[0001] WIRELESS COMMUNICATION METHOD AND APPARATUS FOR REPORTING TRAFFIC VOLUME MEASUREMENT INFORMATION TO SUPPORT ENHANCED UPLINK DATA TRANSMISSIONS

[0002] FIELD OF INVENTION

[0003] The present invention is related to a wireless communication system including a wireless transmit/receive unit (WTRU) and a Node-B. More particularly, the present invention is related to reporting enhanced uplink (EU) traffic volume measurement (TVM) information to support EU data transmissions between the WTRU and the Node-B over a signaling channel having a limited capacity.

[0004] BACKGROUND

[0005] Methods for enhancing uplink (UL) coverage, throughput and transmission latency in a wireless communication system, such as a frequency division duplex (FDD) system, are currently being investigated in release 6 (R6) of the third generation partnership project (3GPP). Instead of scheduling and assigning uplink physical channels in a radio network controller (RNC), a Node-B (i.e., base station) controller is used such that more efficient decisions can be made and uplink radio resources can be managed on a short-term basis better than the RNC, even if the RNC retains overall control of the system. A similar approach has already been adopted in the downlink for release 5 (R5) of high speed data packet access (HSDPA) in a universal mobile telecommunications system (UMTS) for both an FDD mode and a time division duplex (TDD) mode.

[0006] In order for the Node-B to make efficient allocation decisions and prioritize between different priority flows, the Node-B must keep track of TVMs along with the associated priority. However, conventional UL signaling methods have limited capacity, and thus may not be able to accommodate the reporting of TVMs along with their associated priorities.

[0007] SUMMARY

[0008] The present invention is a wireless communication method and apparatus for reporting EU TVM information to support EU data transmissions between a WTRU, (i.e., a mobile station), and a Node-B. The apparatus may be a wireless communication system, a WTRU and/or an integrated circuit (IC). EU data is generated and stored in a buffer of the WTRU. The WTRU transmits an initial TVM information request message to the Node-B indicating that the WTRU has EU data to transfer to the Node-B. In response to receiving the initial TVM information request message, the Node-B schedules one or more allowed EU data transmissions between the WTRU and the Node-B by transmitting an EU data scheduling message to the WTRU.

[0009] The WTRU transfers all of the EU data stored in the buffer to the Node-B if the allowed EU data transmissions are sufficient to support transmission of all of the EU data stored in the buffer. Otherwise, the WTRU may transmit detailed TVM information multiplexed with at least a portion of the EU data to the Node-B.

[0010] The TVM information may indicate the quantity of the stored EU data. The detailed TVM information may indicate a quantity of buffered EU data associated with each of a plurality of traffic priority classes. The detailed TVM information may be multiplexed at a layer 2 medium access control (MAC) entity, or at a layer 3 radio resource control (RRC) or other equivalent layer 3 signaling entity.

[0011] The procedure used to transfer EU data stored in the buffer of the WTRU may be dependent upon whether or not the quantity of the EU data exceeds an established threshold. The initial TVM information request message may be transmitted to the Node-B only after the quantity of the stored EU data exceeds the established threshold. When the established threshold is not exceeded, the WTRU may transfer all of the EU data from the buffer of the WTRU to the Node-B without requiring scheduling

information from the Node-B. If the established threshold is set to zero, the WTRU may transfer the stored EU data from the buffer of the WTRU to the Node-B only after receiving scheduling information from the Node-B.

[0012] BRIEF DESCRIPTION OF THE DRAWING(S)

[0013] A more detailed understanding of the invention may be had from the following description of a preferred example, given by way of example and to be understood in conjunction with the accompanying drawing wherein:

[0014] Figure 1 shows a wireless communication system operating in accordance with the present invention;

[0015] Figure 2 is a signal flow diagram for the system of Figure 1 when more than one EU transmission is necessary to transmit all of the EU data buffered in the WTRU;

[0016] Figure 3 is a signal flow diagram for the system of Figure 1 when only one EU transmission is necessary to transmit all of the EU data buffered in the WTRU; and

[0017] Figure 4 is a flowchart of a process including method steps for implementing the reporting of TVMs in accordance with the present invention.

[0018] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0019] Hereafter, the terminology "WTRU" includes but is not limited to a user equipment (UE), mobile station, fixed or mobile subscriber unit, pager, or any other type of device capable of operating in a wireless environment.

[0020] When referred to hereafter, the terminology "Node-B" includes but is not limited to a base station, site controller, access point or any other type of interfacing device in a wireless environment.

[0021] The present invention may be further applicable to TDD, FDD, and time division synchronous code division multiple access (TD-SCDMA),

as applied to UMTS, CDMA 2000 and CDMA in general, but is envisaged to be applicable to other wireless systems as well.

