The Performance of DS-CDMA Cellular Systems with Variable-Bit-Rate Traffic

Bradley Claude Sowden

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Abstract

The deployment of third generation (3G) cellular systems is resulting in a transition from cellular systems that predominantly carry constant-bit-rate (CBR) voice traffic to multi-service packet based systems that predominantly carry variable-bit-rate (VBR) traffic. With 3G DS-CDMA cellular systems there is a direct relationship between user traffic and propagation dependent performance as additional traffic causes increased system interference. This thesis investigates the impact of VBR traffic on the propagation dependent performance of DS-CDMA cellular systems that utilise frame-by-frame dynamic resource allocation on the radio channel.

A DS-CDMA cellular system model is developed and the downlink performance of both outdoor macro-cellular and indoor pico-cellular systems is evaluated with a variety of traffic types. Both traffic scheduling performance and propagation dependent performance are evaluated as the two are inter-linked. Scenarios are identified where propagation dependent performance is sensitive to the statistical properties of the user traffic streams and it is shown that a significant performance difference potentially exists between different traffic types when the number of users per cell is low. When a significant performance difference does exist, burstier more variable traffic generally results in superior propagation dependent performance. The base transceiver station (BTS) transmitter power mean and variance provides a good indication of the level of propagation dependent performance regardless of the specific traffic type. Traffic scheduling policies that deliberately reduce the variability of user traffic streams are considered and in terms of propagation dependent performance these are shown to have a minimal impact on the performance difference between different traffic types.

The implications of VBR traffic on DS-CDMA cellular system design are outlined and it is shown that VBR traffic can be approximated as CBR traffic in many scenarios and this is a convenient approximation as it simplifies system design and detailed traffic models do not need to be developed.

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