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Pani et al.

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(54) **MANAGEMENT AND SETUP OF ENHANCED MAC-E/ES RESOURCES IN CELL-FACH STATE**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 785 days.

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H04W 76/04 (2009.01)

(52) **U.S. Cl.**
CPC ***H04W 72/042*** (2013.01); *H04W 76/046* (2013.01); *H04W 92/12* (2013.01)

(58) **Field of Classification Search**
CPC . H04W 72/042; H04W 76/046; H04W 92/12; H04W 72/12; H04W 76/068; H04W 74/0833; H04W 72/0406; H04W 72/04; H04W 28/04; H04L 5/0053
USPC 370/329, 311; 455/450, 509
See application file for complete search history.

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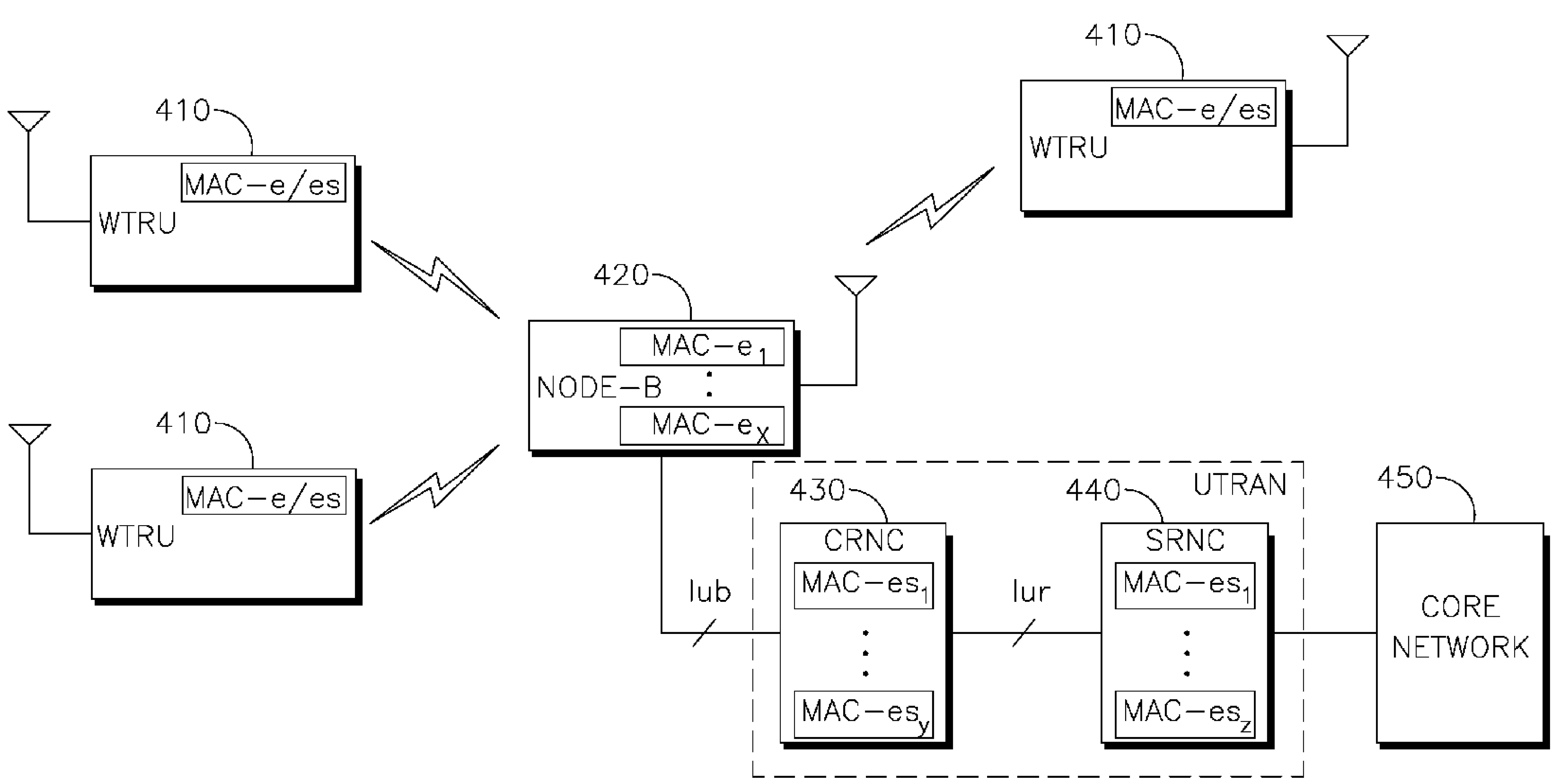
(57) **ABSTRACT**

A method and apparatus are disclosed to manage the enhanced medium access control-e (MAC-e) and enhanced MAC-es resources and respective variables for the enhanced dedicated channel (E-DCH) in the enhanced Cell_FACH state. Due to the nature of the E-DCH transmission in the uplink (UL) in the Cell_FACH state and the fact that a wireless transmit/receive unit (WTRU) might set up and release the E-DCH resources more frequently, methods to deal with the TSN numbering are described.

