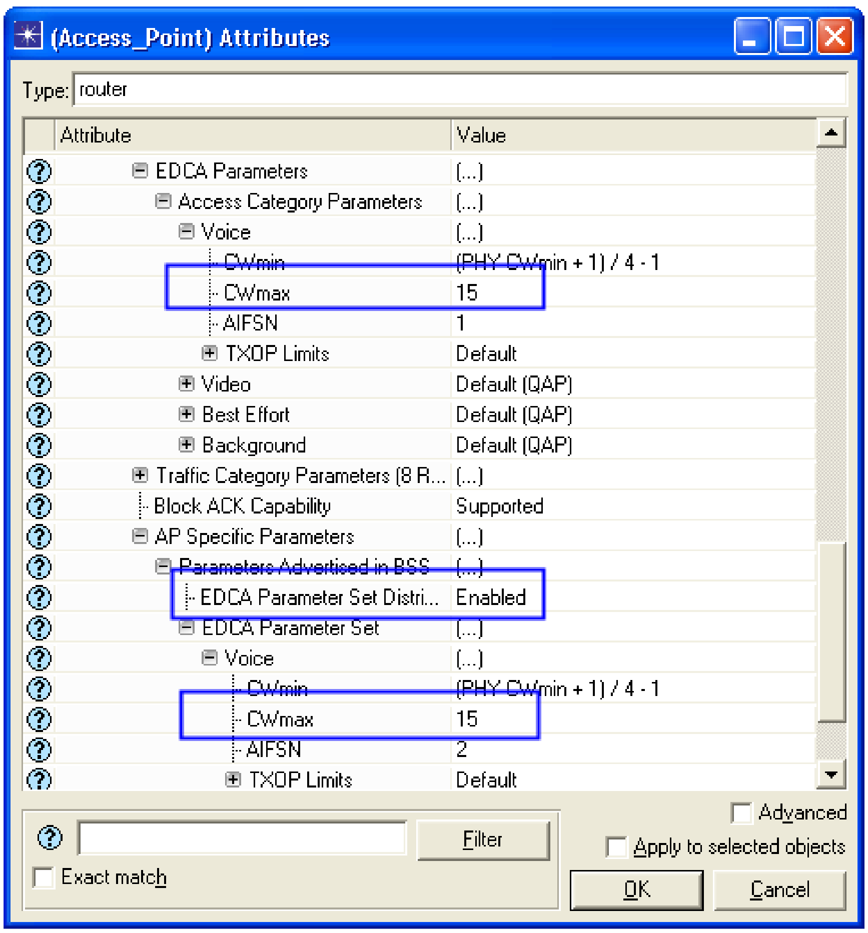

Fig. 2. Setting for CWmax and EDCA Parameters

In order to reduce delays of voice traffic and to improve the performance of a WLAN for both applications (HTTP and voice) in the second scenario, the acknowledgements at access layer 2 are disabled (Fig. 3).

