DYNAMIC RESOURCE ALLOCATION, SCHEDULING AND SIGNALING FOR VARIABLE DATA RATE SERVICE IN LTE

[0001] FIELD OF INVENTION

[0002] The present invention is related to wireless communication systems. More particularly, the present invention is related to a method and apparatus for dynamic resource allocation, scheduling and signaling for variable data rate service in long term evolution (LTE) systems.

[0003] BACKGROUND

[0004] Wireless communication systems are well known in the art. Communications standards are developed in order to provide global connectivity for wireless systems and to achieve performance goals in terms of, for example, throughput, latency and coverage. One current standard in widespread use, called Universal Mobile Telecommunications Systems (UMTS), was developed as part of Third Generation (3G) Radio Systems, and is maintained by the Third Generation Partnership Project (3GPP).

[0005] A typical UMTS system architecture in accordance with current 3GPP specifications is depicted in Figure 1. The UMTS network architecture includes a Core Network (CN) interconnected with a UMTS Terrestrial Radio Access Network (UTRAN) via an Iu interface. The UTRAN is configured to provide wireless telecommunication services to users through wireless transmit receive units (WTRUs), referred to as user equipments (UEs) in the 3GPP standard, via a Uu radio interface. For example, a commonly employed air interface defined in the

UMTS standard is wideband code division multiple access (W-CDMA). The UTRAN has one or more radio network controllers (RNCs) and base stations, referred to as Node Bs by 3GPP, which collectively provide for the geographic coverage for wireless communications with UEs. One or more Node Bs is connected to each RNC via an Iub interface. RNCs within a UTRAN communicate via an Iur interface.

[0006] The Uu radio interface of a 3GPP system uses Transport Channels (TrCHs) for transfer of higher layer packet containing user data and signaling between UEs and Node Bs. In 3GPP communications, TrCH data is conveyed by one or more physical channels defined by mutually exclusive physical radio resources, or shared physical radio resources in the case of shared channels

[0007] To improve reliability of data transmission, automatic repeat request (ARQ) or hybrid ARQ (HARQ) is implemented. HARQ and ARQ employ a mechanism to send feedback to the original sender in the form of a positive acknowledgment (ACK) or a negative acknowledgement (NACK) that respectively indicate successful or unsuccessful receipt of a data packet to a transmitter so that the transmitter may retransmit a failed packet. HARQ also uses error correcting codes, such as turbo codes, for added reliability.

[0008] Evolved universal terrestrial radio access (E-UTRA) and OUTRAN long term evolution (LTE) are part of a current effort lead by 3GPP towards achieving high

data-rate, low-latency, packet-optimized system capacity and coverage in UMTS systems. In this regard, LTE is being designed with significant changes to existing 3GPP radio interface and radio network architecture, requiring evolved Node Bs (eNBs), which are base stations (Node Bs) configured for LTE. For example, it has been proposed for LTE to replace code division multiple access (CDMA) channel access used currently in UMTS, by orthogonal frequency division multiple access (OFDMA) and frequency division multiple access (FDMA) as air interface technologies for downlink and uplink transmissions, respectively. LTE is being designed to use HARQ with one HARQ process assigned to each data flow and include physical layer support for multiple-input multiple-output (MIMO).

[0009] LTE systems are also being designed to be entirely packet switched for both voice and data traffic. This leads to many challenges in the design of LTE systems to support voice over internet protocol (VoIP) service, which is not supported in current UMTS systems. VoIP applications provide continuous voice data traffic such that data rates vary over time due to intermittent voice activity. Variable data rate applications like VoIP provide specific challenges for physical resource allocation, as described below.

[0010] eNBs in LTE are responsible for physical radio resource assignment for both uplink (UL) communications from a UE to the eNB, and downlink (DL) communications from eNB to a UE. Radio resource allocation in

LTE systems involves the assignment of frequency-time (FT) resources in an UL or DL for a particular data flow. Specifically, according to current LTE proposals, FT resources are allocated according to blocks of frequency sub carriers or subchannels in one or more timeslots, generally referred to as radio blocks. The amount of physical resources assigned to a data flow, for example a number of radio blocks, is typically chosen to support the required data rate of the application or possibly other quality of service (QoS) requirements such as priority.