15 Claims, 7 Drawing Sheets



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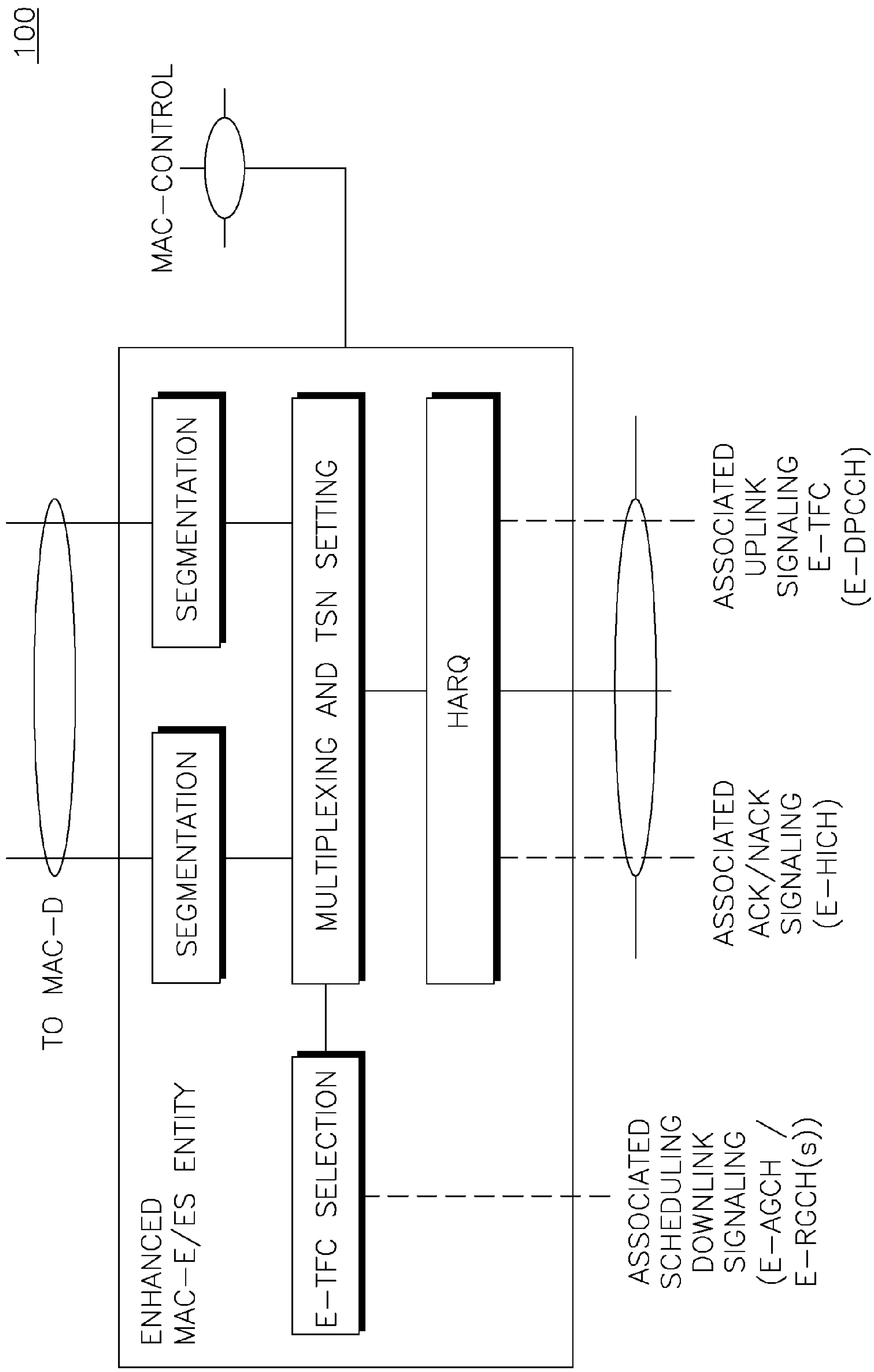
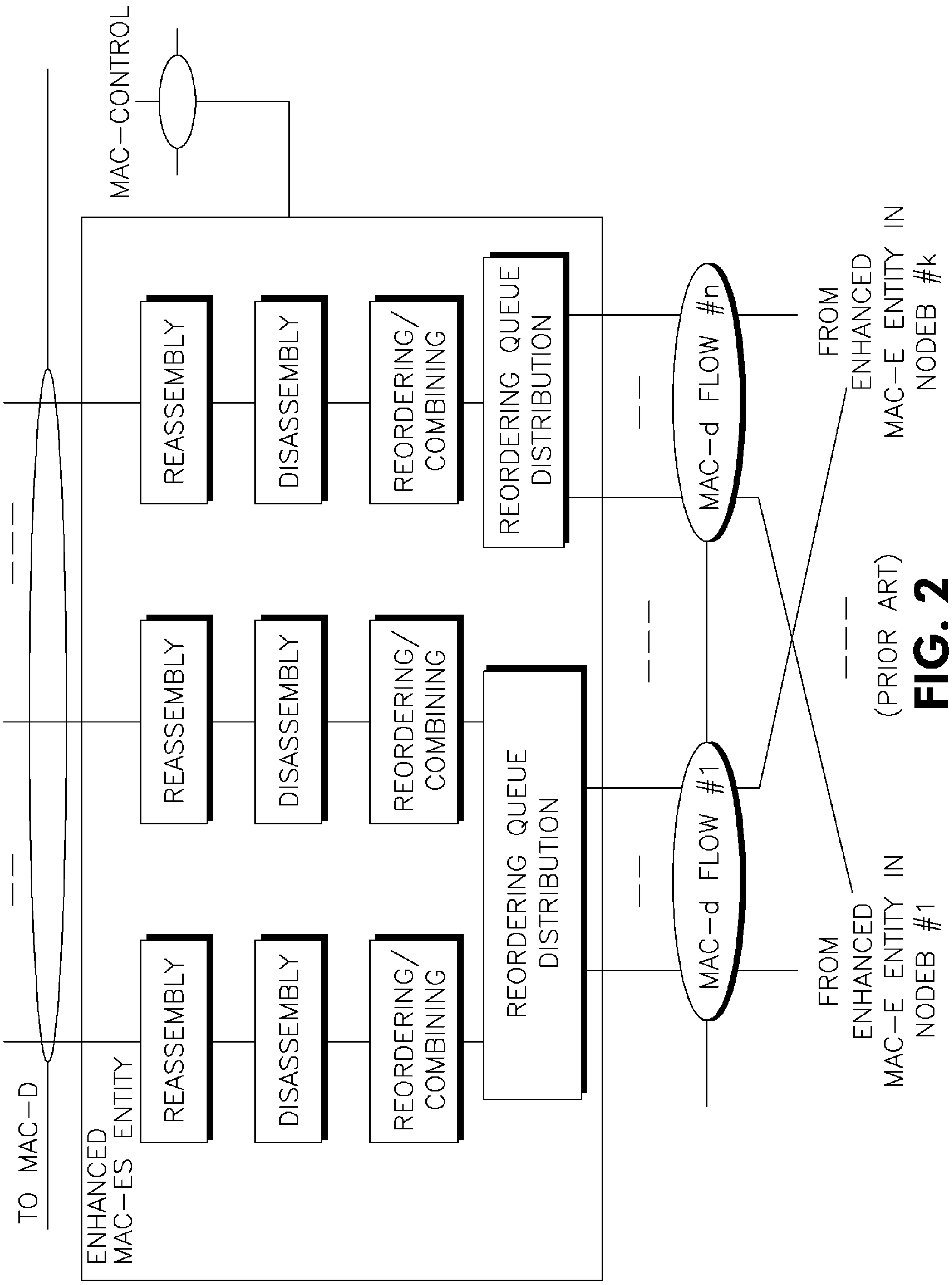


(PRIOR ART)
FIG. 1



(PRIOR ART)