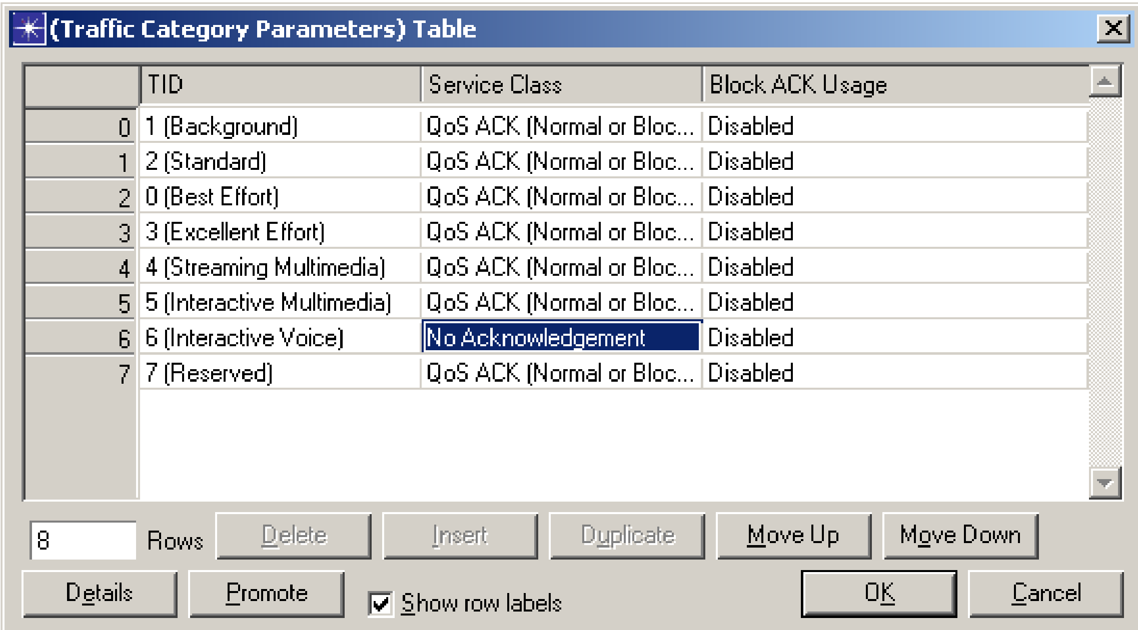

Fig. 3. Setting of Service Class for ToS “Interactive Voice”

After this configuration change the WLAN protocol will begin performing Request to Send / Clear to Send (RTS/CTS) exchange before Voice Access Category (AC) Transmit Opportunities (TXOPs) in order to protect the unacknowledged voice traffic at layer 2. Therefore, retransmission of packages that are due to reaching the limit of attempts is still possible [3].

For the second scenario the HTTP traffic from Best Effort is set to higher category WLAN access ToS, called "Streaming Multimedia" (4).

As HTTP is linked to a higher category of access and despite still having a lower priority than the voice traffic (Interactive Voice 6), it is now expected the HTTP traffic to perform better on the WLAN layers.

3. RESULTS

With the adjustment of the parameters associated with WLAN 802.11e the quality of voice calls across the network is increased on the one hand by reducing the delay variation (Fig. 4), the end to end delay (Fig. 5), the jitter (Fig. 6) and at the same time by increasing the percentage of voice traffic that could successfully be transmitted from source to destination (Fig. 7). Fig. 7 above shows how the sent voice traffic for the two scenarios is overlapping in the graphic.

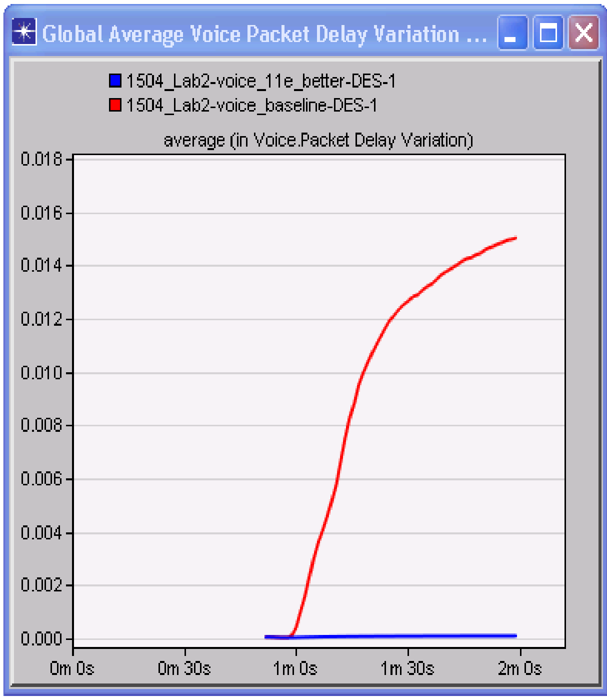

Fig. 4. Average Voice Packet Delay Variation (sec)