[0011] It has been proposed that physical resource allocation for DL and UL communications over the E-UTRA air interface in LTE can be made valid for either a predetermined duration of time, known as non-persistent assignment, or an undetermined duration of time, known as persistent assignment. Since the assignment messages transmitted by the eNB may target both the intended recipient UE of the assignment as well as any UEs currently assigned to the resources specified by the assignment, the eNB may multicast the assignment message, such that the control channel structure allows for UEs to decode control channel messages targeted for other UEs.

[0012] For applications that require sporadic resources, such as hypertext transport protocol (HTTP) web browser traffic, the physical resources are best utilized if they are assigned on an as-need basis. In this case, the resources are explicitly assigned and signaled by the layer 1 (L1) control channel, where L1 includes the phys-

ical (PHY) layer. For applications requiring periodic or continuous allocation of resources, such as for VoIP, periodic or continuous signaling of assigned physical resources may be avoided using persistent allocation. According to persistent allocation, radio resource assignments are valid as long as an explicit deallocation is not made. The objective of persistent scheduling is to reduce L1 and layer 2 (L2) control channel overhead, especially for VoIP traffic, where L2 includes the medium access control (MAC) layer. Persistent and non-persistent assignments by the L1 control channel may be supported using, for example, a persistent flag or a message ID to distinguish between the two types of assignment in an assignment message transmitted by the eNB.

[0013] Figures 2 and 3 illustrate examples of persistent allocation of frequency-time resources in LTE, where each physical layer sub-frame comprises four time interlaces to support HARQ retransmissions of negatively acknowledged data. Each interlace is used for the transmission of a particular higher layer data flow, such that the same interlace in a subsequent sub-frame is used for retransmission of packets that were unsuccessfully transmitted. A fixed set of frequency-time (FT) resources are assigned in each interlace for control traffic as a control channel, which may include the L1 common control channel (CCCH) and synchronization channel.

[0014] Figure 2 shows an example of persistent allocation and deallocation. In sub-frame 1, a first set of frequency-time resources (FT1), including one or more ra-

dio blocks, are allocated to UE_1 via the control channel. Assuming the transmission of data to UE_1 completes after i-1 subframes, the eNB sends in sub-frame i a control message to UE_1 and UB_2 in order to deallocate resources FT1 from UE_1 and allocate them to UE_2. The control channel can be used in the intermediate sub-frames between subframes 1 and i for the assignment of other FT resources. Figure 3 shows an example of persistent allocation and expansion, where eNB assigns additional physical resources FT2 to UE_1 in sub-frame i to support higher data rates for UE_1.

[0015] A characteristic of many real time services (RTS), such as voice services, is variable data rates. In the case of voice services, a conversation is characterized by periods of speech followed by periods of silence, thus requiring alternating constantly varying data rates. For example, a typical adaptive multi-rate (AMR) channel for voice service supports eight encoding rates from 4.75 Kbps to 12.2 Kbps and a typical adaptive multi-rate wideband (AMR-WB) channel supports nine encoding rates from 6.6 Kbps to 23.85 Kbps.

[0016] Current techniques for persistent resource scheduling are not designed to accommodate variations in data rates. Under conventional persistent allocation, physical resources are allocated to support either a maximum data rate for a data flow or some sufficiently large fixed data rate supported by the physical channel. Accordingly, physical resources are wasted because the resource allocation is not able to adapt to changes in

required data rates resulting from, for example, intermittent voice activity.

[0017] In order to support variable data rates, an eNB must be signaled the changing data rates for both UL and DL traffic. In LTE systems, an eNB can easily monitor DL data rate variations that originated at the eNB and make efficient DL resource assignment. However, current UMTS systems and proposals for LTE systems do not provide a manner for an eNB to monitor data rate variations for UL traffic originating at a UE so that the eNB may accordingly assign the appropriate amount of UL physical resources in a dynamic and efficient manner. Additionally, current proposals for LTE systems do not support high-level configuration operations for VoIP service.

[0018] The inventors have recognized that there is a need in LTE systems for support of dynamic resource allocation in combination with persistent resource allocation, along with efficient scheduling and control signaling, in order to support RTS applications with changing data rates such as VoIP. Therefore, the inventors have developed a method and apparatus for solving these problems in LTE systems.

