

Enhanced Seamless Handoff Using Multiple Access Points in Wireless Local Area Network

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Abstract

The Mobility in wireless cellular communication systems is its backbone so as to enhance the quality of service and maintain the continuous service. Handoff is an important task in maintaining the continuity of call in cellular systems and its failure can result in ongoing call termination. In cellular mobile networks, the coverage region is divided into smaller cells in order to achieve high system capacity. Each cell has a Base-Station (BS), which provides the service to the Mobile Terminals (MTs), i.e. users equipped with phones, within its region. Before a mobile user can communicate with other user(s) in the network, a group of the frequency bands or channels should usually be assigned. The MTs is free to move across cells. When the mobile user crossing a cell boundary or by deterioration in quality of the signal in the current channel, handoff process is initiated. The scope of this project is to design 802.11 handoff schemes to solve the handoff problems in closely-spaced WLANs. The major problem in multiple WLANs are so many users trying to use same access point(AP), and interferences from nearby WLAN. The better hand off scheme based on signal strength and velocity of the nodes is proposed. The simulation results show that the proposed handoff scheme significantly reduces packet losses compared with existing handoff schemes.

Keywords—Handoff, mobile radio mobility management, wireless local area network (WLAN).

I. INTRODUCTION

Wireless Local Area Networking (WLAN) has experienced tremendous growth in the last ten years with the proliferation of IEEE 802.11 devices. In the following century, radio communication and radar proved to be invaluable to the military, which included the development of spread spectrum technology. WLANs use high-frequency radio waves rather than wires to communicate between nodes. These networks provide a very fast data speed compared with the data rates of mobile telecommunications technology, and their range is very limited. Wi-Fi is the most widespread and popular example of WLAN technology.

One of the challenges in network management is to establish connection between end to end heterogeneous wireless technologies. To provide such end-to-end connection between heterogeneous networks we need to perform handoff. Handoff is the process of changing the channel associated with the current connection, while a call is in progress, to the neighboring cell in order to provide uninterrupted service to the mobile subscriber. The IEEE 802.11 standard specifies IEEE 802.11 handoff operation with three procedures namely scanning, authentication and, reassociation. The scanning mobile terminal (MT) may choose the best appropriate APs for its handoff. The authentication and reassociation procedures are used for validation and connection establishment for the mobile terminal.

We propose a velocity based handoff scheme in multiple wireless local area network. In our proposed method MT will choose the AP based on the signal strength of the AP and velocity of the node movement. Each APs propagates its coverage range, initially we set a threshold value for better handoff. When the RSSI drops below the threshold value, it will scan the best AP for handoff. Threshold value is generated by signal strength and velocity of the MT. The MT makes the handoff decision according to signal quality, which can be measured by the RSSI (Received signal strength indicator).

This paper is organised as follows. In Section II, we discuss the previous work with an overview of scanning. In Section III, we discuss handoff operation. In Section IV, we propose a velocity based handoff operation and provide experimental results. Finally, we conclude in Section V.

II. PREVIOUS WORK

Handoff schemes can be categorized into prioritized handoff and non-prioritized handoff schemes. In non-prioritized schemes, handoff calls and new calls are served equally. When the BS has an idle channel, it is assigned due to first-come first-serve basis regardless of whether the call is new or handoff. Since, no priority is given to a handoff request over a new call, the CDP(Call Dropping Probability) is increased. All available channels in the BS are shared by handoff and new calls. This

scheme results in high channel utilization. The Complete Sharing (CS) and Complete Partitioning (CP) policies are used as NPS. This policy can lead to waste capacity if the load offered by a traffic stream drops below its allocated capacity. On the other hand, prioritized schemes ought to minimize both the CDP (Call Dropping Probability) and CBP (Call Blocking Probability) by giving the priority to handoff calls over new calls in some way. Most handoff prioritization schemes have the same mechanism: lowering the CDP while increasing CBP due to the quality of service (QoS) perspective, new call would rather be denied than terminating of ongoing call.

