

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
15 January 2009 (15.01.2009)

PCT

(10) International Publication Number
WO 2009/009332 A1

(51) International Patent Classification:

H04B 7/26 (2006.01)

(21) International Application Number:

PCT/US2008/068768

(22) International Filing Date: 30 June 2008 (30.06.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

11/776,146 11 July 2007 (11.07.2007) US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: **HARD HANDOVER PROTOCOL TO ACHIEVE EARLY MAC READINESS**

(57) Abstract: A technique to reduce the service disruption time of a mobile station (MS) when the MS performs a hard handover (HHO) is provided. An MS receives MAC context information that is necessary to connect to the target base station (BS) through the serving BS during the HHO preparation time instead of HHO execution time. The HHO preparation phase refers to the stage where a handover is initiated but the MS is still connected with the current serving BS. On the other hand, once the HHO execution begins, the MS must disconnect from the serving BS in order to establish the communication with the target BS.

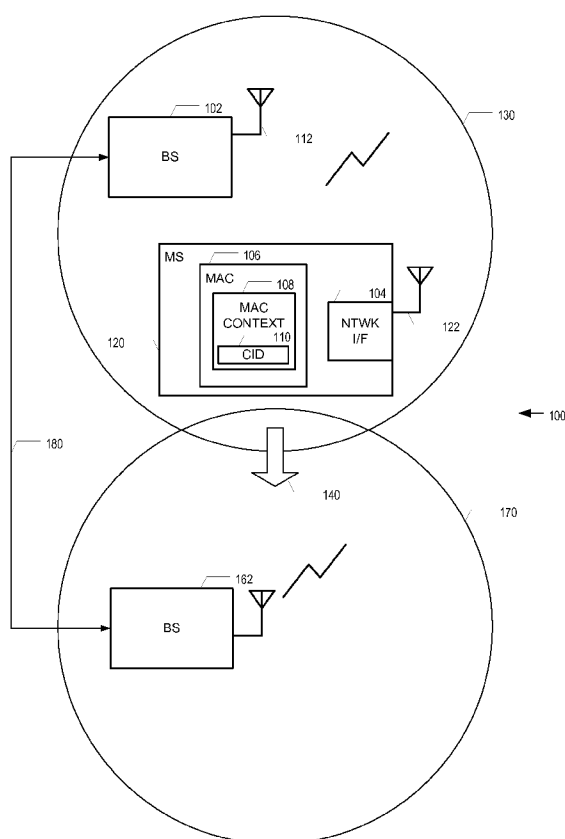


FIG. 1



Published:

— *with international search report*

HARD HANDOVER PROTOCOL TO ACHIEVE EARLY MAC READINESS

BACKGROUND

Description of the Related Art

WiMAX is an acronym that stands for Worldwide Interoperability for Microwave
5 Access, which is a certification mark for products that pass conformity and interoperability
tests for the IEEE 802.16 standard. Wireless broadband access networks, sometimes
referred to as WiMAX, generally include one or more base stations (BSs) and one or more
mobile wireless stations (MSs).

During operation an MS may transition from a current serving BS to a target BS
10 for various reasons, for example, degraded link characteristics, differing quality of service,
and the like. With some types of data and applications, for example, voice over IP (VoIP)
and multimedia, transitions between BSs may interrupt service using current techniques
due to a series of network re-entry procedures. It is desirable to minimize service
disruption time short enough so that performance degradation of delay sensitive
15 applications is unnoticeable.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be better understood, and its numerous features and
advantages made apparent to those skilled in the art by referencing the accompanying
drawings.

20 FIG. 1 illustrates a wireless network operating environment according to some
embodiments of the present invention.

FIG. 2 illustrates a message sequence for minimizing service disruption time
according to an embodiment of the present invention.

FIG. 3 illustrates an alternate message sequence for minimizing service disruption
25 time according to an embodiment of the present invention.

The use of the same reference symbols in different drawings indicates similar or

identical items.

DESCRIPTION OF THE EMBODIMENT(S)

In the following description, numerous specific details are set forth. However, it is understood that embodiments of the invention may be practiced without these specific
5 details. In other instances, well-known methods, structures and techniques have not been shown in detail in order not to obscure an understanding of this description.

References to “one embodiment,” “an embodiment,” “example embodiment,” “various embodiments,” etc., indicate that the embodiment(s) of the invention so described may include a particular feature, structure, or characteristic, but not every embodiment
10 necessarily includes the particular feature, structure, or characteristic. Further, repeated use of the phrase “in one embodiment” does not necessarily refer to the same embodiment, although it may.

As used herein, unless otherwise specified the use of the ordinal adjectives “first,” “second,” “third,” etc., to describe a common object, merely indicate that different
15 instances of like objects are being referred to, and are not intended to imply that the objects so described must be in a given sequence, either temporally, spatially, in ranking, or in any other manner.