[0019] WO 2006/019267 describes a method for scheduling uplink resources in a wireless system. A base station allocates an amount of resources to a subscriber station. When a request for data rate change is received, the base station allocates a corresponding amount of resources.

[0020] SUMMARY

[0021] A method and apparatus for radio resource allocation, scheduling and signaling for variable data rate and real time service (RTS) applications are provided, where the present invention is preferably used in long term evolution (LTE) and high speed packet access (HSPA) systems.

[0022] More specifically, such methods and apparatuses are defined in the appended claims 1, 6, 11, 12, 17, and 22.

[0023] A more detailed understanding of the invention may be hab from the following description of a preferred embodiment, given by way of example and to be understood in conjunction wiht the accompanying drawings.

[0024] BRIEF DESCRIPTION OF THE DRAWINGS

[0025] Figure 1 is a block diagram of the system architecture of a conventional UMTS network.

[0026] Figure 2 is a diagram showing an example of persistent assignment allocation and deallocation in the time-frequency domain.

[0027] Figure 3 is a diagram showing an example of persistent assignment allocation and expansion in the time-frequency domain.

[0028] Figure 4 is a flow diagram of a method for high-level configuration of real time services (RTS), in accordance with a first embodiment of the present invention.

[0029] Figure 5 is a flow diagram of a method for signaling variable data rates for uplink traffic, in accordance with a second embodiment of the present invention.

[0030] Figure 6 is a flow diagram of a method for dynamic allocation and signalling of radio resources at an evolved Node B (eNB) for RTS with variable data rates, in accordance with a third embodiment of the present invention.

[0031] Figure 7 is a flow diagram of a method for dynamic allocation and signalling of radio resources at a user equipment (UE) for RTS with variable data rates, in accordance with a fourth embodiment of the present invention.

[0032] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0033] Hereafter, a wireless transmit/receive unit (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. When referred to hereafter, a base station includes but is not limited to a Node-B, evolved Node B (eNB), site controller, access point or any other type of interfacing device in a wireless environment. A base station is a type of WTRU.

[0034] Although Generation Partnership Project (3GPP) long term evolution (LTE) is used by way of example in the following description, the present invention is applicable to wireless communication systems including, but not limited to, high speed packet access (HSPA) and HSPA evolution (HSPA+) systems. Additionally, real time services (RTS) such as voice over internet protocol (VoIP) are used by way of example to describe the in-

vention. However, the present invention is intended to support any intermittently transmitting or variable data applications, and may also be used to adapt resource allocation for retransmissions. In the following, radio access bearer (RAB) or logical channel may be used interchangeably with data flow.

[0035] According to a first preferred embodiment, high-level information for a RTS data flow including a data flow identification (ID), or equivalently a radio access bearer (RAB) or logical channel ID, and a hybrid automatic repeat request (HARQ) process ID, are transmitted from an eNB to higher layers of a recipient UE during a configuration stage prior to the transmission of the data flow. A HARQ process is preferably assigned for an entire data flow. Accordingly, the data flow ID and HARQ process ID are preferably only transmitted once at the beginning of the data flow and not on a per packet basis. For example, referring to Figure 2, a data flow ID and HARQ process ID for a user equipment UE_1 is sent in sub-frame 1 in connection with the assignment of frequency-time (FT) resources FT1 to UE_1. Similarly, a data flow ID and HARQ process ID for another user equipment UE_2 is sent in subframe i in connection with the assignment of frequency-time (FT) resources FT1 to UE_2 following the completion of the use of FT1 by UE_1.

[0036] Additionally, packet sequence numbers are preferably assigned at higher radio link control (RLC) layers, such that sequence numbers are not used at lower layers such as physical (PHY) and medium access con-

trol (MAC) layers. Accordingly, the reordering of packets that are received is handled at or above the RLC layer, for example, by a layer 3 (L3) protocol such as radio resource control (RRC).