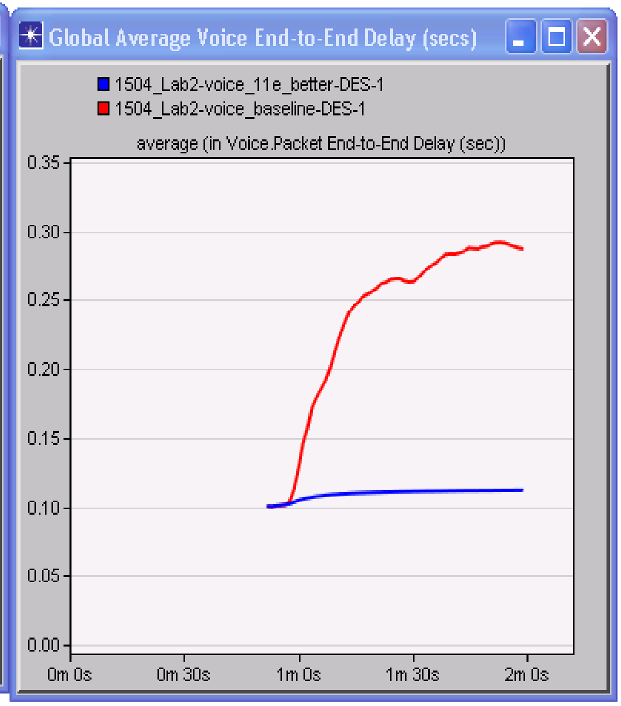

Fig. 5. Average Voice End-to-End Delay (sec)

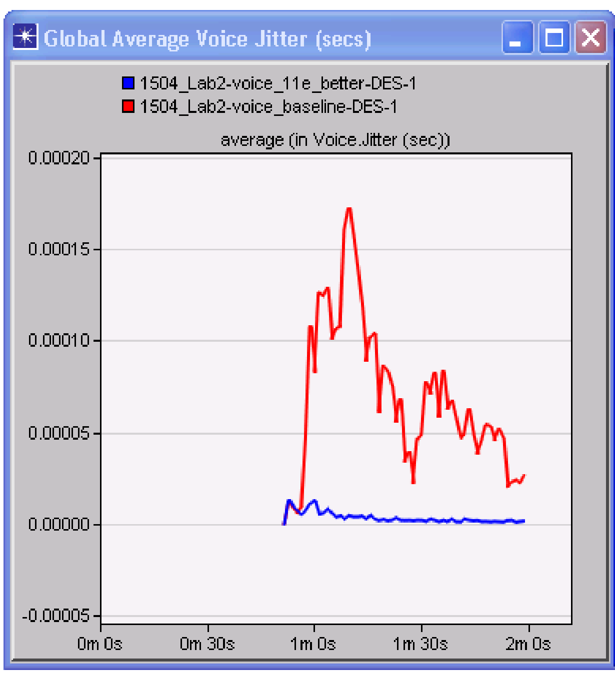

Fig. 6. Average Voice Jitter (sec)

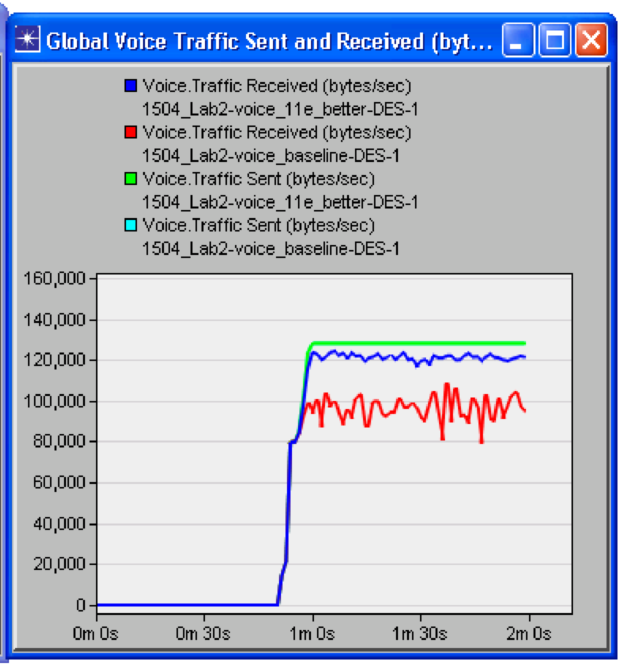

Fig. 7. Voice Traffic Sent and Received (bytes/sec)

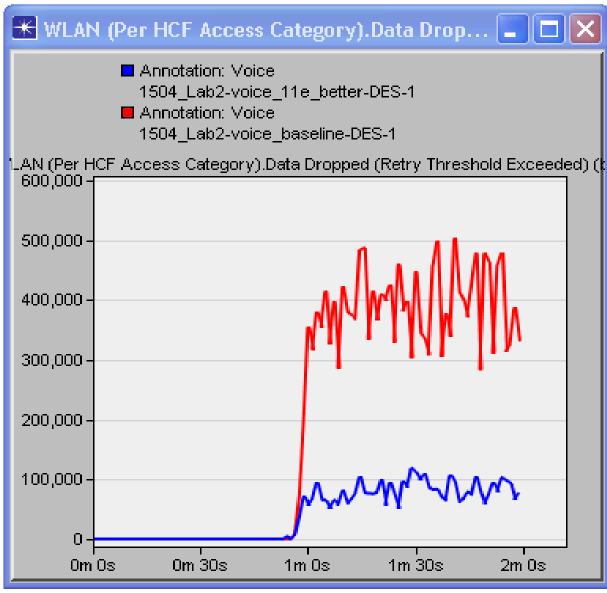

Fig. 8. WLAN – Data Dropped (bits/sec)