Unless specifically stated otherwise, as apparent from the following discussions, it is appreciated that throughout the specification discussions utilizing terms such as
20 “processing,” “computing,” “calculating,” or the like, refer to the action and/or processes of a computer or computing system, or similar electronic computing device, that manipulate and/or transform data represented as physical, such as electronic, quantities into other data similarly represented as physical quantities.

In a similar manner, the term “processor” may refer to any device or portion of a
25 device that processes electronic data from registers and/or memory to transform that electronic data into other electronic data that may be stored in registers and/or memory. A “computing platform” may comprise one or more processors.

According to current WiMAX based systems, when a mobile station (MS)

switches from a current cell with a current serving base station (BS) to a target cell with a target BS through the process of a hard handover (HHO), the MS disconnects from the current BS and performs a series of network re-entry procedures in order to connect with the target BS. During the HHO, there is a service disruption during which the MS cannot
5 send or receive data traffic. It is important to minimize the service disruption such that the performance degradation of delay sensitive applications, for example, voice over IP (VoIP), is unnoticeable.

Once the MS moves to the target cell, according to the current WiMAX network re-entry procedures, the MS needs to obtain uplink (UL) and downlink (DL) channel
10 parameters and achieve PHY adjustment through a handover ranging process. Once the PHY adjustment is achieved with the target BS, the MS exchanges MAC management messages with the target BS in order to update MAC context information. The current WiMAX MAC context update procedure includes RNG-REQ/RSP, SBC-REQ/RSP, Authorization, and REG-REQ/RSP message exchanges. In order to reduce the service
15 disruption time, the current WiMAX protocol employs several techniques. First, the MS can omit the handover ranging process only if the MS has learned the channels before the HHO and the channels are still valid. However, in practice, the MS can hardly assume the previous learning is valid during its actual HHO due to channel dynamics and synchronization requirement. Therefore, the actual PHY measurement and adjustment
20 with the target BS at the time of handover is unavoidable in many cases. Second, WiMAX protocol provides for handover optimization, through which all the MAC context update steps can be combined into one step and thus the MS is required to exchange only RNG-REQ/RSP with the target BS. Specifically, the content of SBC-RSP and REG-RSP messages are encoded as TLV information of the RNG-RSP message. Further, the target
25 BS may be informed via backbone communication in advance and thus may be ready (for example, by preparing resources) to accept the MS when it tries to connect with the target BS. Even with these current provisions, it is desirable to further reduce synchronization latency during HHO.

According to an embodiment of the present invention, a technique to improve the
30 synchronization timing of an MS when the MS performs a hard handover (HHO) is provided.

FIG. 1 illustrates a wireless network operating environment 100 in accordance with some embodiments of the present invention. In some embodiments, network operating environment 100 includes a base station (BS) 102 and one or more mobile stations 120 that communicate with BS 102 in a wireless cell 130. Wireless cell 130 may be any type of wireless network, including networks that comply with the Mobile WiMAX, IEEE 802.16e, IEEE 802.16m, 3GPP LTE, 3GPP2 AIE, IEEE 802.20 or other wireless network standards. In some orthogonal frequency division multiplexing (OFDM) and orthogonal frequency division multiple access (OFDMA) embodiments, base station 102 and mobile stations 120 may communicate using multicarrier communication signals comprising a plurality of subcarriers.

Mobile station 120 may include a wireless network interface 104 and a MAC (Media Access and Control) component 106. MAC 106 may include correct MAC context information 108 including connection identifiers 110 for target base station 162 prior to disconnecting from serving BS 102. MAC 106 may include other elements (e.g., an UL or a DL scheduler) that are not necessary for an understanding of the embodiments and are therefore not shown to avoid obscuring the description of the embodiments.

In some embodiments, base station 102 may be a wireless access point (AP), such as a Worldwide Interoperability for Microwave Access (WiMax), or broadband communication station, although the scope of the invention is not limited in this respect as base station 102 may be part of almost any wireless communication device. In some embodiments, base station 102 may be a communication station, such as WiMax, or broadband wireless access (BWA) network communication station, although the scope of the invention is not limited in this respect.

Mobile station (MS) 120 may be any type of device that desires to access wireless cell 130 through BS 102. In some embodiments, mobile station 120 may be part of a portable wireless communication device, such as personal digital assistant (PDA), a laptop or portable computer with wireless communication capability, a web tablet, a wireless telephone, a wireless headset, a pager, an instant messaging device, a digital camera, an access point, a television, a medical device (e.g., a heart rate monitor, a blood pressure monitor, etc.), or other device that may receive and/or transmit information wirelessly.

