Mobility Management Incorporating Pattern Recognition in the Handoff Decision

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Abstract

In the age of global communications, heterogeneous networks are seen to be the best choice of strategy to ensure continuous and uninterruptible services. This will allow mobile terminal to stay in connection even they are migrating into different segment coverage through the handoff process. In the quest for efficient handoff especially in the heterogeneous environment, various techniques of handoff decision making have been used. This paper will discuss different techniques in the traditional handover decision algorithm and explore the method of handoff decision using pattern recognition method, mainly the Adaptive Network Fuzzy Inference System (ANFIS). The paper will also present results simulated in an experiment, and comparison between different handoff algorithms with respect to ANFIS.

1. Introduction

Multi-service convergence is one of the hottest research topics recently, fulfilling the vision of connection any place, any where and any time. To fulfill the vision, a global communication service provider has been looking for ways to maximize their service coverage through the exploitation of heterogeneous networks. [1]

In Europe, there were many projects that looked into the possibility of hybrid inter-technology communications. For example, the Multi-Segment System for Broadband Ubiquitous Access to Internet Services and Demonstrator (SUITED) [2] explored the convergence of more than three services in the Broadband Internet Protocol (IP) environment where inter-segment (or inter-technology) handoff (ISHO) were investigated.

In order to ensure continuous communication, a handoff, inter-technology or intra-technology, needs to be performed once a mobile terminal is out of coverage from the existing Base Station (BS) or Access Point (AP). In the IP environment, there is a high risk of network performance degradation every time handoff is performed. Thus, unnecessary handoffs are highly undesirable especially when the application demands a very high Quality of Service (QoS) performance such as video and voice streaming.

With the newer demand in the IP Broadband performance, traditional handoff decision algorithms have become obsolete and a newer generation of handoff decision algorithms emerge to cope with the new challenges of providing uninterruptible QoS guaranteed services to the users.

2. Handoff Algorithm

2.1. Traditional Algorithm

Traditionally, single technology handoff algorithms were based on single metrics such as the Received Signal Strength (RSS), distance, Signal to Noise Ratio (SNR), Bit Error Rate (BER), traffic load, distance, word error indicator or quality indicator [3-6]. For example, the First Generation (1G) mobile communication standard, the Advance Mobile Phone Service (AMPS) and the Total Access Communication System (TACS) handoff decisions were based on the RSS measured at the BS. Many algorithms were used to gauge the metric and make decisions for handoff, namely the Relative RSS, Relative RSS with Threshold, Relative RSS with Hysteresis and Relative RSS with Hysteresis and Threshold.

2.1.1. Relative RSS. This is the simplest handoff algorithm in which the RSS between two BS is compared. In this algorithm, the handoff will triggered when the targeted BS has a higher RSS level measured than the current BS. The problem with this algorithm is that handoff will still be carried on when both RSS of the current BS and targeted BS is below the minimum

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