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A Survey on Quality of Service during Horizontal Handover within a WLAN Network

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Abstract: Wireless Local Area Network (WLAN) has become more popular in recent years. With increase in demand users are expecting Quality of Service (QoS) for multimedia services in WLAN. QoS is a key problem of today's networks. Many frameworks have been proposed to provide service differentiation in the Internet. A large number of 802.11 QoS enhancement schemes for a mobile undergoing horizontal handovers within a Wi-Fi network have been proposed, each one focusing on a particular mode. This paper summarizes a survey of previous work done related to effect on quality of a service when it from one base station to another within a WLAN network.

Keywords: WLAN, IEEE 802.11, Horizontal handover, homogeneous network, QoS (Quality of Service) etc.

I. INTRODUCTION

Wireless technologies have become more and more involved into people's daily life. Today without wireless technologies, life would have been unbelievably inconvenient. While wireless communications offers many advantages, such as mobility and flexibility, it suffers insufficient data rata & coverage area. IEEE 802.11 is one of the most deployed wireless technologies all over the world and is likely to play a major role in next-generation wireless communication networks. The main characteristics of the IEEE 802.11 technology are simplicity, flexibility and cost effectiveness. This technology provides people with a ubiquitous communication and computing environment in offices, hospitals, campuses, factories, airports, stock markets, etc. Simultaneously multimedia applications have experienced an explosive growth. People are now requiring to receive high-speed video, audio, voice and web services even when they are moving in offices or traveling around campuses. However, multimedia applications require some quality of service (QoS) support such as guaranteed bandwidth, delay, jitter and error rate. Guaranteeing those QoS requirements in WLAN is very challenging due to the QoS unaware functions of its medium access control (MAC) layer and the noisy and variable physical (PHY) layer characteristics.

The multimedia nature of many services requires the provision of QoS, Quality of Service, including meeting the user and application requirements for throughput, delay and packet loss. To date many services have been provided in a nomadic fashion to laptops as edge devices, however more portable edge devices, and a business/consumer culture that expects continuous connectivity requires true mobility, including handover of calls from one access point to another. Handover is a very obvious term being used in wireless communication. There are two types of handover between access points, in which a mobile device is communicating with a correspondent node.

1.Horizontal handover: A simpler alternative is where the handover occurs between two access points that use the same wireless technology and are operated by the same network operator. In this case the IP address of the mobile device can remain unchanged and the handover occurs at the wireless link layer.

2.Vertical handover: The second case involves a change in IP address and is handled using mobile IP, in addition to the wireless layer.

In this paper work we have taken a horizontal handover. Various studies and research work have been done on the horizontal handover with a WLAN network. As we know that there are various quality of service issues that arise in the horizontal handover during a WLAN like throughput, latency, jitter, delay etc. & also there are various algorithms that are used to support this mobility. So in this paper we will discuss about the work that has been done on this issue i.e. horizontal handover.

II. RELATED LITERATURE

Handover is basically a process of maintaining a user active session when a mobile terminal changes its connection from one access point to another. Depending upon the access network, the handover can be horizontal or vertical. Horizontal handover takes place between the point of attachment that uses the same network technologies for e.g. IEEE802.11 access point and a cellular base station while the vertical handover can be described as the process in which the point of attachment uses the different network technologies for e.g. WLAN & UMTS.

A handover process comprises of basically three stages: (1) handover decision (2) radio link transfer (3) channel assignment. Handover decision basically involves the selection of the point of attachment of target and handover time, radio link transfer is the task which forms the link to new attachment and channel assignment involves the allocation of channel resources. A number of papers have studied the performance of the IEEE 802.11 protocol. Most of the earliest work is focused on obtaining the throughput under various network configurations through simulations (***Weinmiller et al***. [1]).

Bianchi [2] developed and analyzed a detailed mathematical performance model of the DCF, which was improved by ***Wu et al***. [3]. Both papers have studied the saturation throughput of the IEEE 802.11 MAC layer, which yields an accurate approximation of the WLAN saturation throughput. However, persistent UDP flows instead of TCP flows are studied in their work, resulting in sources always having packets in their queue ready to send. Based on this Markov chain, the situation with the situation with non-persistent traffic sources was studied by ***Litijens et al.*** [4] and

Winands [5]. The number of active stations varies dynamically in time according to the initiation and completion of file transfers at random time instants. The authors have proposed an integrated packet/flow level modeling approach.