[0037] Figure 4 is a flow diagram of a method 400 for high-level configuration of RTS in accordance with the first embodiment of the present invention. In step 405, an eNB sends a data flow ID (or equivalently a RAB or logical channel ID) and a HARQ process ID as part of a configuration message for an RTS data flow before the transmission of data flow packets, for example in connection with FT1 assignment to UE1 in subframe 1 of Figure 2. In step 410, the eNB does not include data flow ID and process ID fields in data flow packets for higher layers, but packet sequence numbers are included in an RLC control header, for example, for packets transmitted in subframes 2 through i-1 for the UE_1 communication of Figure 2 which ends. There is a resultant saving in higher layer signaling, since the higher layers received, for example, the data flow ID and HARQ process ID for the communication regarding UE_1 in sub-frame 1 which are then available for use in processing the data packets for the UE_1 communication that are received in sub-frames 2 through i-1 without repetitive signaling of the ID information. Further saving in signaling is realized through the elimination of sequence number signaling in the lower layers. In implementing method 400, a transmitter is configured to transmit data flow and HARQ process IDs in a configuration message and transmit packet sequence

numbers in an RLC control header.

[0038] According to a second embodiment of the present invention, a UE preferably signals information to an eNB concerning variable data rates in uplink (UL) communications. This is preferably done by reporting a change in data rate relative to a current data rate. An RTS data flow is initially assigned a certain amount of physical resources in order to support a current data rate using, for example, persistent assignment. When the UE detects a new data rate, the UE preferably signals to the eNB the difference between the current data rate and the new data rate. By signaling only the difference in data rate, the number of overhead bits used is minimized.

[0039] By way of example, 4 reporting bits are required to report the actual data rate when up to 9 codec rates as used in a VoIP service. More reporting bits are used if more codec rates are available. When only the change in data rate is reported, the number of reporting bits is reduced from 4 to 3 because the greatest change in data rate from the lowest rate to the highest rate is only 8. Preferably, the minimum number of reporting bits is used to report the possible variations in data rate for a particular RTS service.

[0040] The change in data rate of an RTS data flow over the UL may be signaled using layer 1 (L1), layer 2 (L2) or layer 3 (L3) signaling, where L1 includes the physical (PHY) layer, layer 2 includes the medium access control (MAC) and radio link control (RLC) layers and layer 3 includes the radio resource control (RRC) layer.

Alternatively, the change in data rate may be signaled at higher layers.

[0041] L1 signaling of changes in data rate of UL traffic is preferably done using L1 control signaling, such that variable data rate reporting bits may be multiplexed with other UL L1 signals including hybrid automatic repeat request (HARQ), acknowledgment (ACK), negative acknowledgment (NAK) and channel quality indicator (CQI). Alternatively, an UL thin channel may be used. The UL thin channel is preferably used by a UE that needs to report a rate change to the eNB in an expedited manner so that the eNB assigns new UL resources to the RTS sooner. In another alternative, a data rate change indication can be sent using a synchronous random access channel (RACH), where the RACH has the benefit of small access delays.

[0042] The signaling of changes in data rate of UL traffic at L2 is preferably done by including rate change reporting bits in a MAC header of a packet scheduled for transmission over the UL. Alternatively, a rate change indication can be piggybacked with any UL L2 packet if the timing of the piggybacked packet is within a reasonable delay. Alternatively, a rate change indication can be sent via MAC control packet data unit (PDU), where the MAC control PDU may exclusively contain the data rate change indication or may contain other information for other control purposes. In another alternative, a rate change indication may be included in a periodic RLC status report from the UE to the eNB. Using L3 signaling, a

change in data rate may be signaled by including a rate change indication in RRC signaling.

[0043] When the eNB detects the data rate change reported by a UE, the eNB dynamically reallocates physical resources assigned to the RTS of that UE accordingly. For example, if the data rate decreased, then the eNB can reallocate some of the resources originally assigned to the UE during persistent assignment to other UEs. The eNB may assign additional resources to the UE in the case of an increase in data rate.

[0044] Preferably, the dynamic allocation by the eNB overrides the initial resource allocation by persistent assignment. The eNB may specify a time duration during which the dynamic allocation overrides the original allocation when signaling the dynamic resource allocation to the UE. If no duration is specified, then it may be assumed that the dynamic allocation is only used once. The dynamic allocation by eNB to override persistent resource allocation is not only applicable to variable data rate services, but may also be used to reallocate resources for retransmissions.