With respect to scanning process performed in mobile terminal, active or passive scanning is defined. During passive scanning the mobile terminals should receive access point's beacon frames, which is transmitted every beacon interval. A beacon interval is typically 100 ms. On the contrary, a mobile terminal with active scanning should broadcast probe request frame in a channel and wait for the probe response frame. The probe response frame is sent by the nearby access points to the mobile terminal on receiving the probe request frame. The mobile station performs scanning process in all available channels. Thus, the scanning time increases in proportion to the number of available channels and introduces packet loss and latency.

III. HANDOFF OPERATION

A seamless handoff is defined as a handoff scheme that maintains the connectivity of all applications on the mobile device when handoff occurs. The two goals of seamless handoff are low latencies and few packet losses. Handoff can be classified based on several factors, like the type of the network, the involved network elements or the number of active connections and the type of traffic that the network supports. Classification of handoff is explained as follows,

A. Network Types Involved

This is the most common classification factor. Handoffs can be classified as either horizontal or vertical. This depends on whether a handoff takes place between a single type of network interface and a variety of different network interfaces.

i) Vertical handoff:

Mobile terminal can be handed over to access points those supporting different network technologies. For example, the changeover of signal transmission from WiMax base station to LTE network is considered a vertical handoff process.

ii) Horizontal handoff:

Mobile terminal hand overed between access points supporting the same network technology. For

example, the changeover of signal transmission between same type of network i.e. WiMax-to-WiMax base station is considered as a horizontal handoff process.

B. Number of Connections Involved

i) Hard handoff:

In a hard handoff, the radio link to the old base station is released at the same time a radio link to the new base station is established. In other words, using hard handoff, a mobile node is allowed to maintain a connection with only one base station at any given time.

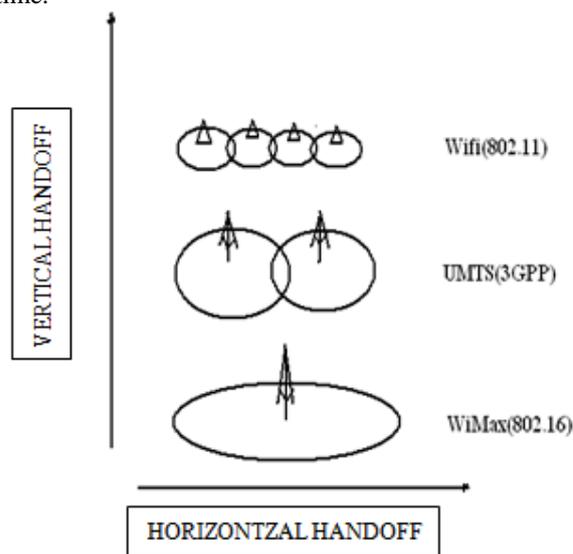


FIGURE 1: HANDOFF TYPES

ii) Soft handoff:

A mobile node maintains a radio connection with no less than two base stations in an overlapping handoff region and does not release any of the signals until it drops below a specified threshold value. Soft handoffs are possible in situations where the mobile node is moving between cells operating on the same frequency.

iii) Softer handoff:

A softer handoff is very similar to a soft handoff, except the mobile terminal switches connections over radio links that belong to the same access point.

Handoff process is initiated when the mobile terminal moves away from the serving base station to the target base station. The handoff process consists of the following stages-

Cell selection, handoff decision, hand off initiation, make connection to target cell, mobile terminal authorization, termination with the serving cell. At first, the mobile terminal performs cell selection by scanning for all the neighbouring access points. The access point with strong signal strength is selected for hand off by the mobile terminal.