In some embodiments, base station 102 may be referred to as a transmitting station

and mobile station 120 may be referred to as a receiving station or subscribing station, however base station 102 may have receiving capability and mobile station 120 may include transmitting capability. Although base station 102 and mobile station 120 are illustrated as having several separate functional elements, one or more of the functional
5 elements may be combined and may be implemented by combinations of software-configured elements, such as processing elements including digital signal processors (DSPs), and/or other hardware elements. For example, some elements may comprise one or more microprocessors, DSPs, application specific integrated circuits (ASICs), and combinations of various hardware and logic circuitry for performing at least the functions
10 described herein. In some embodiments, the functional elements of base station 102 and mobile station 120 may refer to one or more processes operating on one or more processing elements.

In some embodiments, base station 102 and mobile station 120 may communicate in accordance with specific communication standards, such as the IEEE 802.16-2004 and
15 the IEEE 802.16(e) standards for wireless metropolitan area networks (WMANs) including variations and evolutions thereof, although the scope of the invention is not limited in this respect as they may also be suitable to transmit and/or receive communications in accordance with other techniques and standards. For more information with respect to the IEEE 802.16 standards, please refer to “IEEE Standards for
20 Information Technology -- Telecommunications and Information Exchange between Systems” - Metropolitan Area Networks - Specific Requirements – Part 16: “Air Interface for Fixed Broadband Wireless Access Systems,” May 2005 and related amendments/versions.

Antennas 112 of BS 102 and antennas 122 of MS 120 may comprise directional or
25 omnidirectional antennas, including, for example, dipole antennas, monopole antennas, patch antennas, loop antennas, microstrip antennas or other types of antennas suitable for transmission of RF signals. In some embodiments, instead of two or more antennas, a single antenna with multiple apertures may be used. In these embodiments, each aperture may be considered a separate antenna. In some embodiments, antennas 112 and/or
30 antennas 122 may be effectively separated to take advantage of spatial diversity and the different channel characteristics that may result between each of antennas 112 of base station 102 and each of antennas 122 of mobile station 120.

During operation MS 120 may transition from communicating with BS 102 in cell 130 to communicating with BS 162 in target cell 170 for various reasons, for example, degraded link characteristics as MS 120 moves in the direction of arrow 140. Such a transition may be initiated by BS 102 or MS 120. BS 102 and BS 162 may be connected
5 via wired backbone 180 or a wireless interface, not shown. According to an embodiment of the present invention, MS 120 possesses the correct MAC context information to communicate with BS 162 prior to disconnecting from BS 102 using minimal control message overhead and thus the MAC context update steps are no longer needed when MS 120 moves to cell 170 and connects with BS 162. Specifically, a MAC readiness process
10 at MS 120 for the target cell 170 is added into the HHO preparation phase. The HHO preparation phase refers to the stage where a handover is initiated but MS 120 is still connected with BS 102.

All the existing handover procedure and optimization techniques assume that the MAC context information can be updated at MS 120 only after the PHY adjustment is
15 completed with the target BS 162. This assumption is true if MS 120 initially enters the network, that is, MS 120 has not previously communicated with any BS. Therefore, without achieving PHY adjustment with a BS, MS 120 cannot communicate at all. Because the existing handover procedure was defined based on the existing network entry procedure, it was designed as if the condition still needs to be met. However, the
20 assumption is not necessarily true because the handover process is a transitioning procedure instead of a new entering procedure. That is, the PHY readiness of MS 120 in target cell 170 may not necessarily be a prerequisite for the MAC readiness of MS 102 in target cell 170 in a transitioning procedure. Therefore, the MAC readiness of MS 120 in target cell 170 can be completed in advance for the HHO while MS 120 is still connected
25 with BS 102. In this way, the steps to re-enter the network after the disconnection are reduced and thus the service disruption time can be greatly reduced. Specifically, MS 120 has updated MAC context information including connection identifiers from target BS 162 prior to disconnecting from BS 102.

Specifically, MAC context information includes connection identifier update,
30 capability negotiation information, and registration information used between target BS 162 and MS 120. In the current WiMAX protocol, connection identifier update is encoded as TLV values in RNG_RSP. Capability negotiation information as TLV values of SBC-

REQ/RSP includes supported duplex mode, protocol data unit construction method, transmission power capability, modulator/demodulator configuration, authorization policy, handover trigger metric that can be used, etc. registration information as TLV values of REG_REQ/RSP includes management features supported, security association update, mobility features supported, etc. Even though it is possible that some values of capability negotiation information and registration information change as a result of a handover, in many cases, the values remain after handover. On the other hand, connection identifiers must change as a result of handover.

FIG. 2 illustrates a message sequence for minimizing service disruption time according to an embodiment of the present invention. During the HHO preparation phase, an MS 202 initiates a handover by sending a handover request message to serving BS 204, at transmission 212. The handover request message may be similar to current WiMAX message MOB_MSHO-REQ, however, it further includes a PHHO indicator. By setting the PHHO indicator, MS 202 is requesting to receive MAC context information and connection identifiers for potential target BSs prior to disconnecting from serving BS 204. The information is all or some, depending on the level of handover optimization desired, of the TLV encoded information typically received in the RNG-RSP, SBC-RSP, and REG-RSP messages after an MS has connected to a target BS.

