METHODS FOR FORWARD ERROR CORRECTION CODING ABOVE A RADIO LINK CONTROL LAYER AND RELATED APPARATUS

CLAIM OF PRIORITY UNDER 35 U.S.C. §119

The present application for patent claims priority to Provisional Application No. 60/497,457 entitled "Method and Apparatus for Seamless Delivery of Broadcast and Multicast Content Across Cell Borders and/or Between Different Transmission Schemes" filed Aug. 21, 2003 and Provisional Application No. 60/497,456 entitled "L2 Design for Outer Coding Scheme" filed Aug. 21, 2003, both of which can be assigned to the assignee hereof and hereby expressly incorporated by reference herein.

BACKGROUND

1. Field

The present invention relates generally to communication systems, and more specifically to delivery of broadcast and multicast content.

2. Background

Wireless communication systems have traditionally been used to carry voice traffic and low data rate non-voice traffic. Today wireless communication systems are being implemented that also carry high data rate (HDR) multimedia traffic, such as video, data, and other types of traffic. Multimedia Broadcast and Multicast Service (MBMS) channels may be used to transmit streaming applications based on voice, audio and video data sources such as, radio broadcasts, television broadcasts, movies, and other types of audio or video content. Streaming data sources can tolerate delay and a certain amount of loss or bit errors, since these sources are sometimes intermittent and typically compressed. As such, the data-rate of transmissions arriving at the Radio Access Network (RAN) can be highly variable. Because application buffers are typically finite, the MBMS transmission mechanisms are needed that support variable source data-rates.

Base stations typically provide such multimedia traffic services to the subscriber stations by transmitting an information signal that can be often organized into a plurality of packets. A packet may be a group of bytes, including data (payload) and control elements, that are arranged into a specific format. The control elements may comprise, for example, a preamble and a quality metric that can include a cyclical redundancy check (CRC), parity bit(s), and other types of metrics. The packets are usually formatted into a message in accordance with a communication channel structure. The message travels between the origination terminal and the destination terminal, and can be affected by characteristics of the communication channel, such as, signal-to-noise ratio, fading, time variance, and other such characteristics. Such characteristics can affect the modulated signal differently in different communication channels. Among other considerations, transmission of a modulated information signal over a wireless communication channel requires selection of appropriate methods for protecting the information in the modulated signal. Such methods may comprise, for example, encoding, symbol repetition, interleaving, and other methods known to one of ordinary skill in the art. However, these methods increase overhead. Therefore, an engineering compromise between reliability of message delivery and the amount of overhead must be made.

The operator typically selects either a Point-to-Point (PTP) connection or a Point-to-Multipoint (PTM) connection on a cell by cell basis depending on the number of subscriber stations or User Equipment (UE) interested in receiving the MBMS content.

Point-to-Point (PTP) transmission uses dedicated channels to send the service to selected users in the coverage area. A "dedicated" channel carries information to/from a single subscriber station. In Point-to-Point (PTP) transmissions a separate channel can be used for transmission to each mobile station. Dedicated user traffic for one user service in the forward link or downlink direction can be sent, for example, through a logical channel called the Dedicated Traffic Channel (DTCH). Point-to-Point (PTP) communication services are typically most efficient, for example, if there are not enough users demanding a specific Multimedia Broadcast and Multicast Service (MBMS) in the coverage area. In such cases, Point-to-Point (PTP) transmission may be used in which the base station transmits the service only to the specific users who have requested the service. For example, in WCDMA systems it can be more efficient to use a dedicated channel or Point-to-Point (PTP) transmission until there are more than a predetermined number of mobile stations.

A "broadcast communication" or "Point-to-Multipoint (PTM) communication" is a communication over a common communication channel to a plurality of mobile stations. A "common" channel carries information to/from multiple subscriber stations, and may be simultaneously used by several terminals. In a Point-to-Multipoint (PTM) communication service, a cellular base station may broadcast multimedia traffic service on a common channel if, for example, the number of users demanding the service exceeds a predetermined threshold number within the coverage area of the base station. In CDMA 2000 systems, broadcast or Point-to-Multipoint (PTM) transmission is typically used in lieu of the PtP transmission, since the PtM radio bearer is almost as efficient as the PtP radio bearer. Common channel transmissions from a particular base station may not necessarily be synchronized with common channel transmissions from other base stations. In a typical broadcast system one or more central stations serve content to a (broadcast net of users). The central station(s) can transmit information to either all subscriber stations or to a specific group of subscriber stations. Each subscriber station interested in a broadcast service monitors a common forward link signal. Point-to-Multipoint (PTM) transmissions can be sent on a downlink or forward common channel. This common broadcast forward link signal is typically broadcast on a unidirectional channel, such as the Common Traffic Channel (CTCH) that exists in the forward link or "downlink" direction. Because this channel is unidirectional, the subscriber station generally does not communicate with the base station since allowing all subscriber units to communicate back to the base station might overload the communication system. Thus, in the context of Point-to-Multipoint (PTM) communication services, when there is an error in the information received by the subscriber stations, the subscriber stations may not be able to communicate back to the base station. Consequently, other means of information protection can be desirable.

In CDMA 2000 systems, the subscriber station can soft combine in Point-to-Multipoint (PTM) transmission. Even when steps are taken to protect the information signal, the conditions of the communication channel can degrade such that the destination station cannot decode some of the packets transferred over dedicated channels. In such cases, one approach can be to simply re-transmit the non-decoded packets using an Automatic Retransmission reQuest (ARQ) made by the destination (subscriber) station to the origination (base) station. Retransmission helps ensure delivery of the