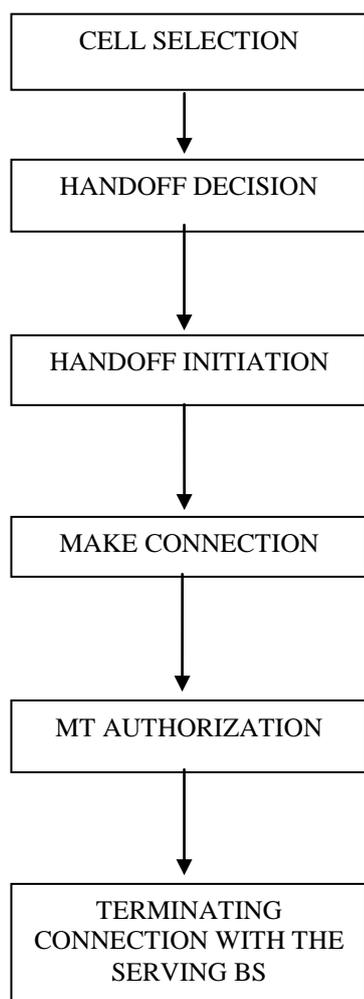


FIGURE 2:HANDOFF PROCESS

The handoff decision and initiation process denotes the beginning of handoff process. During handoff decision stage, the mobile terminal decides whether a handoff is necessary or not. If handoff is required then the handoff initiation stage will request the neighboring access point with strong signal strength to serve the mobile terminal. In the case where handoff is not required the mobile terminal continues in the serving base station. Then connection to the target base station or access point is made by the mobile terminal. Next step is to terminate the connection of the serving base station. Before terminating the connection to the serving base station the mobile terminal should receive a authorization from the target base station. A good handoff should minimize handoff delay and reduce wireless channel resource wastes.

IV. PROPOSED HANDOFF SYSTEM

Wi-Fi and WLAN is based on IEEE 802.11 standard. Wi-Fi typically provides local network access for around a few hundred feet with speeds of up to 54 Mbps. Wi-Fi is intended for LAN

applications, users scale from one to tens with one subscriber for each CPE device. Fixed channel sizes (20MHz). The 802.11 standards focus on the bottom two levels the ISO model, the physical layer and link layer. Any LAN application, network operating system, protocol, including TCP/IP and Novell NetWare, will run on an 802.11-compliant WLAN as easily as they run over ethernet.

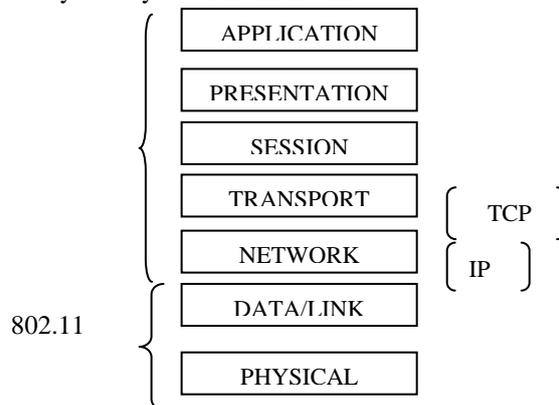


FIGURE 3.IEEE 802.11 and OSI Model

The major motivation and benefit from Wireless LANs is increased mobility. Untethered from conventional network connections, network users can move about almost without restriction and access LANs from nearly anywhere. The other advantages for WLAN include cost-effective network setup for hard-to-wire locations such as older buildings and solid-wall structures and reduced cost of ownership-particularly in dynamic environments requiring frequent modifications, thanks to minimal wiring and installation costs per device and user. WLANs liberate users from dependence on hard-wired access to the network backbone, giving them anytime, anywhere network access.