Upon receiving the handover request message, the serving BS 204 contacts one or more potential target BSs 206 to query about resource status, assign connection identifiers and prepare MAC readiness at transmission 214. Target BS 206 provides a response with service level prediction for MS 202 attempting the handover, assigned connection identifier(s) and other MAC context information as required at transmission 216. Upon receiving the response from the one or more potential target BSs 206, serving BS 204 sends MS 202 the received information from the potential target BSs 206 at transmission 218. The handover response message may be similar to current WiMAX message MOB_BSHO-RSP, however, it further includes connection identifiers and other MAC context information, if any.

MS 202, upon selection of a target BS, then disconnects from BS 204 by transmitting a commit to handover message, at transmission 220. The commit to handover message may be similar to current WiMAX message MOB_HO-IND. Upon sending this

message, MS 202 finishes the HHO preparation phase and then begins HHO execution. The service disruption time begins after this message is sent, however, re-connection time is minimized according to embodiments of the present invention because MS 202 already possesses MAC context information including updated connection identifiers for the target
5 BS.

MS 202 may begin data communication with the target BS using the received connection identifiers as soon as it achieves PHY adjustment. That is, MS 202 only needs to perform PHY synchronization and adjustment during the service disruption time with the selected target BS 206. As the target BS 206 notices the successful network
10 attachment of MS 202, BS 206 sends a handover completion indication to the old serving BS 204 at transmission 222. Thus, the old serving BS 204 can send the indication to other potential target BSs (if any) that were not chosen as a new serving BS so that they can release their reserved resources, at transmission 224.

FIG. 3 illustrates an alternate message sequence for minimizing service disruption
15 time according to an embodiment of the present invention. During the HHO preparation phase, a serving BS 304 can initiate a handover. First, serving BS 304 contacts one or more potential target BSs 306 to query about resource status, assign connection identifiers and prepare MAC readiness at transmission 312. Target BS 306 provides a response with service level prediction for MS 302 attempting the handover, assigned connection
20 identifier(s) and other MAC context information as required at transmission 314. Upon receiving the response from the one or more potential target BSs 306, serving BS 304 sends MS 302 a handover request message with the received information from the potential target BSs 306 at transmission 316. The handover request message may be similar to current WiMAX message MOB_BSHO-REQ, however, it further includes
25 connection identifiers and other MAC context information, if any.

MS 302, upon selection of a target BS, then disconnects from serving BS 304 by transmitting commit to handover message, at transmission 318. The commit to handover message may be similar to current WiMAX message MOB_HO-IND. Upon sending this message, MS 302 finishes the HHO preparation phase and then begins HHO execution.
30 The service disruption time begins after this message is sent, however, re-connection time is minimized according to embodiments of the present invention because MS 302 already

possesses MAC context information including updated connection identifiers for the target BS.

MS 302 may begin data communication with the target BS using the received connection identifiers as soon as it achieves PHY adjustment. That is, MS 302 only needs to perform PHY synchronization and adjustment during the service disruption time. As the target BS 306 notices the successful network attachment of MS 302, BS 306 sends a handover completion indication to the old serving BS 304 at transmission 320. Thus, the old serving BS 304 can send the indication to other potential target BSs (if any) that were not chosen as a new serving BS so that they can release their reserved resources, transmission 322.

Embodiments of the invention may be used in a variety of applications. Some embodiments of the invention may be used in conjunction with various devices and systems, for example, a transmitter, a receiver, a transceiver, a transmitter-receiver, a wireless communication station, a wireless communication device, a wireless Access Point (AP), a modem, a wireless modem, a Personal Computer (PC), a desktop computer, a mobile computer, a laptop computer, a notebook computer, a tablet computer, a server computer, a handheld computer, a handheld device, a Personal Digital Assistant (PDA) device, a handheld PDA device, a network, a wireless network, a Local Area Network (LAN), a Wireless LAN (WLAN), a Metropolitan Area Network (MAN), a Wireless MAN (WMAN), a Wide Area Network (WAN), a Wireless WAN (WWAN), devices and/or networks operating in accordance with existing IEEE 802.11, 802.11a, 802.11b, 802.11e, 802.11g, 802.11 h, 802.11i, 802.11n, 802.16, 802.16d, 802.16e standards and/or future versions and/or derivatives and/or Long Term Evolution (LTE) of the above standards, a Personal Area Network (PAN), a Wireless PAN (WPAN), units and/or devices which are part of the above WLAN and/or PAN and/or WPAN networks, one way and/or two-way radio communication systems, cellular radio-telephone communication systems, a cellular telephone, a wireless telephone, a Personal Communication Systems (PCS) device, a PDA device which incorporates a wireless communication device, a Multiple Input Multiple Output (MIMO) transceiver or device, a Single Input Multiple Output (SIMO) transceiver or device, a Multiple Input Single Output (MISO) transceiver or device, a Multi Receiver Chain (MRC) transceiver or device, a transceiver or device having "smart antenna" technology or multiple antenna technology, or the like. Some