FIG. 2

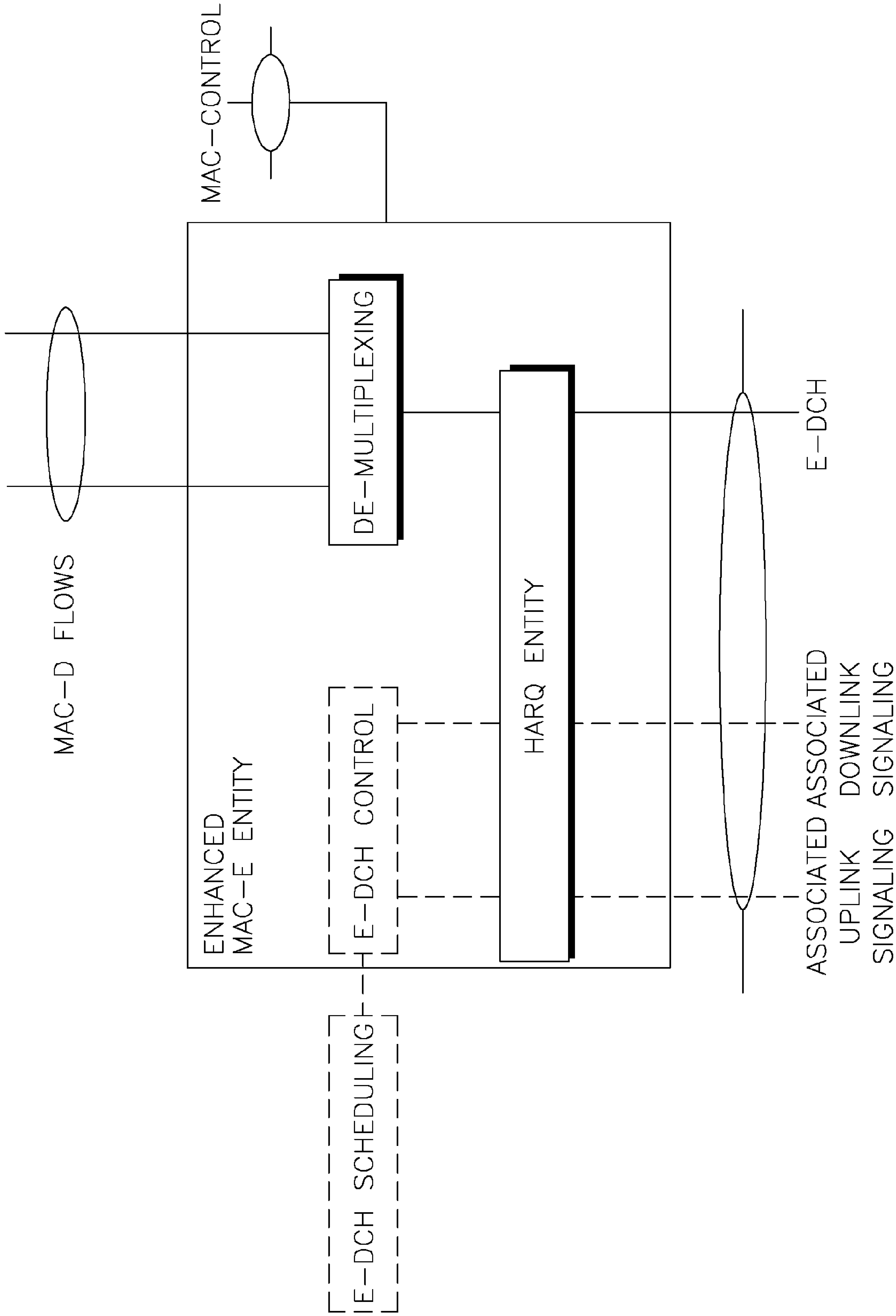
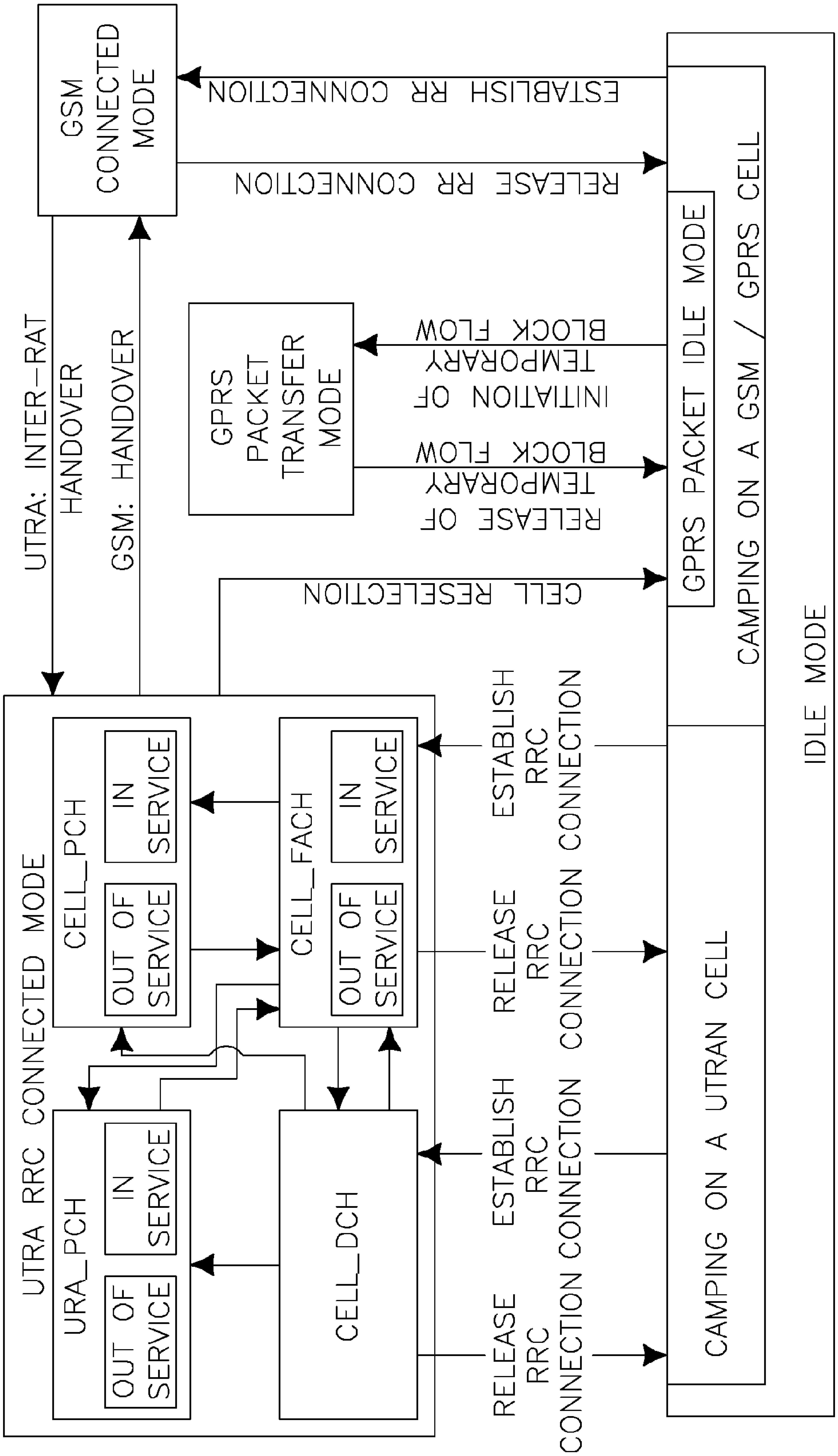


FIG. 2A
(PRIOR ART)