Skyrianglou et al. (2002) proposed a module that reads the QoS classification in the IP header of a packet and places it in an appropriate queue. The module is located between the MAC and IP layer in the wireless station. The limitation of Skyrianoglou's approach is in the modification of the MAC layer which results in the wireless station not conforming to the widely accepted IEEE 802.11 standard. Skyrianoglou's work focused on a generic wireless station which could be a wireless interoperability for Microwave access (WiMAX), Bluetooth or WLAN station. This is a limiting factor since different wireless standards have different MAC layer implementation hence different layer 2 QoS implementations [6].

Park et al. (2003) proposed integrating the IETF differentiated services (Diffserv) QoS architecture on the wired network, with IEEE-802.11 QoS mechanism on the WLAN. In this scheme the WLAN STA uses Diffserv to classify, mark and shape IP packets before they are encapsulated into a WLAN MAC header. The Diffserv markings are used to determine the corresponding traffic category identification (TCID) that will be written on to the MAC header. The WLAN frame will then be placed in a transmission queue corresponding to its TCID. This implies that all WLAN STAs need to be modified to support Diffserv which introduces additional complexities. Park *et al.*'s approach is not ideal since QoS in WLANs is better addressed at the MAC layer rather than the IP layer [7].

Qiang Ni, et al. (2004) proposed a large number of 802.11 QoS enhancement schemes each one focusing on a particular mode. Their work summarizes all the schemes and presents a survey on current research activities. They analyze the QoS limitations of IEEE 802.11 wireless MAC layers and purposed different schemes like station-based service differentiation using DCF enhancement, DFS scheme, VMAC scheme and Blackburst scheme. Simulations were performed using NS-2 [8].

Der-Jiunn Deng and Hsu-Chun Yen (2005) purposed a polling with non-pre-emptive priority-based access control scheme for the IEEE 802.11 protocol. Under that scheme, they modify the DCF access method in the contention period which supports multiple levels of priorities which in turn enables the user handoff calls in Wireless LANs. They perform simulations to compute jitter and delay performance for voice and video traffic. The purposed scheme was provably optimal for voice traffic in that it gives minimum average waiting time for voice packets [9].

Hongqiang Zhai et al. (2005) analyzes the WLAN's performance in terms of maximum protocol capacity or throughput, delay and packet loss rate. Although the performance of 802.11 protocol, such as throughput or delay, has been extensively studied in the saturated case, they demonstrated that maximum throughput can only be achieved in the non-saturated case and is almost independent of the number of active nodes. The authors have conducted a comprehensive simulation study using NS-2 simulator to verify their analytical results and to tune the 802.11 to work at the optimal point with maximum throughput and low delay and packet loss rate. Simulation results show that by controlling the total traffic rate, the original 802.11 protocol can support strict QoS requirements, such as those required by Voice over Internet Protocol (VoIP) or streaming video and at the same time achieve high channel utilization [10].

Chunming Liu and Chi Zhou (2006) have taken a Wi-Fi network and purposed a scheme to provide Quality of service in Wireless Local Area Network (WLAN). They develop a scheduling algorithm in link layer to support multimedia services with guaranteed QoS in WLAN. The purposed scheduling algorithm makes use of the idle system to reduce average packet loss of real-time (RT) variable-bit-rate (VBR) services, while satisfying required transmission delay and throughput requirements of all RT services. Long-term transmission quality for both RT and NRT services is analyzed based on the measurements of the packet loss probability for RT services and the throughput for NRT services. Performance is evaluated using OPNET simulator. Simulation results show that the purposed joint scheme is effective to enhance QoS and increase system resource utilization [11].

Sandjai Bhulai et al. (2006) develops a simple model for the performance of WLAN networks, taking into account the limitations in coverage and handover control. The presented model captures the statistical behaviour of TCP packets at the MAC layer, taking into account the effects of initiation and completion of data transfers due to mobility of the stations when entering or leaving a cell. They develop closed form expressions for the throughput of TCP flows in IEEE 802.11 in the presence of multiple classes of customers with different mobility patterns in multiple cells. NS-2 simulator was being used for the simulation purpose and finally the expressions are shown to be highly accurate when validated by simulation results [12].