embodiments of the invention may be used in conjunction with one or more types of wireless communication signals and/or systems, for example, Radio Frequency (RF), Infra Red (IR), Frequency-Division Multiplexing (FDM), Orthogonal FDM (OFDM), Time-Division Multiplexing (TDM), Time-Division Multiple Access (TDMA), Extended TDMA (E-TDMA), General Packet Radio Service (GPRS), Extended GPRS, Code-Division Multiple Access (CDMA), Wideband CDMA (WCDMA), CDMA 2000, Multi-Carrier Modulation (MDM), Discrete Multi-Tone (DMT), Bluetooth (RTM), ZigBee (TM), or the like. Embodiments of the invention may be used in various other apparatuses, devices, systems and/or networks.

The techniques described above may be embodied in a computer-readable medium for configuring a computing system to execute the method. The computer readable media may include, for example and without limitation, any number of the following: magnetic storage media including disk and tape storage media; optical storage media such as compact disk media (e.g., CD-ROM, CD-R, etc.) and digital video disk storage media; holographic memory; nonvolatile memory storage media including semiconductor-based memory units such as FLASH memory, EEPROM, EPROM, ROM; ferromagnetic digital memories; volatile storage media including registers, buffers or caches, main memory, RAM, etc.; and data transmission media including permanent and intermittent computer networks, point-to-point telecommunication equipment, carrier wave transmission media, the Internet, just to name a few. Other new and various types of computer-readable media may be used to store and/or transmit the software modules discussed herein. Computing systems may be found in many forms including but not limited to mainframes, minicomputers, servers, workstations, personal computers, notepads, personal digital assistants, various wireless devices and embedded systems, just to name a few. A typical computing system includes at least one processing unit, associated memory and a number of input/output (I/O) devices. A computing system processes information according to a program and produces resultant output information via I/O devices.

Realizations in accordance with the present invention have been described in the context of particular embodiments. These embodiments are meant to be illustrative and not limiting. Many variations, modifications, additions, and improvements are possible. Accordingly, plural instances may be provided for components described herein as a single instance. Boundaries between various components, operations and data stores are

somewhat arbitrary, and particular operations are illustrated in the context of specific illustrative configurations. Other allocations of functionality are envisioned and may fall within the scope of claims that follow. Finally, structures and functionality presented as discrete components in the various configurations may be implemented as a combined
5 structure or component. These and other variations, modifications, additions, and improvements may fall within the scope of the invention as defined in the claims that follow.

WHAT IS CLAIMED IS:

1. A method comprising:
requesting MAC context information of a neighbor base station for a mobile
station prior to the mobile station disconnecting from a current base station.
- 5 2. The method as recited in Claim 1, further comprising providing the MAC
context information of the neighbor base station to the mobile station with a request for a
handover.
3. The method as recited in Claim 1, further comprising providing the MAC
context information of the neighbor base station to the mobile station with a response to a
10 request for a handover.
4. The method as recited in Claim 1, further comprising requesting additional
MAC context information for an alternate neighbor base station for the mobile station
prior to the mobile station disconnecting from the current base station.
5. The method as recited in Claim 4, further comprising providing the MAC
15 context information for the neighbor base station and the additional MAC context
information for the alternate neighbor base station to the mobile station with a request for
a handover.
6. The method as recited in Claim 5, further comprising upon selection and
connection to the neighbor base station or the alternate neighbor base station by the mobile
20 station, receiving a handover completion notification.
7. The method as recited in Claim 6, further comprising upon receiving the
handover completion notification, sending notification to release the resources of a non-
selected neighbor base station.

8. The method as recited in Claim 4, further comprising providing the MAC context information for the neighbor base station and the additional MAC context information for the alternate neighbor base station to the mobile station with a response to a request for a handover.

5 9. The method as recited in Claim 1, wherein the mobile station and the current base station communicate wirelessly.

10 10. The method as recited in Claim 1, wherein the MAC context information includes connection identifiers for a connection between the mobile station and the neighbor base station.

11 11. A machine-readable medium having machine executable instructions for performing a method, the method comprising:
 requesting MAC context information of a neighbor base station for a mobile station prior to the mobile station disconnecting from a current base station.

12 12. The machine-readable medium as recited in Claim 11, the method further
15 comprising providing the MAC context information of the neighbor base station to the mobile station with a request for a handover.

13. The machine-readable medium as recited in Claim 11, the method further comprising providing the MAC context information of the neighbor base station to the mobile station with a response to a request for a handover.