(PRIOR ART)
FIG. 3

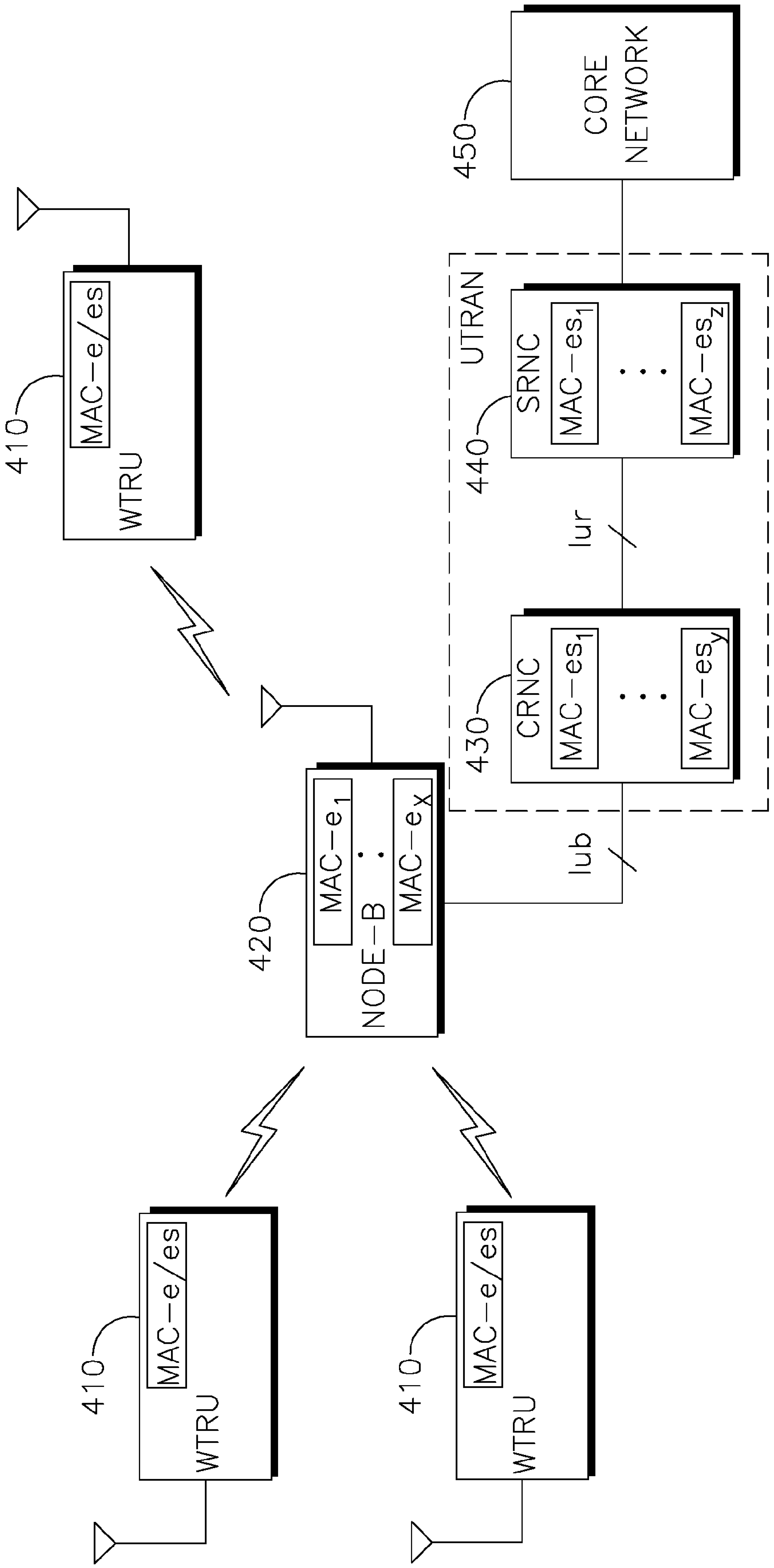

CORE NETWORK
450
UTRAN
SRNC
440
MAC−es1
MAC−esz
Iur
CRNC
430
MAC−es1
MAC−esy
Iub
NODE−B
420
MAC−e1
MAC−ex
WTRU
410
MAC−e/es
WTRU
410
MAC−e/es
WTRU
410
MAC−e/es