[0045] Figure 5 is a flow diagram of a method 500 for signaling variable data rates for UL RTS traffic, in accordance with the second embodiment of the present invention. A UE signals variable data rates for UL RTS traffic to an eNB by reporting the change in data rate relative to a current data rate using a minimum number of bits, in step 505. The reporting may be done using L1, L2 or L3 signaling, as described above. In step 510, the eNB

adjusts the amount of physical resources assigned to the UE for the RTS according to the reported change in data rate. In contrast with the prior art of Figures 2 and 3, the FT resource allocation for UE_1 made in sub-frame 1 does not necessarily remain fixed until sub-frame i, but can be dynamically changed per step 510 in a sub-frame prior to sub-frame i. In implementing method 500, a transceiver component may be configured to transmit signals reflecting change in data rate, and a resource allocation component may be configured to allocate physical resources.

[0046] According to a third embodiment of the present invention, DL and UL radio resources assigned to an RTS data flow are dynamically allocated in order to efficiently use the physical resources assigned to variable data rates services. Typically, the maximum amount of radio resources required for an RTS are initially assigned by persistent allocation, in order to support the maximum data rate for the RTS. For illustrative purposes, it is assumed that a set of N radio blocks are initially allocated by persistent scheduling. The eNB preferably dynamically allocates only a subset of the N radio blocks to the RTS data low when lower data rates are required. Under higher data rates, the eNB allocates a larger set of radio blocks, and can allocate new radio blocks in addition to the original set of N radio blocks, if desired. If sub-band allocation is supported, where radio resources are allocated according to fractions of a radio block, then dynamic resource allocation is preferably adapted to the gran-

ularity of sub-bands.

[0047] Preferably, only the change in radio resource allocation resulting from dynamic resource allocation is signaled by the eNB to the target UE in order to reduce signaling overhead. In one embodiment, the radio resource blocks assigned to the RTS are indexed, such that the radio blocks may be arranged in increasing or decreasing order according to index number. Accordingly, the eNB only signals the number of radio blocks for dynamic allocation, such that the UE accordingly uses the reported number of radio blocks in order of index number starting with the radio block with either lowest or the highest index number. By way of example, radio blocks indexed 2, 3, 5 and 8 are assigned to a UE (i.e. N=4) for an RTS data flow during persistent scheduling. In response to a decrease in data rate, the eNB reports that only 3 radio blocks are dynamically allocated to the UE. Based on the report from the eNB and starting with the lowest index, the UE knows that the new resource allocation is radio blocks 2, 3 and 5. Alternatively, a positive or negative difference between the original allocation of N blocks and the number needed may be signaled. Where more blocks are required, default parameters can be provided or block identification can be signaled for the additional blocks.

[0048] A new radio resource allocation is preferably signaled by a eNB to a UE as a field in L1 or L2 control signaling for fast DL or UL dynamic resource allocation, or, in L3 RRC signaling in the case of slowly changing

resource allocation. When L1 or L2 control signaling is used, a physical layer ACK or NAK is preferably transmitted back to the eNB to improve the reliability of the resource allocation signaling. Additionally, information including, but not limited to, the duration of new radio resource allocation, repetition period, sequence pattern, radio resource and the frequency hopping pattern may be provided as part of the radio resource allocation signaling, when desired.

[0049] Figure 6 is a flow diagram of a method 600 for dynamic allocation and signaling of radio resources at an eNB for RTS with variable data rates, in accordance with the third embodiment of the present invention. In step 605, an eNB is notified of a change in data rate for an RTS data flow over a wireless link between the eNB and a UE such that N radio blocks are currently assigned to the RTS. In step 610, the eNB dynamically allocates radio blocks to the UE for the RTS data flow in response to the change in data rate such that if the data rate decreased, then a subset of the N radio blocks are assigned, and if the data rate increased, then additional radio blocks are assigned. In step 615, the eNB signals to the UE the new radio block allocation by only signaling the change in radio block assignment. In contrast with the prior art of Figures 2 and 3, the FT resource allocation for UE_1 made in sub-frame 1 does not necessarily remain fixed until sub-frame i, but can be dynamically changed per step 615 prior to sub-frame i. In implementing method 600, a data rate detection component may be configured

to detect changes in data rate associated with a data flow, and a resource allocation component can be configured to allocate physical resources and is associated with a transmitter in order to signal resource allocations to a UE.