[0022] The features of the present invention may be incorporated into an IC or be configured in a circuit comprising a multitude of interconnecting components.

[0023] Figure 1 shows a wireless communication system 100 operating in accordance with the present invention. The system 100 includes a WTRU 105 and a Node-B 110 which communicate with each other via wireless signals 115. The WTRU 105 includes at least one buffer 120.

[0024] Figure 2 is a signal flow diagram for the wireless communication system 100 when the EU data transmissions allowed by a first EU data scheduling message are not sufficient to transmit all of the EU data stored in the buffer 120 of the WTRU 105. EU data 205 is generated at the WTRU 105 and is stored in the buffer 120 of the WTRU 105. When the quantity of the EU data in the buffer 120 exceeds an established EU data buffer threshold, the WTRU 105 sends an initial TVM information request message 210 to the Node-B 110 via an EU signaling channel. Due to the limited payload capacity of the EU signaling channel, detailed TVM information may not be included with the initial TVM information request message 210. The initial TVM information request message 210 may just indicate that the WTRU 105 has EU data ready to send, and/or may serve as a rate request to the Node-B 110 by including an approximation of the amount of EU data.

[0025] Referring still to Figure 2, upon receiving the initial TVM information request message 210, the Node-B 110 schedules one or more EU transmissions between the WTRU 105 and the Node-B 110 via a first EU data scheduling message 215. In response to receiving the first EU data scheduling message 215, the WTRU 105 sends one or more EU data transmissions 220 to the Node-B 110 allowed by the first EU data scheduling message 215. If the EU data transmissions scheduled by the Node-B 110 are not sufficient to transmit all of the EU data buffered in the

WTRU 105, the WTRU 105 sends EU data transmissions 220 including detailed TVM information that indicates the approximate amount of data buffered in the WTRU 105. Optionally, the detailed TVM information may indicate an amount of buffered data associated with each associated traffic priority class or logical channel mapped to the EU dedicated channel (EU-DCH). The detailed TVM information may be multiplexed at layer 2 or layer 3 with the EU data. At layer 2, the detailed TVM information may be identified in the EU-DCH MAC header, and at layer 3 the detailed TVM information may be signaled within a radio resource control (RRC) or other equivalent L3 signaling entity. The EU data transmissions 220 may include several independent physical transmissions.

[0026] Node-B 110 can utilize the comprehensive knowledge of the TVM information and potentially associated priorities and/or logical channels reported via the EU data transmissions 220 in subsequent uplink scheduling. When the WTRU 105 obtains additional EU data later on, the WTRU 105 may choose to report updated TVM information to the Node-B 110. The Node-B 110 then schedules subsequent EU data transmissions from the WTRU 105 to the Node-B 110 via subsequent EU data scheduling messages 225a - 225n.

[0027] Figure 3 is a signal flow diagram for the wireless communication system 100 when one or more EU data transmissions allowed by an EU data scheduling message are sufficient to transmit all of the EU data stored in the buffer 120 in the WTRU 105. EU data 305 is generated at the WTRU 105 and is stored in the buffer 120 of the WTRU 105. When the quantity of the EU data in the buffer 120 exceeds an established EU data buffer threshold, the WTRU 105 sends an initial TVM information request message 310 to the Node-B 110 via an EU signaling channel.

[0028] EU data transmissions sent by the WTRU 105 are not required to be scheduled by the Node-B 110 when the established EU data buffer threshold is not exceeded.

[0029] Still referring to Figure 3, upon receiving the initial TVM information request message 310, the Node-B schedules one or more EU data transmissions between the WTRU 105 and the Node-B via an EU data scheduling message 315. In response to receiving the EU data scheduling message 315, the WTRU 105 sends one or more EU data transmissions 320 allowed by the EU data scheduling message 315. If the EU transmissions allowed by the EU data scheduling message 315 are sufficient to transmit all of the EU data buffered in the WTRU 105, all of the EU data stored in the buffer 120 of the WTRU 105 is sent to the Node-B. No additional TVM reporting is necessary since the WTRU 105 is aware that there is no additional EU data to transmit to the Node-B 110.

[0030] Data associated with priority class or logical channels/MAC-d flows associated with TVMs may be stored in the Node-B 110 to make more precise channel allocations and more efficient use of radio resources. The Node-B 110 utilizes the TVMs and associated priorities to establish subsequent EU data scheduling with greater accuracy due to the additional TVM detail provided by the WTRU 105.