FIG. 4

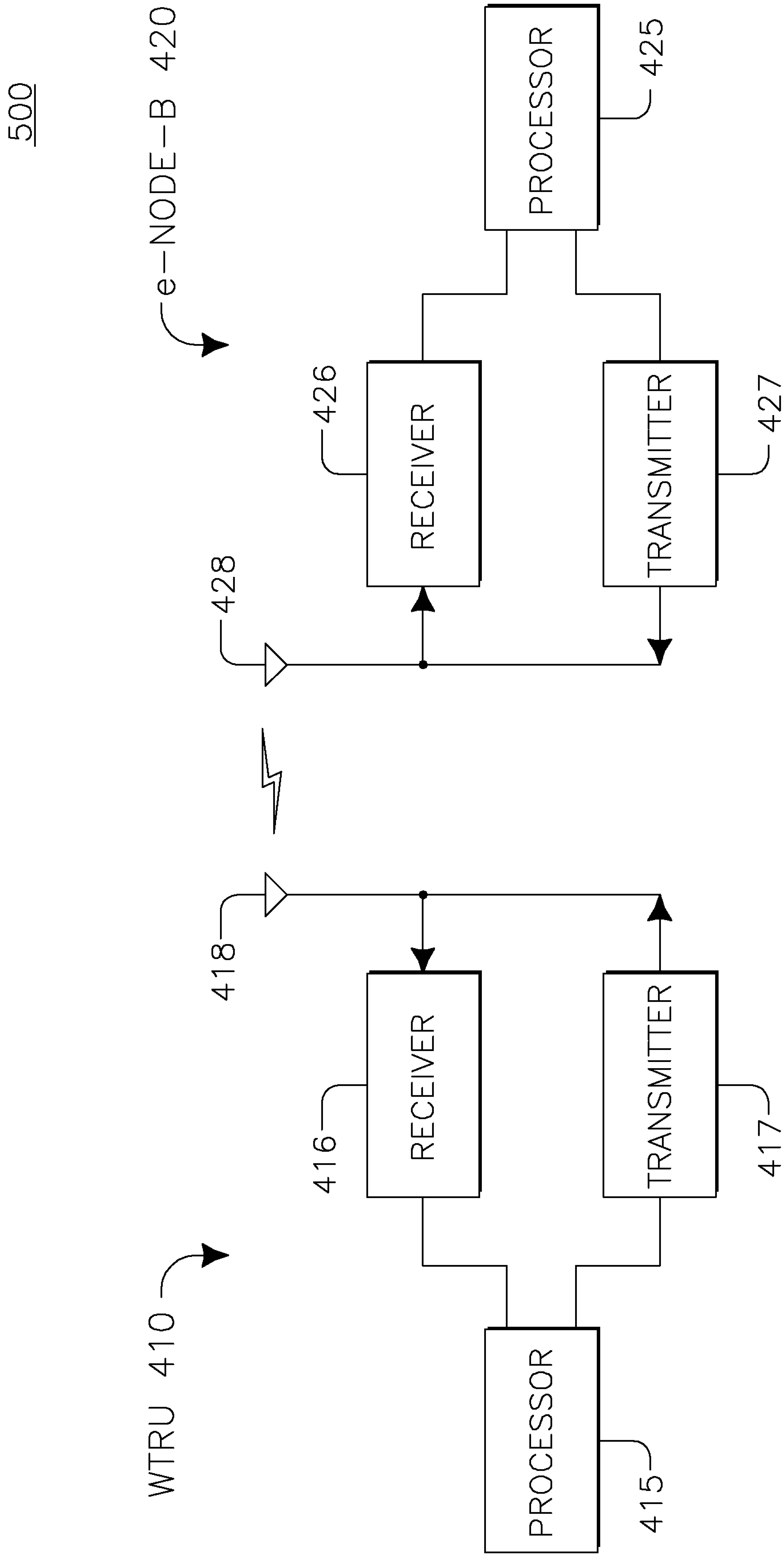

500
e-NODE-B 420
PROCESSOR
425
RECEIVER
426
TRANSMITTER
427
428
418
RECEIVER
416
TRANSMITTER
417
WTRU 410
PROCESSOR
415

FIG. 5

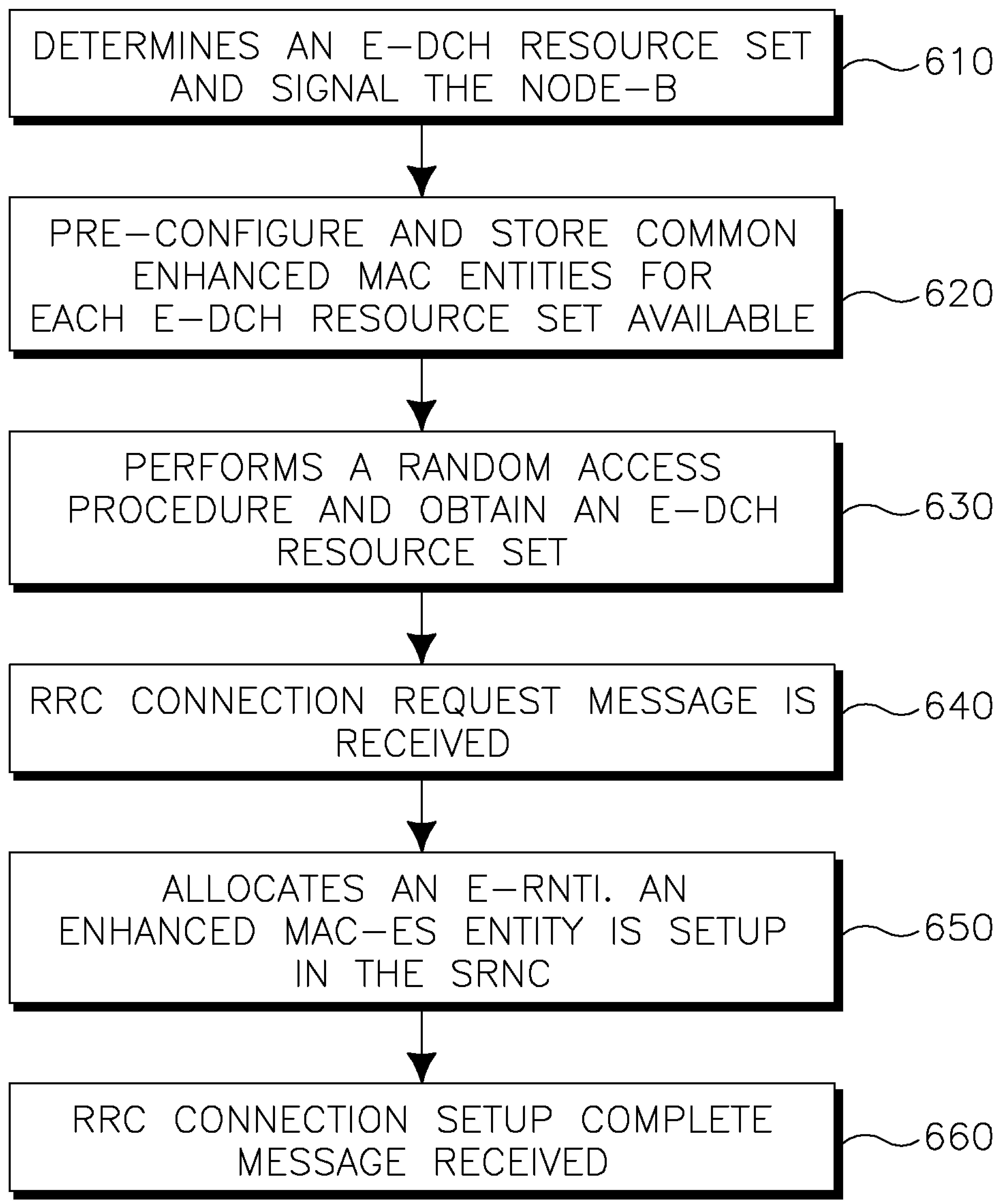

DETERMINES AN E-DCH RESOURCE SET AND SIGNAL THE NODE-B
610
PRE-CONFIGURE AND STORE COMMON ENHANCED MAC ENTITIES FOR EACH E-DCH RESOURCE SET AVAILABLE
620
PERFORMS A RANDOM ACCESS PROCEDURE AND OBTAIN AN E-DCH RESOURCE SET
630
RRC CONNECTION REQUEST MESSAGE IS RECEIVED
640
ALLOCATES AN E-RNTI. AN ENHANCED MAC-ES ENTITY IS SETUP IN THE SRNC
650
RRC CONNECTION SETUP COMPLETE MESSAGE RECEIVED
660

FIG. 6

MANAGEMENT AND SETUP OF ENHANCED MAC-E/ES RESOURCES IN CELL-FACH STATE

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Patent Appl. No 60/982,528, filed Oct. 25, 2007 and U.S. Provisional Patent Appl. No. 61/018,567, filed Jan. 2, 2008 which are incorporated by reference as if fully set forth.

FIELD OF INVENTION

This application is related to wireless communications.

BACKGROUND

An enhanced uplink mechanism has been introduced for the Third Generation Partnership Project (3GPP) standards. As a part of the enhanced uplink mechanism and improved Layer 2 (L2), new functional entities have been introduced in the medium access control (MAC) including enhanced MAC-e/es entities. In a wireless transmit/receive unit (WTRU), the enhanced MAC-e/es are considered one single sublayer. However in the network side the enhanced MAC-e and the enhanced MAC-es entities may be considered separate, with the enhanced MAC-e residing in the Node-B and the enhanced MAC-es residing in the serving radio network controller (SRNC). One enhanced MAC-e and one enhanced MAC-es entity are present for each WTRU in the Node B and in the SRNC, respectively. The entities are separate in the network so that the more real-time critical functionality of enhanced MAC-e may be placed into the Node-B.

FIG. **1** is a block diagram of an enhanced MAC entity **100** of a WTRU. The enhanced MAC in the WTRU comprises a hybrid automatic repeat-request (HARQ) module, a multiplexing and transmission sequence number (TSN) setting module, an enhanced uplink transport format combination (E-TFC) selection module, and two segmentation modules.

The HARQ module performs the MAC functions relating to the HARQ protocol, including storing enhanced MAC-e payloads and re-transmitting them. The HARQ module determines the E-TFC, the retransmission sequence number (RSN), and the power offset to be used by Layer 1 (L1).

The multiplexing and TSN module concatenates multiple MAC-d protocol data units (PDUs) into enhanced MAC-es PDUs, and multiplexes one or multiple enhanced MAC-es PDUs into a single enhanced MAC-e PDU, to be transmitted in a subsequent transmission time interval (TTI), as instructed by the E-TFC selection module.

The E-TFC selection module performs E-TFC selection according to scheduling information, relative and absolute grants received from a UMTS Terrestrial Radio Access Network (UTRAN) via L1 signalling, and a serving grant signalled through the RRC for arbitration among the different flows mapped on the E-DCH.

The segmentation module performs segmenting of the MAC-d PDUs.

FIGS. **2** and **2**A show the enhanced MAC-e and enhanced MAC-es entities located at the Node-B and RNCs, respectively. Referring to FIG. **2**, the enhanced MAC-es sublayer manages E-DCH specific functionality. The enhanced MAC-es entity comprises a disassembly module, a reordering and queue distribution module, a reordering/combining module, and a reassembly module.

The reordering queue distribution module routes the enhanced MAC-es PDUs to the correct reordering buffer based on the serving radio network controller (SRNC) configuration and based on the logical channel identity.

The reordering/combining module reorders received enhanced MAC-es PDUs according to the received TSN and Node-B tagging, (i.e. CFN, subframe number). Enhanced MAC-es PDUs with consecutive TSNs are delivered to the disassembly module upon reception.

The macro diversity selection module operates in the enhanced MAC-es, in case of soft handover with multiple Node-Bs.

The disassembly module is responsible for disassembly of enhanced MAC-es PDUs, including removal of the enhanced MAC-es header.

The reassembly function reassembles segmented MAC-d PDUs, and delivers the MAC-d PDUs to the correct MAC-d entity.

Referring to FIG. **2**A, shows a MAC-e entity in communication with an E-DCH scheduling module. The enhanced MAC-e entity comprises an E-DCH control module, a de-multiplexing module, and a HARQ entity.

The E-DCH scheduling module manages E-DCH cell resources between WTRUs. Based on scheduling requests, scheduling grants are determined and transmitted.

The E-DCH control module is responsible for reception of scheduling requests and transmission of scheduling grants.

The de-multiplexing module performs the de-multiplexing of enhanced MAC-e PDUs into enhanced MAC-es PDUs. Enhanced MAC-es PDUs are forwarded to the SRNC in their associated MAC-d flow.

The HARQ module may support multiple HARQ processes. Each process is responsible for generating ACKs or NACKs indicating delivery status of E-DCH transmissions.

FIG. **3** shows the radio resource controller (RRC) service states of a 3GPP WTRU with an enhanced uplink. The WTRU may operate in several states which depend on the user activity. The following states have been defined: Idle, Cell_DCH, Cell_FACH, URA_PCH and Cell_PCH. The RRC state changes are controlled by the network using RNC parameters, the WTRU does not decide to perform state changes by itself.

In the Cell_DCH state, a dedicated physical channel is allocated to the WTRU in the uplink and the downlink. The WTRU is known on a cell level according to its current active set. The WTRU may use dedicated transport channels, shared transport channels, or a combination of these transport channels.

A WTRU is in the Cell_FACH state if it has been assigned to use the common control channels (e.g. CPCH). In the Cell_FACH state, no dedicated physical channel is allocated to the WTRU, and the WTRU continuously monitors a FACH (e.g., S-CCPCH) or a High Speed Downlink Shared Channel (HS-DSCH) in the downlink. The WTRU is assigned a default common or shared transport channel in the uplink (e.g. RACH) that it can use anytime according to the access procedure for that transport channel. The position of the WTRU is known by the UTRAN on a cell level according to the cell where the WTRU last performed a cell update.