[0050] In accordance with a fourth embodiment of the present invention, a table relating data rates to radio resource characteristics is used for efficient radio resource allocation and signaling ofUL resources. Both the eNB and the UE preferably store a pre-calculated table relating a number of radio resource blocks, or when applicable sub-bands, required for RTS data rates for a range of channel conditions according to, for example, modulation and coding scheme (MCS). When a new data rate is identified at the UE for a current RTS data flow over the UL, the UE preferably calculates the needed radio resources under determined UL channel conditions based on the table entry for that data rate. Accordingly, the UE does not have to communicate with the eNB to adapt its resource assignment, and overhead control signaling to the eNB is reduced.

[0051] In a preferred embodiment, the eNB signals a pre-allocated table to the UE where the table identifies specific radio resources, such as radio blocks or sub-bands, that are required for various RTS data rates for a range of channel conditions. For example, radio blocks may be referred to by index number, as described above. The UE dynamically allocates UL resources in response to a change in data rate of an RTS data flow by looking

up the corresponding resources in the table, and signals the assigned resource set to the eNB. The UE may wait for an approval message from the eNB before using the newly assigned UL resources. The eNB preferably sends an approval of new radio resource assignment when additional resources are allocated to accommodate an increase in data rate. The approval message from the eNB is optional when radio resources are deallocated for decreases in data rate.

[0052] Figure 7 is a flow diagram of a method 700 for dynamic allocation and signaling of radio resources at a user equipment (UE) for RTS with variable data rates, in accordance with the fourth embodiment of the present invention. In step 705, a UE receives a table from an eNB that maps required radio resources or resource characteristics to RTS data rates under predetermined channel conditions. In step 710, the UE detects a change in data rate of an UL RTS data flow, and determines the corresponding radio resource allocation from the table. In step 715, the UE signals the determined radio resource allocation to the eNB and waits for an approval signal from the eNB before using the determined radio resources. In contrast with the prior art of Figures 2 and 3, the FT resource allocation for UE_1 made in sub-frame 1 does not necessarily remain fixed until sub-frame i, but can be dynamically changed in a sub-frame prior to sub-frame i. In implementing method 700, a transceiver is used to receive the table from the eNB and signal radio resource allocations to the eNB, and a data rate detection compo-

nent is configured to detect changes in data rate.

[0053] Although the features and elements of the present invention are described in the preferred embodiments in particular combinations, each feature or element can be used alone without the other features and elements of the preferred embodiments or in various combinations with or without other features and elements of the present invention. The methods or flow charts provided in the present invention may be implemented in a computer program, software, or firmware tangibly embodied in a computer-readable storage medium for execution by a general purpose computer or a processor. Examples of computer-readable storage mediums include a read only memory (ROM), a random access memory (RAM), a register, cache memory, semiconductor memory devices, magnetic media such as internal hard disks and removable disks, magneto-optical media, and optical media such as CD-ROM disks, and digital versatile disks (DVDs).

[0054] Suitable processors include, by way of example, a general purpose processor, a special purpose processor, a conventional processor, a digital signal processor (DSP), a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs) circuits, any integrated circuit, and/or a state machine.

[0055] A processor in association with software may

be used to implement a radio frequency transceiver for in use in a wireless transmit receive unit (WTRU), user equipment, terminal, base station, radio network controller, or any host computer. The WTRU may be used in conjunction with modules, implemented in hardware and/or software, such as a camera, a video camera module, a videophone, a speakerphone, a vibration device, a speaker, a microphone, a television transceiver, a hands free headset, a keyboard, a Bluetooth® module, a frequency modulated (FM) radio unit, a liquid crystal display (LCD) display unit, an organic light-emitting diode (OLED) display unit, a digital music player, a media player, a video game player module, an Internet browser, and/or any wireless local area network (WLAN) module.

Claims

1. A wireless transmit/receive unit, WTRU, comprising:

means for receiving a first allocation of resources for uplink communications;
means for transmitting uplink communications according to the first allocation of resources;
means for receiving control information indicating a second allocation of resources for uplink communications; and
means for transmitting uplink communications according to the second allocation of resources **characterized in that** the WTRU is adapted to transmit uplink communications according to the second allocation of resources for a predetermined time duration and to transmit uplink communications according to the first allocation of resources after the predetermined time duration.