We propose a velocity based handoff scheme in multiple wireless local area network. In our proposed method mobile terminal will choose the access point based on the signal strength of the AP and velocity of the node movement. Each APs propagates its coverage range, initially we set a threshold value for better handoff. When the received signal strength indicator (RSSI) drops below the threshold value, it will scan the best AP for handoff. Threshold value generated by signal strength of the APs. The MT makes the handoff decision according to signal quality, which can be measured by the RSSI (Received signal strength indicator).

$$RSSI < TH_{handoff} \quad (1)$$

The $TH_{handover}$ represents the handoff threshold. Handoff procedures are initiated when the RSSI drops below the $TH_{handover}$. Also, handoff is executed only if there is another AP for which the RSSI is at least the minimum signal level. We know that when the MS moves in a high velocity, the

network channel information will change frequently, so that some unnecessary stages must be performed, which makes severe degradation in system performance such as handoff delay and network resource waste. To overcome this we set two threshold values – one threshold is set for nodes moving with higher velocity and another for nodes moving with lower velocity. If the Thhandover is set higher, the frequency of handoff initiated will be higher, thus the network channel information can be acquired quickly. If the Thhandover is set lower, the handoff frequency becomes lower and the wireless channel resource is consumed less. Velocity or speed of the MN is given by,

$$v = D_0 / t \tag{2}$$

D_0 is the diameter of the serving cell and t is the time taken by the MT to remain connected with AP/BS.

$$t = D_0 / v \tag{3}$$

$$t = 2 R / v \tag{4}$$

R is the radius of the serving cell. The architecture of proposed system consists of angle analyzer, position analyzer ,signal strength analyzer, a threshold generator and handoff comparator within the mobile station. The angle and position analyzer periodically updates the position of the mobile node within the cell to the serving AP. The threshold generator generate a threshold value based on the velocity and RSSI of the mobile node. The handoff comparator compares the threshold value and selects appropriate AP for handoff.

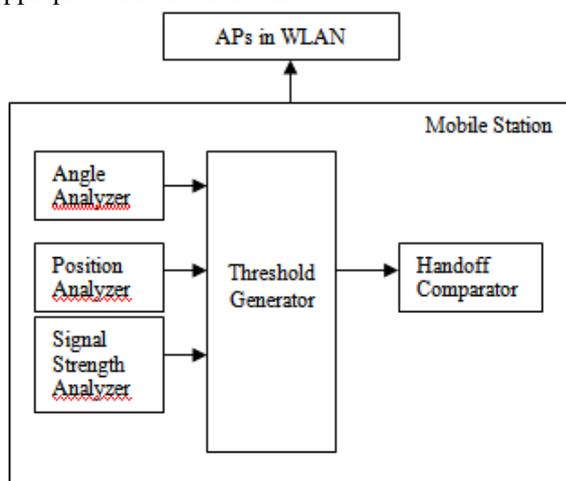


FIGURE 4: ARCHITECTURE DIAGRAM

The simulation is performed using the network simulator 2 (NS2) tool and the language used for simulation is tool command language (TCL) at front end and c++ at the backend. For simulation purpose we create ten nodes with four access points. The simulation results show that the proposed system has reduced packet loss than the existing system and throughput of proposed system has increased substantially.

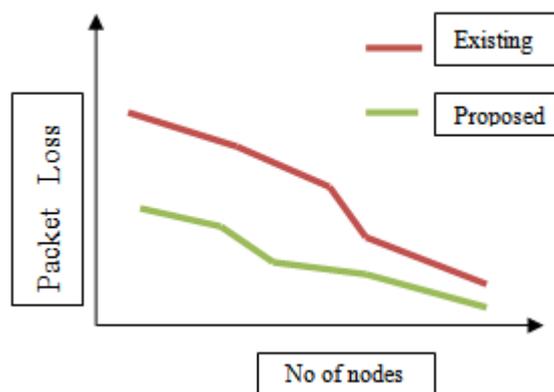


FIGURE 5: SIMULATION RESULT

V. CONCLUSION

In this paper, we proposed an optimized handoff scheme based on the speed of an mobile node in wireless networks. We proposed two thresholds on the speed of mobile node. The mobile node checks its speed against the predefined threshold and according to its current speed it selects the appropriate network. A Wi Fi network cannot be used for fast mobile node movement, because of its smaller coverage area and frequent handover problem. The proposed scheme outperforms the existing scheme by reducing the packet loss.

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