In the Cell_PCH state, no dedicated physical channel is allocated to the WTRU. The WTRU selects a PCH, and uses discontinuous reception for monitoring the selected PCH via an associated PICH. No uplink activity is possible. The position of the WTRU is known by the UTRAN on a cell level according to the cell where the WTRU last performed a cell update in the CELL_FACH state.

In the URA_PCH state, no dedicated channel is allocated to the WTRU. The WTRU selects a PCH, and uses discontinuous reception for monitoring the selected PCH via an associated PICH. No uplink activity is possible. The location of the WTRU is known on a UTRAN registration area level according to the URA assigned to the WTRU during the last URA update in the Cell_FACH state.

As a part of the enhanced uplink mechanism an, enhanced random access channel (E-RACH) has been introduced for the CELL_FACH state. The E-RACH refers to the use of the enhanced dedicated channel (E-DCH) in the Cell_FACH state or the resource/physical channel used by the WTRU for uplink contention-based access. Previously, the only uplink mechanism for a WTRU in the Cell_FACH state was transmission via the RACH using a slotted-Aloha approach with an acquisition indication message.

With the introduction of the E-DCH in the Cell_FACH state, the WTRUs and the network may require the introduction of enhanced MAC-e/es entities in order to enable the communication between the WTRU and the network. Due to the nature of the E-DCH operation in the Cell_FACH state, a number of issues may arise with the E-DCH MAC resources. One of the issues relates to defining how and when to set up the enhanced MAC-e/es entities. In addition, rules regarding the location of the enhanced MAC-e/es entities and whether the enhanced MAC-e and/or enhanced MAC-es are common or dedicated entities are desired. Also, additional RNC to Node-B interface (Iub) signaling for the setup and management of the MAC entities are desired. Accordingly methods to manage E-DCH resources and to manage TSN numbering are desired.

SUMMARY

Methods and apparatus are disclosed to manage the enhanced MAC-e and enhanced MAC-es resources and respective variables for the E-DCH in the enhanced Cell_FACH state. Due to the nature of the E-DCH transmission in the uplink (UL) in the Cell_FACH state and the fact that the WTRU might set up and release the E-DCH resources more frequently, methods to manage the TSN numbering are described.

BRIEF DESCRIPTION OF THE DRAWINGS

A more detailed understanding may be had from the following description, given by way of example in conjunction with the accompanying drawings wherein:

FIG. **1** is a block diagram of a enhanced MAC-e/es entity of a WTRU;

FIGS. **2** and **2**A are block diagrams of enhanced MAC-e/es entities of a Node-B and an RNC, respectively;

FIG. **3** is a block diagram of the RRC states in an HSPA+ system;

FIG. **4** shows an example wireless communication system including a plurality of wireless transmit/receive units (WTRUs), a base station, and a radio network controller (RNC);

FIG. **5** is a functional block diagram of a WTRU and the base station of FIG. **4**; and

FIG. **6** is a flow diagram of a method where the enhanced MAC-e and enhanced MAC-es entities are preconfigured as common entities for each enhanced dedicated channel (E-DCH) resource set that may be assigned to the WTRU upon an E-RACH access procedure.

DETAILED DESCRIPTION

When referred to hereafter, the terminology "wireless transmit/receive unit (WTRU)" includes but is not limited to a user equipment (UE), a mobile station, a fixed or mobile subscriber unit, a pager, a cellular telephone, a personal digital assistant (PDA), a computer, or any other type of user device capable of operating in a wireless environment. When referred to hereafter, the terminology "base station" includes but is not limited to a Node-B, a site controller, an access point (AP), or any other type of interfacing device capable of operating in a wireless environment.

FIG. **4** shows a wireless communication system **400** including a plurality of WTRUs **410**, a Node-B **420**, a CRNC **430**, an SRNC **440** and a core network **450**. As shown in FIG. **4**, the WTRUs **410** are in communication with the Node-B **420**, which is in communication with the CRNC **430** and the SRNC **440**. Although three WTRUs **410**, one Node-B **420**, one CRNC **430**, and one SRNC **440** are shown in FIG. **4**, it should be noted that any combination of wireless and wired devices may be included in the wireless communication system **400**.

When refered to hereafter, the CRNC **430** and the SRNC **440** may be collectively referred to as the UTRAN.

FIG. **5** is a functional block diagram **500** of a WTRU **410** and the Node-B **420** of the wireless communication system **400** of FIG. **4**. As shown in FIG. **5**, the WTRU **410** is in communication with the Node-B **420** and both are configured to perform a method to manage and setup enhanced MAC-e/es resources in a Cell_FACH state.

In addition to the components that may be found in a typical WTRU, the WTRU **410** includes a processor **415**, a receiver **416**, a transmitter **417**, and an antenna **418**. The processor **415** is configured to perform a method to manage and setup enhanced MAC-e/es resources in a Cell_FACH state. The receiver **416** and the transmitter **417** are in communication with the processor **415**. The antenna **418** is in communication with both the receiver **416** and the transmitter **417** to facilitate the transmission and reception of wireless data.

In addition to the components that may be found in a typical base station, the Node-B **420** includes a processor **425**, a receiver **426**, a transmitter **427**, and an antenna **428**. The processor **425** is configured to perform a method to manage and setup enhanced MAC-e/es resources in a Cell_FACH state. The receiver **426** and the transmitter **427** are in communication with the processor **425**. The antenna **428** is in communication with both the receiver **426** and the transmitter **427** to facilitate the transmission and reception of wireless data.

The WTRU **410** may be configured to transmit on the E-RACH to register the WTRU **410** to the network for an initial RRC connection request, cell selection, and reselection. The connection requests are transmitted over the common control channel (CCCH). Once the WTRU is registered, the WTRU may transmit Dedicated Traffic Channel (DTCH) or Dedicated Control Channel (DCCH) traffic to the network. Wherein the DTCH is a bi-directional channel that carriers user data and DCCH traffic comprises dedicated control information between a WTRU and the UTRAN. It is established through the RRC (Radio Resource Control) connection setup procedure. However, when the WTRU **410** is transmitting an initial E-RACH access attempt, the enhanced MAC-e and enhanced MAC-es entities may or may not be setup. Accordingly, several alternatives to configuring the enhanced MAC-e and enhanced MAC-es are described in greater detail herein.

Referring back to FIG. **4**, the WTRU **410** may be configured with an enhanced MAC-e/es entity **419** when both the WTRU **410** and the network support the E-RACH, (i.e. capable of using the E-DCH in the CELL_DACH state) and the HS-DSCH. Wherein the HS-DSCH is a downlink transport channel shared by several WTRUs. The HS-DSCH is assoicated with one downlink dedicated physical channel (DPCH) and one or several highspeed shared control channels (HS-SCCHs). The enhanced MAC-e/es entity **419** in the WTRU **410** may include a HARQ module, a multiplexing and TSN module, an E-TFC selection module, segmentation modules, a module used to append an E-RNTI, and a module used for CRC calculation for Common Control Channel (CCCH) traffic. The CCCH supports common procedures required to establish a dedicated link with the UTRAN. The CCCH may include the RACH and E-RACH, the forward access channel (FACH), and the paging channel (PCH). The enhanced MAC-e/es entity **419** may also include an access class control module. The WTRU **410** may transition to the Cell_FACH state when there is uplink data to transmit, or it is already in the Cell_DCH state and the network moves it to the Cell_FACH state for lack of activity, etc. The WTRU **410** may be configured to maintain the enhanced MAC-e/es entity as long as it is able to transmit uplink data on the E-DCH. The WTRU **410** may further be configured to maintain the enhanced MAC-e/es entity when operating in idle mode when an RRC connection request is initiated by the WTRU **410**.