2. The WTRU of claim 1 wherein the second allocation of resources overrides the first allocation of resources during the predetermined time duration.

3. The WTRU of claim 1 wherein the control information is received as L1/L2 control information.

4. The WTRU of claim 3 wherein the L1/L2 control information is received in an orthogonal frequency division multiple access, OFDMA, format.

5. The WTRU of any one of claims 1-4 wherein the predetermined time duration is a single subframe.

6. A method for dynamic resource allocation comprising:

receiving a first allocation of resources for uplink communications;
transmitting uplink communications according to the first allocation of resources ;
receiving control information indicating a second allocation of resources for uplink communications; and
transmitting uplink communications according to the second allocation of resources **characterized in that** uplink communications are transmitted according to the second allocation of resources for a predetermined time duration and that uplink communications are transmitted according to the first allocation of resources after the predetermined time duration.

7. The method of claim 6 wherein the second allocation of resources overrides the first allocation of resources during the predetermined time duration.

8. The method of claim 7 wherein the control information is received as L1/L2 control information.

9. The method of claim 8 wherein the L1/L2 control information is received in an orthogonal frequency division multiple access, OFDMA, format.

10. The method of any one of claims 6-9 wherein the predetermined time duration is a single subframe.

11. A base station, comprising:

means for transmitting to a wireless transmit/receive unit, WTRU, a first allocation of resources for uplink communications;
means for receiving, from the WTRU, uplink communications according to the first allocation of resources;
means for transmitting, to the WTRU, control information indicating a second allocation of resources for uplink communications; and
means for receiving, from the WTRU, uplink communications according to the second allo-

cation of resources **characterized in that** the base station is adapted to receive uplink communications according to the second allocation of resources for a predetermined time duration and to receive uplink communications according to the first allocation of resources after the predetermined time duration.

12. A wireless transmit/receive unit, WTRU, comprising:

means for receiving a first allocation of resources for downlink communications;
means for receiving downlink communications according to the first allocation of resources;
means for receiving control information indicating a second allocation of resources for downlink communications; and
means for receiving downlink communications according to the second allocation of resources, **characterized in that** the WTRU is adapted to receive downlink communications according to the second allocation of resources for a predetermined time duration and to receive downlink communications according to the first allocation of resources after the predetermined time duration.

13. The WTRU of claim 12 wherein the second allocation of resources overrides the first allocation of resources during the predetermined time duration.

14. The WTRU of claim 12 wherein the control information is received as L1/L2 control information.

15. The WTRU of claim 14 wherein the L1/L2 control information is received in an orthogonal frequency division multiple access, OFDMA, format.

16. The WTRU of any one of claims 12-15 wherein the predetermined time duration is a single subframe.

17. A method for dynamic resource allocation comprising:

receiving a first allocation of resources for downlink communications;
receiving downlink communications according to the first allocation of resources ;
receiving control information indicating a second allocation of resources for downlink communications; and
receiving downlink communications according to the second allocation of resources **characterized in that** downlink are received according to the second allocation of resources for a predetermined time duration and that downlink communications are received according to the first allocation of resources after the predetermined time duration.

18. The method of claim 17 wherein the second allocation of resources overrides the first allocation of resources during the predetermined time duration.

19. The method of claim 17 or 18 wherein the control information is received as L1/L2 control information.

20. The method of claim 17 wherein the L1/L2 control information is received in an orthogonal frequency division multiple access, OFDMA, format.

21. The method of any one of claims 17-20 wherein the predetermined time duration is a single subframe.

22. A base station, comprising:

means for transmitting to a wireless transmit/receive unit, WTRU, a first allocation of resources for downlink communications;
means for transmitting, to the WTRU, downlink communications according to the first allocation of resources;
means for transmitting, to the WTRU, control information indicating a second allocation of resources for downlink communications; and
means for transmitting, to the WTRU, downlink communications according to the second allocation of resources **characterized in that** the base station is adapted to transmit downlink communications according to the second allocation of resources for a predetermined time duration and to transmit downlink communications according to the first allocation of resources after the predetermined time duration.