20 14. The machine-readable medium as recited in Claim 11, the method further comprising requesting additional MAC context information for an alternate neighbor base station for the mobile station prior to the mobile station disconnecting from the current base station.

25 15. The machine-readable medium as recited in Claim 14, the method further comprising providing the MAC context information for the neighbor base station and the additional MAC context information for the alternate neighbor base station to the mobile station with a request for a handover.

16. An apparatus comprising:
a network interface to receive, via an antenna, a message containing MAC context
information and connection identifiers for multiple potential connections;
and
5 a MAC component coupled to the network interface to select one of the multiple
potential connections for a handover operation from a current connection to
the one of the multiple potential connections.
17. The apparatus as recited in Claim 16, wherein the current connection and the
multiple potential connections are wireless connections.
- 10 18. The apparatus as recited in Claim 16, wherein the message is a handover
request response message from a current serving base station.
19. The apparatus as recited in Claim 16, wherein the message is a handover
request message from a current serving base station.
20. The apparatus as recited in Claim 16, wherein the network interface is further
15 to send a commit to handover message after the MAC component has selected the one of
the multiple potential connections.
21. The apparatus as recited in Claim 16, wherein the MAC context information
is related to multiple neighbor base stations.
22. The apparatus as recited in Claim 16, wherein each of the multiple potential
20 connections is to a different neighbor base station.
23. The apparatus as recited in Claim 20, wherein each of the multiple potential
connections is to a different neighbor base station.