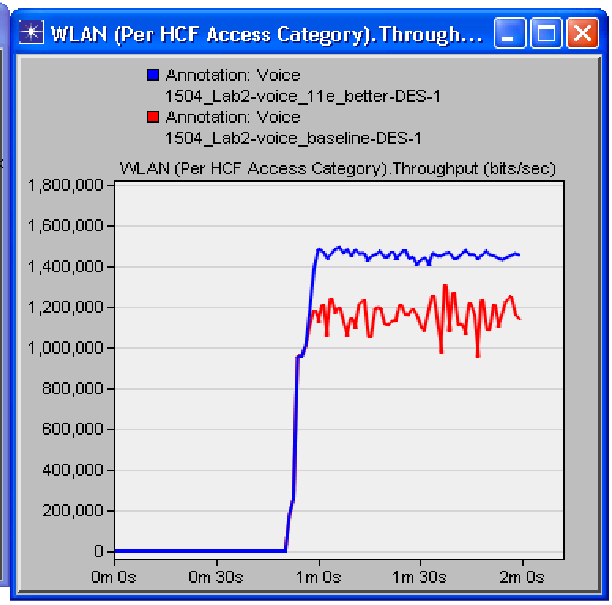

Fig. 9. WLAN (Per HCF Access Category) – Throughput (bits/sec)

In addition to the increase of Voice Throughput (Fig. 9), a reducing of the number of data dropped is achieved due to threshold exceed (Fig. 8). Dropped data for Voice category of access is significantly reduced in comparison with the first scenario. Increasing the WLAN Throughput (Fig. 10) also confirms the positive result of the adjustment of the parameters.

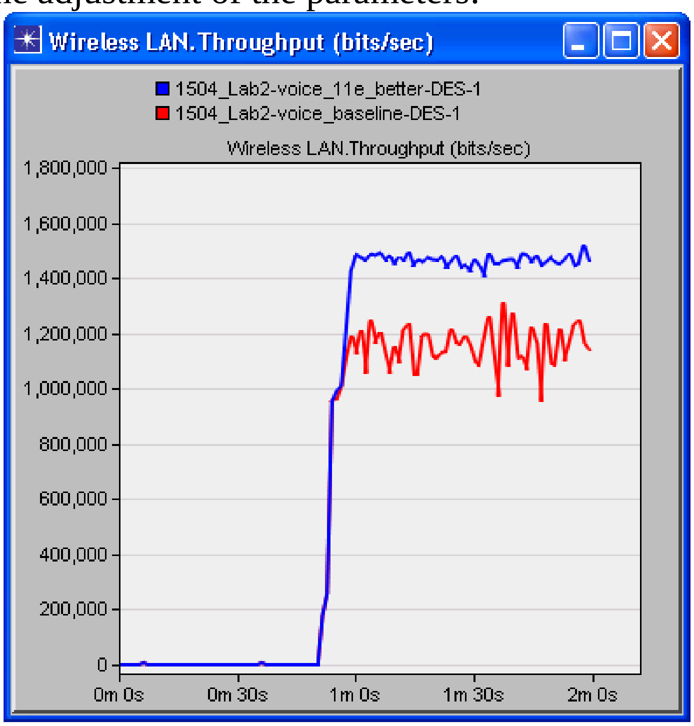

Fig. 10. Wireless LAN Throughput (bits/sec)

4. CONCLUSION

Using QoS improves performance but at the same time it is necessary to make specific parameter settings. The adjustment of parameters associated with WLAN 802.11e leads to an increase of the QoS for a particular group of users (in this case Voice users) and also to a reduction of the data dropped due to threshold exceed. Setting of the parameters helps to achieve a better average network performance. By adjusting the parameters of EDCA the networks work at a level that provides acceptable quality for all running applications.

5. REFERENCES

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