Handover Characteristics and Handover Performance in Digital Mobile Systems

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Thesis submitted for the degree of

Doctor of Philosophy

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September 1999

Contents

Summary

In wireless communication systems having unpredictable radio propagation environments, it is most important from the user's point of view to maintain an adequate level of service quality during call conversation and a low probability of call drop. Moreover, for future wireless systems in which small radius cells and heavy user demands are being considered, fast handover request processing is becoming a more noteworthy factor. The handover request processing time itself and the delay caused by heavy signalling traffic, can have an effect on call quality and/or the probability of call conversation disconnection during handover procedures.

A well known reason for call drop is a lack of free radio channel resources at the new base station. The other reason is low call quality, i.e. the received signal strength for the current base station falling below the threshold of reception. This low call quality makes the user's conversation quality poor and may result in the conversation being disconnected, even if the base station can provide a new radio channel to the user. To provide a better quality of call service where the radio link quality is poor, handover algorithms, which monitor the radio link of the Base Station, are used. If the handover algorithm can support a very accurate handover decision, while the handover request processing delay is too long, this accurate handover decision would not be processed properly. The received signal strength of the current base station during the handover request processing time will fall below the receive threshold, that is the radio link between the Mobile System and the Base Station becomes poor. On the other hand, if the system can provide fast handover request processing, while the handover decision is not accurate, then extra unnecessary handovers can occur or the call may be disconnected due to low call quality. Therefore an accurate handover decision and a fast handover request response time are needed to provide high quality of call conversation and low

call dropout rate in future mobile systems.

In this thesis, we first investigate the characteristics of the handover algorithm. Because the handover decision criteria: signal strength and signal quality, power budget and so on, are highly related to the radio propagation environment and the cell layout, the handover algorithm investigation will be done using a realistic radio propagation model. To obtain a wider variety of data for this handover analysis, different BS transmit power models in conjunction with a worst case power model will be considered. Secondly, to study how the handover request response time affects the call quality or call drop, hard handoff and soft handoff algorithms will also be analysed with and without power control algorithms, on the basis of handover processing times. Thirdly, we study a linear highway model to examine handover performance at the system level in which heavy new call and handover traffic occurs. For efficient handover performance measurements, we propose a new measure which we call PGOS (proposed grade of service). We also consider the handover request delay. In particular, reasons for call drop will be classified and call drop enhancement approaches will be introduced. Some "Handover Rejection Schemes" are proposed to improve the system performance when the system suffers from a long handover request delay at low hysteresis window levels, and heavy user demands, as would occur in a TDMA system. A channel reservation scheme is introduced as a call drop enhancement scheme. A scheme combining channel reservation with the handover rejection schemes is proposed and studied. The various call drop enhancement schemes are compared.