The Node-B **420** may be configured with x enhanced MAC-e entities (enhanced MAC-e_1 to enhanced MAC-e_x), where x is the number of common E-DCH resources for all types of traffic. Each enhanced MAC-e entity may include an E-DCH scheduling module, an E-DCH control module, a de-multiplexing module, and a HARQ module. The enhanced MAC-e entities may also be configured to read the E-RNTI used for contention resolution. The enhanced MAC-e entities may be configured to communicate with WTRUs that have not been assigned a U-RNTI or E-RNTI, in which case the WTRUs will communicate via the CCCH. Each enhanced MAC-e entity may be associated to a common E-DCH resource that a WTRU acquires as part of the random access procedure. For example, the Node-B **420** may be configured to use an enhanced MAC-e entity while a WTRU is attempting an E-RACH access and/or after the WTRU has performed cell selection/reselection (i.e. DTCH/DCCH traffic). The enhanced MAC-e entities may be preconfigured in the Node-B **420** (i.e. setup when the E-DCH resource pool for the CELL_FACH state and idle-mode is provided to the Node B) or it may be setup in response to a signal received from a WTRU or RNC. Alternatively, the Node-B **420** may be configured to setup and maintain one dedicated enhanced MAC-e entity for each WTRU, for as long as the WTRU in a given state.

The CRNC **430** may be configured with y enhanced MAC-es entities (enhanced MAC-es_1 to enhanced MAC-es_y) used only for CCCH traffic, where y is the number of common E-DCH resources in the cell. Each enhanced MAC-es entity is associated to a common E-DCH resource set that may be used by a WTRU. Each enhanced MAC-es entity may include a disassembly module, a reordering and queue distribution module, a reordering module, a macro-diversity selection module, a reassembly module, and a CRC error correction module. Each enhanced MAC-es entity may be used during communications with a WTRU that has not been assigned a U-RNTI or E-RNTI (i.e. for CCCH traffic). The CCCH traffic may be terminated in the CRNC **430** such that the CCCH data traffic is not forwarded to the SRNC **440**. Alternatively, the CRNC **430** may be configured to setup one dedicated enhanced MAC-es entity for each WTRU, for as long as the WTRU in a given state.

The SRNC **440** is configured with z enhanced MAC-es entities (enhanced MAC-es_1 to enhanced MAC-es_z) for the DTCH/DCCH traffic, wherein z is the number of WTRUs in the Cell_FACH state. Each of the z enhanced MAC-es entities may be associated with the WTRU **410** after its WTRU-id is determined. Each enhanced MAC-es entity may comprise a disassembly module, a reordering and queue distribution module, a reordering module, a macro-diversity selection module, and a reassembly module. The SRNC **440** may be configured to setup the enhanced MAC-es entity in response to the WTRU entering the Cell_FACH state. The DTCH/DCCH traffic terminates in the SRNC **440**.

Alternatively, the Node-B **420** and the CRNC **430** may be configured to maintain one dedicated enhanced MAC-e and MAC-es entity, respectively, for each WTRU as long as the WTRU is in the Cell_FACH state, independent of the E-DCH resources.

Alternatively, the Node-B **420** and the CRNC **430** may be configured to setup enhanced MAC-e and enhanced MAC-es entities after the Node-B **420** assigns and transmits an E-DCH radio network temporary identifier (E-RNTI) for the WTRU **410**.

In some scenarios, the SRNC **440** may not know the WTRU's **410** identity until the first transmission of the WTRU **410**, which is after reception of the acquisition indicator channel (AICH) or the E-AICH. In such a case, the SRNC **440** may be configured to setup the enhanced MAC-es for the WTRU **410** at the time the WTRU-ID is read from the header. Accordingly, a new Iub signaling procedure may be required to indicate to the SRNC **440** to setup the enhanced MAC-es entity for a given WTRU.

When common enhanced MAC-e and/or enhanced MAC-es resources are setup for a given connection, they may be setup as part of the common transport channel setup procedure between an RNC and the Node-B **420**.

FIG. **6** is a flow diagram of a method where the CRNC **430** pre-configures and stores a common enhanced MAC-es entity and the Node-B **420** pre-configures and stores a common enhanced MAC-e entity for each enhanced dedicated channel (E-DCH) resource set that may be assigned to a WTRU upon an E-RACH access procedure. Referring to FIG. **6**, the CRNC determines an E-DCH resource set and signals the Node-B (**610**). The CRNC and Node-B pre-configure and store common enhanced MAC-es and enhanced MAC-e entities, respectively, for each E-DCH resource set available (**620**). A WTRU performs a random access procedure obtains an E-DCH resource set (**630**). An RRC connection request message is received from a WTRU in Idle Mode using the E-DCH set that is obtained using the random access procedure (**640**). The Node-B allocates an E-RNTI and an enhanced MAC-es entity is setup in the SRNC for the WTRU (**650**).

Since the CRNC's enhanced MAC-es and the Node-B's enhanced MAC-e entities are preconfigured for the E-DCH resource set, the enhanced MAC-e and enhanced MAC-es for the CCCH may be configured to operate as common entities that are associated with one WTRU at a time (i.e. for the WTRU that received the E-RACH access). In one option, the common enhanced MAC-e and MAC-es entities may be used for only the WTRU's initial traffic. Alternatively the enhanced MAC entities may be used throughout the time the WTRU is communicating via the E-DCH resource set corresponding to that enhanced MAC entity. An RRC connection setup complete message may then be received indicating that the WTRU is in connected mode (**660**).

The enhanced MAC-es entity in the CRNC may be associated to a common E-DCH resource set used by the WTRU **410**, or a common E-RNTI that is selected by the WTRU **410**. The SRNC **440** may be configured to setup a dedicated enhanced MAC-es entity for each WTRU operating in the Cell_FACH state which is registered and has an E-RNTI allocated, and the entity may be maintained at least for the duration of the WTRU being in the Cell_FACH/CELL_PCH state for DTCH/DCCH traffic. For DTCH/DCCH traffic, the data is first received in the common enhanced MAC-e entity associated to the common E-DCH resource being used by the UE and then forwarded to the dedicated enhanced MAC-es entity in the SRNC over the Iub/Iur interface. Accordingly, when the enhanced MAC-e is a common entity for any WTRU using the set of resources, a process to identify the WTRU-ID over the Iub/Iur frame protocol may be desired. Several alternatives are described in greater detail hereafter.

In a first alternative, the Node-B **420** may be configured to transmit data on a common transport channel (for WTRUs using the E-DCH in the Cell_FACH state) using an Iub flow. Because the Iub is a common flow, the CRNC **430** may receive data from this common flow per WTRU and does not know to which WTRU this data belongs. Therefore, the Node-B **420** may be configured to transmit a WTRU-ID in the header field of the Iub frame when the enhanced MAC-es is associated with a particular WTRU in the Cell_FACH state (i.e. for DTCH/DCCH traffic). Similarly the CRNC **430** may be configured to transmit a WTRU-ID in the header of an Iur frame. The WTRU-id may comprise an E-RNTI when transmitted via the Iub interface or an S-RNTI when transmitted via the Iur interface. This would allow the SRNC **440** to know proper forwarding address of the data to the correct dedicated enhanced MAC-es entity for the WTRU.

In another alternative, the WTRU-id may comprise one or a combination of the E-RNTI, the U-RNTI, or C-RNTI, or the S-RNTI. For CCCH traffic, no WTRU-id is present and thus the Iub frame protocol shall not include an E-RNTI. The CRNC **430** may be configured to detect that the traffic belongs to CCCH traffic from the logical channel identifier and forward the data to the correct enhanced MAC-es entity in the CRNC **430** that is associated to the proper E-DCH resource. In an optional embodiment, there may be one common transport channel for DTCH/DCCH traffic, and one transport channel setup for each E-DCH resource set for CCCH traffic. The Node-B **420** may be configured to receive the CCCH traffic and to forward the data to the transport channel associated with the enhanced MAC-e entity in which the data was received.