[0031] Figure 4 is a flowchart of a process 400 including method steps for transferring user data from the WTRU 105 to the Node-B 110 in accordance with the present invention. In step 405, EU data is generated and stored in the buffer 120 of the WTRU 105. In optional step 410, a determination is made as to whether or not the quantity of EU data stored in the buffer 120 of the WTRU 105 exceeds an established EU data buffer threshold. When the quantity of the stored EU data in the buffer 120 of the WTRU 105 does not exceed the established threshold, EU transmissions are allowed without Node-B scheduling, and all of the stored EU data is transmitted to the Node-B 110 (step 430). If the quantity of the stored EU data exceeds the established threshold, the WTRU 105 sends an initial TVM information request message to the Node-B 110 indicating that the WTRU 105 has EU data to send to the Node-B 110 (step 415).

[0032] It should be noted that the established EU data buffer threshold may be set to zero. In this case, the storage of any amount of EU data in the buffer 120 of the WTRU 105 will always trigger the transmission of an initial TVM information request message 210.

[0033] Still referring to Figure 4, in step 420, the Node-B 110 sends an EU data scheduling message, including information on one or more allowed EU data transmissions, to the WTRU 105 to schedule transmission of the EU data buffered in the WTRU 105 to the Node-B 110. In step 425, the WTRU 105 determines if the allowed EU data transmissions are sufficient to transmit all of the buffered EU data. If the EU data transmissions allowed by the current scheduling information are sufficient to support transmission of all of the EU data stored in the buffer 120, all of the EU data buffered in the WTRU 105 is transmitted to the Node-B 110 in the allowed EU data transmissions (step 430).

[0034] If the EU data transmissions allowed by the current scheduling information are not sufficient to transmit all of the EU data buffered in the WTRU 105, the WTRU 105 transmits one or more EU data transmissions including detailed TVM information multiplexed with a portion of the stored EU data to the Node-B 110 (step 435). In step 440, the Node-B 110 schedules and transmits one or more additional EU data transmissions until there is no more EU data buffered in the WTRU 105.

[0035] While this invention has been particularly shown and described with reference to preferred embodiments, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the scope of the invention described hereinabove.

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Claims

What is claimed is:

1. A method for use by a wireless transmit/receive unit (WTRU) for uplink transmission, the method comprising:

the WTRU transmitting a message to a Node-B, wherein the message is selected from at least a first type, a second type, and a third type;

wherein on a condition that the WTRU does not have capacity for the second type or the third type, the message is the first type indicating that the WTRU has uplink buffered data to transmit;

wherein on a condition that the WTRU has capacity for the second type message, the message is the second type comprising a plurality of indications, wherein each indication indicates an amount of uplink buffered data associated with at least one logical channel, wherein each logical channel is associated with a priority;

wherein on a condition that the message is not the first type or the second type, the message is the third type having less information than the second type and more information than the first type;

the WTRU receiving, in response to the message, information that indicates a grant of an uplink data transmission; and

the WTRU transmitting uplink data over an uplink channel based on the received information.

2. The method of claim 1 wherein the message includes an indication of a total amount of uplink buffered data.

3. The method of claim 1 wherein the message includes an indication of an amount of uplink buffered data for a plurality of logical channels.

4. The method of claim 1 wherein the uplink data is transmitted over a plurality of physical channels.

5. The method of claim 1 wherein the message is multiplexed with uplink data.

6. The method of claim 5 wherein the message is multiplexed with uplink data at a medium access control (MAC) layer.

7. A wireless transmit/receive unit (WTRU) comprising:

circuitry configured to transmit a message to a Node-B, wherein the message is selected from at least a first type, a second type, and a third type;

wherein on a condition that the WTRU does not have capacity for the second type or the third type, the message is the first type indicating that the WTRU has uplink buffered data to transmit;

wherein on a condition that the WTRU has capacity for the second type message, the message is the second type comprising a plurality of indications, wherein each indication indicates an amount of uplink buffered data associated with at least one logical channel, wherein each logical channel is associated with a priority;

wherein on a condition that the message is not the first type or the second type, the message is the third type having less information than the second type and more information than the first type;

circuitry configured to receive, in response to the message, information that indicates a grant of an uplink data transmission; and

circuitry configured to transmit uplink data over an uplink channel based on the received information.

8. The WTRU of claim 7 wherein the message includes an indication of a total amount of uplink buffered data.

9. The WTRU of claim 7 wherein the message includes an indication of an amount of uplink buffered data for a plurality of logical channels.

10. The WTRU of claim 7 wherein the uplink data is transmitted over a plurality of physical channels.

11. The WTRU of claim 7 wherein the message is multiplexed with

uplink data.

12. The WTRU of claim 11 wherein the message is multiplexed with uplink data at a medium access control (MAC) layer.