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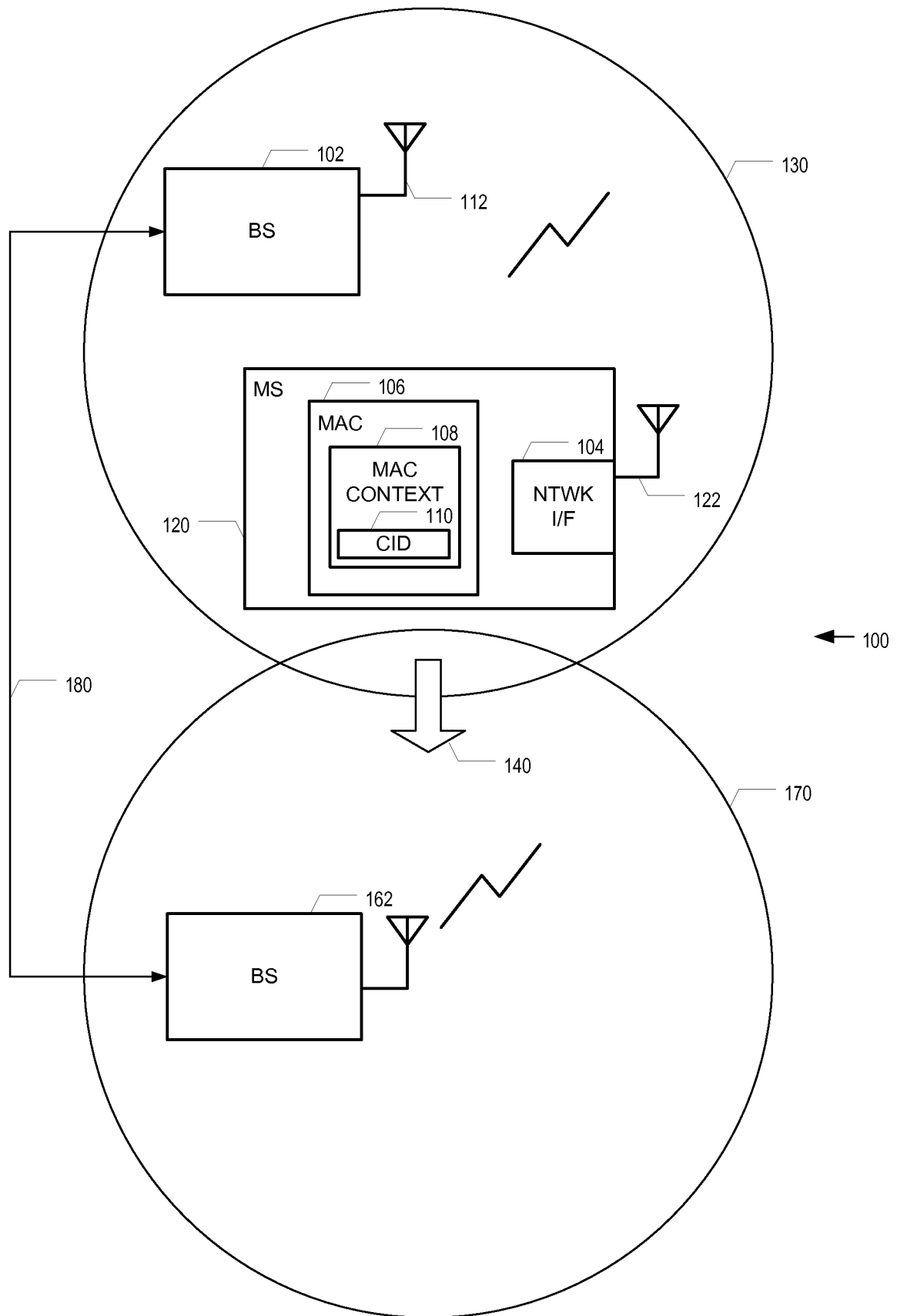
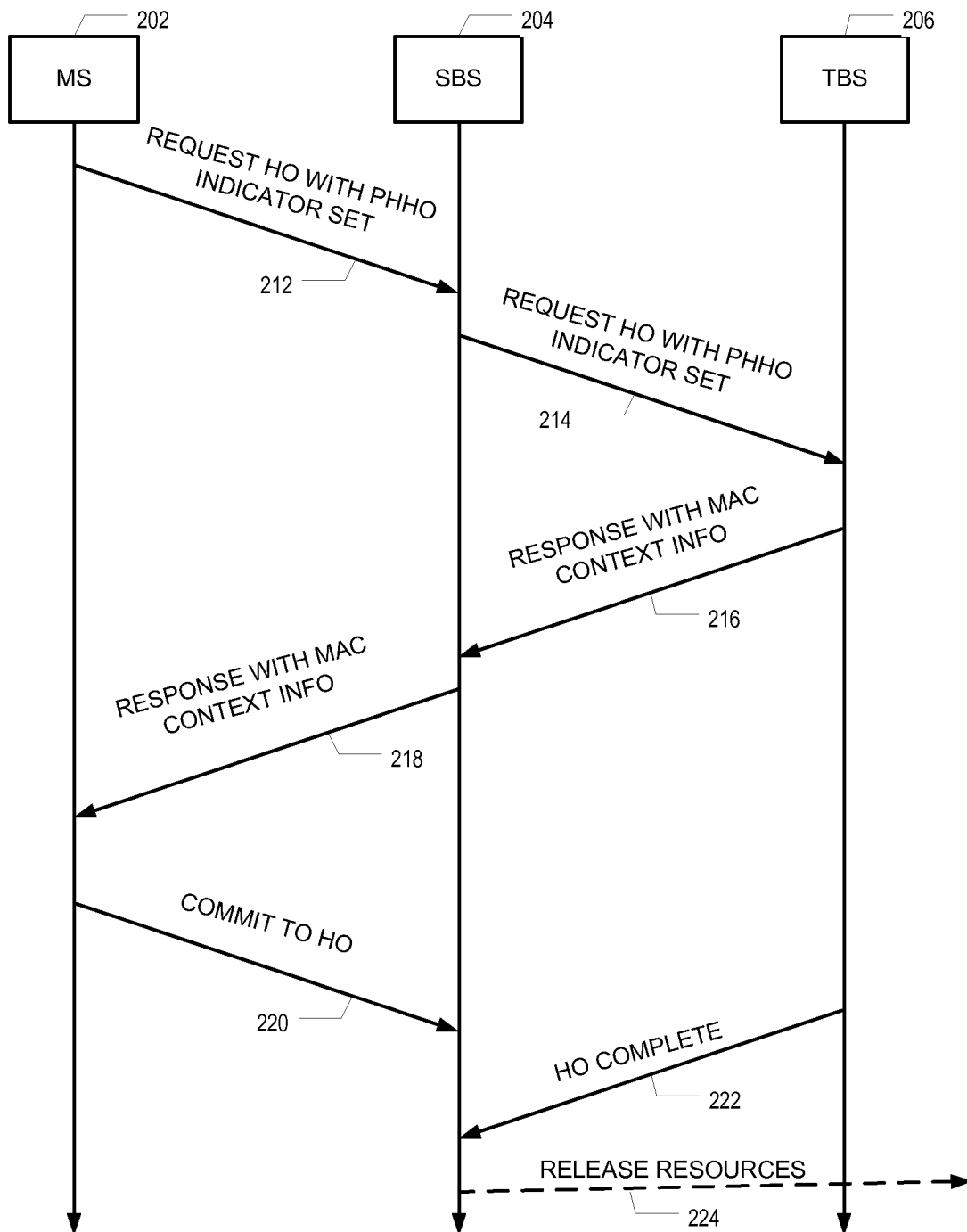
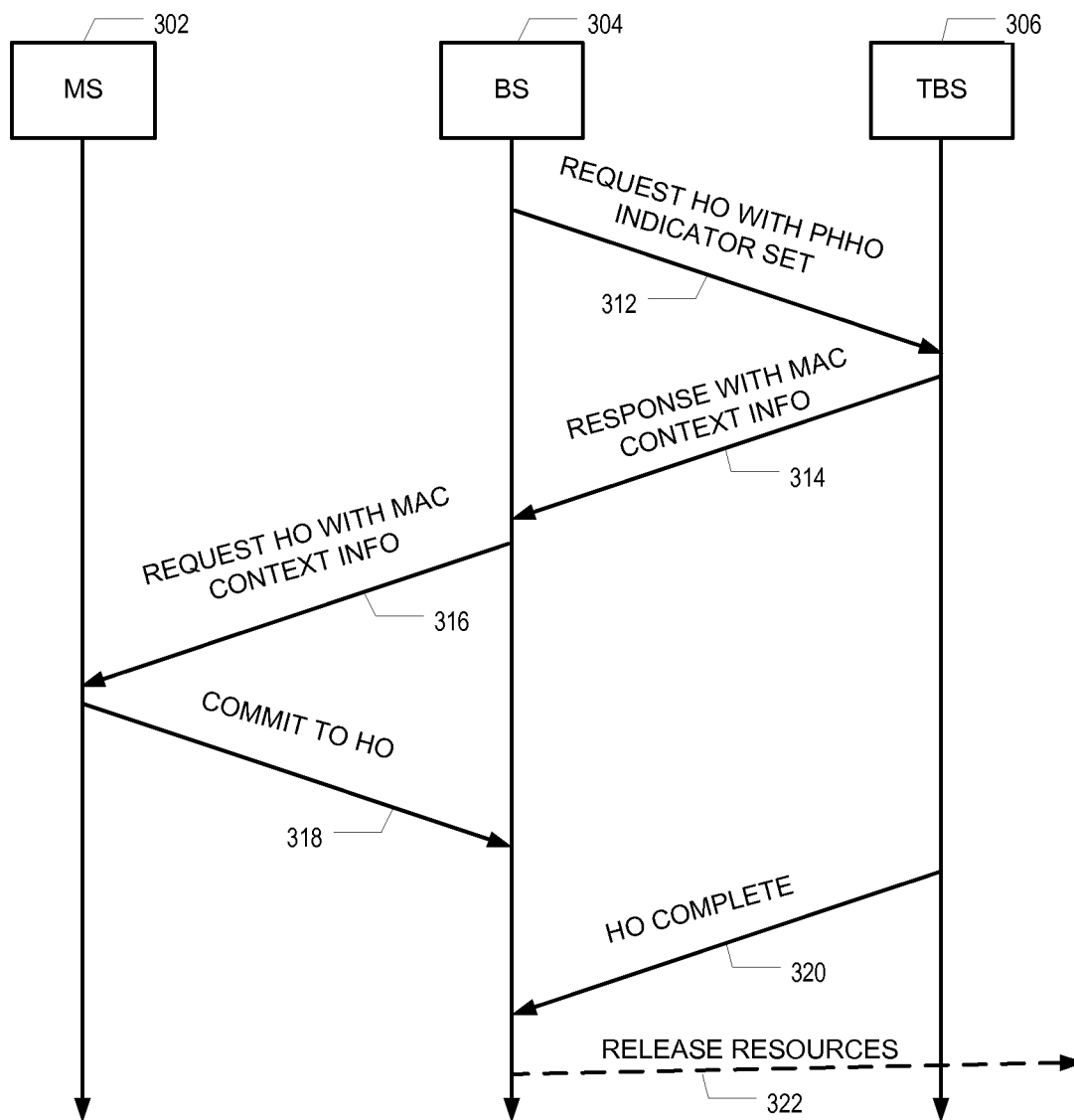