In another alternative, when both the Node-B **420** and the CRNC **430** are configured to setup the common enhanced MAC-e and enhanced MAC-es entities, the WTRU **410** may be configured to transmit a WTRU-id in an enhanced MAC-es header of an enhanced MAC-es PDU. The Node-B **420** may be further configured with a disassembly module capable of to decoding the enhanced MAC-es PDU header and determining the WTRU-id. By transmitting the information in the enhanced MAC-es PDU, the Node-B **420** does not need to transmit an Iub frame with the WTRU-id information. For example, the WTRU **410** may be configured to transmit the WTRU-id in the enhanced MAC-es header only during the initial transmissions for contention resolution purposes. In this case, the Node-B **420** may be configured with an enhanced MAC-e entity that uses the initial transmission to determine forwarding procedures for consecutive data on subsequent transmissions to the RNC. The WTRU **410** may transmit the WTRU-id until it receives an absolute grant of the E-DCH channel, at which point the WTRU **410** can stop transmitting the WTRU-id.

In another alternative, the Node-B **420** may be configured to receive a WTRU-id from a WTRU, and to extract the WTRU-id from the first transmission. The Node-B **420** may then store the WTRU-id and use this information to transmit the WTRU-id to the SRNC **440** or CRNC **430** using Iub signaling during subsequent transmissions. When the WTRU **410** releases the set of E-DCH resources the Node-B **420** may be configured to erase the WTRU-id. Alternatively, if a subsequent E-RACH access attempt is performed and a different WTRU-id is decoded, the Node-B **420** may change the stored WTRU-id information to reflect the new WTRU-id.

In yet another alternative, after a Node-B **420** receives a first transmission from a WTRU, the Node-B **420** may use the first transmission to determine to which WTRU the data belongs. Once the WTRU-id is determined, the Node-B **420** may setup a semi-dedicated flow to the RNC for the duration of the WTRU's connection to the E-DCH resources. This creates a temporary connection flow between the common enhanced MAC-e and the dedicated enhanced MAC-es. This may be setup by transmitting an Iub signal notifying the RNC to initiate the setup a flow between the common enhanced MAC-e and enhanced MAC-es entity corresponding to the WTRU. In this case, the WTRU-id does not have to be specified in the Iub frame protocol because the WTRU-id is present in the enhanced MAC-e header of every transmission and the information is forwarded to the RNC via the Iu frame protocol.

Alternatively, because the E-DCH resources may be negotiated between the Node-B **420** and the WTRU without the involvement of the RNC, the functionalities related to the E-DCH, such as enhanced MAC-es, may be moved to the Node-B **420**. For this embodiment, the logical channel flows may be setup between the enhanced MAC-es and the radio link control (RLC) entities. Alternatively, the WTRU **410** and the Node-B **420** may establish a common transport channel and the WTRU-id and a linearization channel (LCH)-ID may be transmitted over the Iub and/or Iur frame protocol.

Although features and elements are described above in particular combinations, each feature or element can be used alone without the other features and elements or in various combinations with or without other features and elements. The methods or flow charts provided herein may be implemented in a computer program, software, or firmware incorporated 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).

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 other type of integrated circuit (IC), and/or a state machine.

A processor in association with software may be used to implement a radio frequency transceiver for use in a wireless transmit receive unit (WTRU), user equipment (UE), terminal, base station, radio network controller (RNC), 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) or Ultra Wide Band (UWB) module.

What is claimed is:

1. A method implemented by a radio network controller (RNC) of managing medium access control (MAC) resources, the method comprising:

configuring an enhanced MAC entity for each of one or more common enhanced dedicated channel (E-DCH) resources, wherein each of the one or more common E-DCH resources is used for communications with at least one wireless transmit/receive unit (WTRU) that uses common E-DCH for common control channel (CCCH) transmission in at least one of a cell forward access channel (CELL_FACH) state or an idle mode; and

sending one or more signals to a Node-B identifying the one or more common E-DCH resources, the one or more signals indicating to the Node-B to configure an enhanced MAC entity in the Node-B for each of the identified common E-DCH resources.

2. The method of claim **1**, wherein CCCH traffic is terminated in a controlling RNC (CRNC) without forwarding to a serving radio network controller (SRNC).

3. The method of claim **1**, further comprising, for at least one WTRU that use common E-DCH in CELL_FACH state, configuring an enhanced MAC entity in a serving radio network control (SRNC) for dedicated traffic control (DTCH) or dedicated control channel (DCCH) transmissions.

4. The method of claim **1**, wherein the enhanced MAC entity in the RNC and the enhanced MAC entity in the Node-B perform as common entities that are associated with one WTRU at a time.

5. The method of claim **1**, wherein the enhanced MAC entity in the RNC is configured for a common channel and is terminated in a controlling RNC (CRNC).

6. An apparatus, comprising:

a processor configured to configure an enhanced medium access control (MAC) entity for each of one or more common enhanced dedicated channel (E-DCH) resources, wherein each of the one or more common E-DCH resources is used for communications with at least one wireless transmit/receive unit (WTRU) that uses common E-DCH for common control channel (CCCH) transmission in at least one of a cell forward access channel (CELL_ FACH) state or an idle mode; and

a transmitter configured to transmit one or more signals to a Node-B identifying the one or more common E-DCH resources, the one or more signals indicating to the Node-B to configure an enhanced MAC entity in the Node-B for each of the identified common E-DCH resources.

7. The apparatus of claim **6**, wherein CCCH traffic is terminated in a controlling radio node controller (CRNC) without forwarding to a serving radio network controller (SRNC).

8. The apparatus of claim **6**, further comprising, for at least one WTRU that use common E-DCH in CELL_FACH state, the processor configured to configure an enhanced MAC entity in a serving radio network control (SRNC) for dedicated traffic control (DTCH) or dedicated control channel (DCCH) transmissions.

9. The apparatus of claim **6**, wherein the enhanced MAC entity in a radio network controller (RNC) and the enhanced MAC entity in the Node-B perform as common entities that are associated with one WTRU at a time.

10. The apparatus of claim **6**, wherein the enhanced MAC entity in a radio network controller (RNC) is configured for a common channel and is terminated in a controlling RNC (CRNC).

11. An apparatus, comprising:

a processor configured to implement an enhanced medium access control (MAC) entity for each common enhanced dedicated channel (E-DCH) resource of one or more common E-DCH resources, wherein each common E-DCH resource of the one or more common E-DCH resources is available for communications between a Node-B and at least one of a plurality of wireless transmit/receive units (WTRUs) that use common E-DCH for common control channel (CCCH) transmission in at least one of a cell forward access channel (CELL_ FACH) state or an idle mode; and

a transmitter configured to indicate, via one or more signals, to the Node-B to configure an enhanced MAC entity per common E-DCH resource.

12. The apparatus of claim **11**, wherein CCCH traffic is terminated in a controlling radio node controller (CRNC) without forwarding to a serving radio network controller (SRNC).

13. The apparatus of claim **11**, further comprising, for the at least one of the plurality of WTRUs that use common E-DCH in the CELL_FACH state, the processor configured to configure an enhanced MAC entity in a serving radio network control (SRNC) for dedicated traffic control (DTCH) or dedicated control channel (DCCH) transmissions.

14. The apparatus of claim **11**, wherein the enhanced MAC entity in a radio network controller (RNC) and the enhanced MAC entity in the Node-B perform as common entities that are associated with one WTRU at a time.

15. The apparatus of claim **11**, wherein the enhanced MAC entity in a radio network controller (RNC) is configured for a common channel and is terminated in a controlling RNC (CRNC).

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