Samuel Senkindu and H. Anthony Chan (2008) introduces a mapping module that enables the inter-working of WLAN IEEE 802.11-2007 enhanced data channel access (EDCA) MAC layer QoS mechanisms with wired IP layer QoS mechanisms at the boundary of the WLAN and wired network for the provision of uniform end-to-end QoS. The purposed scheme was evaluated using the EDCA QoS mechanism in the WLAN and weighted round robin (WRR) packet scheduling in the wired network. This scheme greatly improves the multimedia service assurance capabilities of a WLAN-wired network and finds wide application in rural telephony, disaster response and military communications [13].

Josiane C. Rodrigues et al. (2009) presents an empirical study of the QoS parameters of a VoIP application in the presence of an interference network, as well as the relevance in the design of wireless networks to determine the range of an access point, taking into account several parameters such as power, jitter, packet loss delay etc. This method takes into consideration a VoIP application and analyzes the performance evaluation of the QoS parameters through a qualification factor, called Network Qualifier. This scheme is purposed to establish a methodology in designing the deployment of wireless networks in indoor environments. Results of the simulation shows that without the presence of the interference network, the WLAN under study has a suitable coverage and quality, it is because the values of all the QoS parameters are above the threshold 60%. Empirical study of the various parameters shows that packet loss metric was the most degraded one among all parameters [14].

W. Jiandong and H. Guohui (2010) analyze and compare four different mechanisms for providing QoS in IEEE 802.11 WLAN. They evaluates the IEEE 802.11 mode for service differentiation (PCF), Distributed Fair Scheduling (DFS), Black burst and a scheme proposed by Deng et al. using NS-2 simulator. The evaluation covers medium utilization, access delay and the ability to support a large number of high priority mobile stations. Simulation results show that compared with other assessment programs, IEEE 802.11 standard PCF mode is not very good at measuring indicators. The Black burst program in the throughput and access delay was measured the best performance at high priority communications. An important advantage of DFS is that it would try to be fair and would not completely ignore low-priority communication, which is very necessary in many practical situations. Also, the simulation show that Black burst program gives the best throughput among all schemes [15].

J. O. Kim et al. (2010) proposed a novel medium access control scheme, B-DCF (Burst DCF), to enhance the legacy DCF. They have taken a Wi-Fi network environment and consider that both voice and video streams are carried by RTP/UDP transport with no flow control and design a scheme to provide a level of QoS differentiation with downlink traffic and to improve downlink multimedia QoS in a cell. QoS differentiation is realized using burst transmission control. B-DCF is evaluated and compared to DCF and EDCA schemes. Results prove that for heavy BE (best effort) loads, the proposed B-DCF scheme can support larger number of conversational voice calls while achieving larger BE throughput [16].

Ki Jong Koo et al. (2011) proposed a QoS control mechanism that estimates the congestion of wireless channels in the wireless LAN and evaluates the voice packet drop ratio based on the estimated congestion status to maintain a VoIP service quality in an acceptable level in the WLAN. OPNET simulator was being used to perform the simulations. The mechanism adjusts the voice packet transmission rate according to the evaluated packet loss ratio, and thereby resolves the congestion situation. They have taken a voice stream roaming over WLAN scenario and calculate collision probability, voice packet size, voice packet loss ratio and end-to-end delay and conclude that this mechanism can keep user's quality of experience levels within acceptable ranges [17].

R. Shankar et al. (2011) illustrate a modified wireless token network (MWTN) to provide the required QoS by decreasing the size of the contention window (CW). They analyze the legacy IEEE 802.11, IEEE 802.11e and wireless token network (WTN) in terms of throughput, delay, load, retransmission and data dropped performance, for converging traffic in WLAN and compare the results with proposed MWTN. Simulations were performed using OPNET simulator which show that MWTN out performs in terms of QoS in WLAN for voice, video and data, which could be observed by 3.6% of enhancement in voice, video and best effort throughput, 5% lesser data drop than WTN for voice, video and best effort, when MWTN is followed, that ensures fairness along with QoS [18].

III. CONCLUSION

In this paper what we have discussed about the handover it's issues like throughput, latency, quality of service etc. We also come across the work which is already done on the horizontal handover using the various considerations like different protocols, techniques, hybrid schemes. But we can say that all the purposed paper rely on the common goal to achieve through put ,reduction in delay ,reducing cost & make use of available bandwidth & to handle high data traffic rate.

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