FIG. 1

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**FIG. 2**

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**FIG. 3**

A. CLASSIFICATION OF SUBJECT MATTER**H04B 7/26(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8 H04B H04Q H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models since 1975

Japanese utility models and applications for utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS (KIPO internal), IEEEExplore, Google

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/0192011 A1 (HONG et al.) 1 September 2005 See the Abstract, FIG. 6, 7, Paragraphs [0032] - [0037], [0078]-[0092]	1 - 23
A	SIK CHOI et al., "Fast Handover Scheme for Real-Time Downlink Services in IEEE 802.16e BWA System", Vehicular Technology Conference, 2005. VTC 2005-Spring. 2005 IEEE 61st Volume 3, 30 May-1 June 2005 Page(s):2028 - 2032 Vol. 3	1 - 23
A	DOO HWAN LEE et al., "Fast Handover Algorithm for IEEE 802.16e Broadband Wireless Access System", Wireless Pervasive Computing, 2006 1st International Symposium on, 16-18 January 2006	1 - 23
P, X	JUNE H. PARK et al., "Improvement of Handover Break Time Performance for Wireless Broadband Access System", WBWF, October 2007	1 - 23
A	KR 10-2006-0103106 A (LG ELECTRONICS) 28 September 2006 See the Abstract, FIG. 5, 6, Claim 1	1 - 23



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search

31 OCTOBER 2008 (31.10.2008)

Date of mailing of the international search report

31 OCTOBER 2008 (31.10.2008)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2008/068768

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