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(71) Applicant (for all designated States except US): **LU-CENT TECHNOLOGIES INC.** [US/US]; 600 Mountain Avenue, Murray Hill, NJ 07974-0636 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **FEDER, Peretz, Moshe** [US/US]; 300 Starling Road, Englewood, NJ 07631 (US). **RAJKUMAR, Ajay** [US/US]; 18 Strawberry Lane, Morristown, NJ 07960 (US).

(74) Agent: **MORGAN, Terry**; Lucent Technologies Inc., Docket Administrator - Room 2F-190, 600 Mountain Avenue, Murray Hill, NJ 07974-0636 (US).

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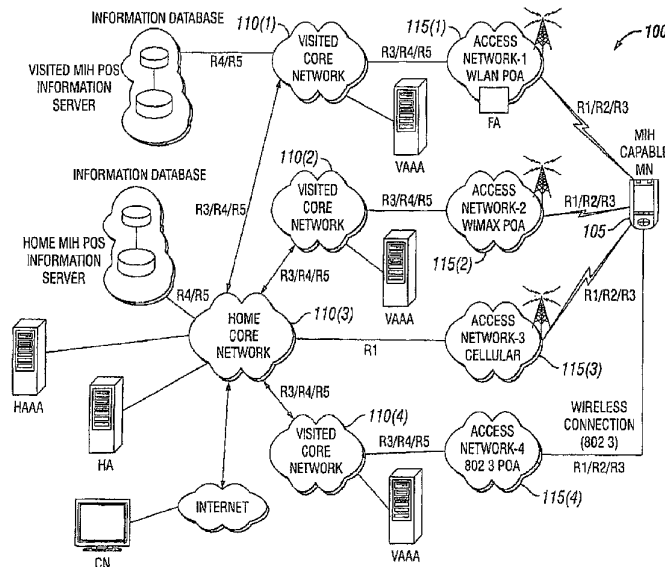
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(54) Title: EVENT CONTEXT TRANSFER IN A HETEROGENEOUS COMMUNICATION SYSTEM



(57) Abstract: The present invention provides a method involving at least one mobile node and a heterogeneous network comprising a plurality of access nodes. The method includes transferring event context information associated with a mobile node from a first access node to a second access node.



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EVENT CONTEXT TRANSFER IN A HETEROGENEOUS COMMUNICATION SYSTEM**BACKGROUND OF THE INVENTION****1. FIELD OF THE INVENTION**

5 This invention relates generally to communication systems, and, more particularly, to heterogeneous communication systems.

2. DESCRIPTION OF THE RELATED ART

10 A conventional communication system uses one or more access nodes to provide network connectivity to one or more mobile nodes. For example, in a cellular communication system that operates according to Universal Mobile Telecommunication Services (UMTS) standards, one or more nodes may be used to provide wireless network connectivity to mobile nodes. The access networks may include wireless access nodes such as base stations, base station routers, access points and the like, which may be connected to a communication network by radio network controllers. The mobile nodes may include cellular telephones, personal data assistants, smart phones, text messaging devices, Global Positioning Systems, navigation systems, network interface cards, notebook computers, desktop computers, and the like. For another example, an access network that operates according to IEEE 802.3 standards may also be used to provide wired network connectivity to a mobile node that has a wired connection to an access node in the wired access network.

20 Numerous types of communication systems have been developed and deployed to provide network connectivity to mobile nodes. Exemplary communication systems include wire-line communication systems, such as Internets, intranets, systems that operate according to IEEE 802.3 standards, and the like. Wireless communication systems have also proliferated. Exemplary wireless communication systems include systems that provide wireless connectivity to micro cells (*e.g.*, systems that provide wireless connectivity according to the IEEE 802.11 or IEEE 802.15 standards) and systems that provide wireless connectivity to macro cells (*e.g.*, systems that operate according to the Third Generation Partnership Project standards - 3GPP, 3GPP2 - and/or systems operate according to the IEEE 802.16 and IEEE 802.20 standards).

30 The coverage provided by these heterogeneous communication systems may intersect and/or overlap. For example, a wireless access point for a wireless local area network may provide network connectivity to mobile nodes in a micro cell associated with a coffee shop that is within the macro cell coverage area associated with a base station of a cellular communication system. For another example, a wire-line connection may be available in an office building that also provides network connectivity via a wireless local area network. The office building may also be in a geographic area that receives cellular telephone coverage from one or more service providers.

At least partly in response to the proliferation of different communication systems, mobile nodes that support more than one type of access network have been developed. For example, a smart phone may support a wireless communication interface for accessing networks over an air interface and a wire-line communication interface for accessing networks when a physical connection to an access node is available.

5 Mobile nodes that support multiple communication interfaces may hand off from one access node to another. Handoffs are typically triggered by one or more metrics such as signal quality, synchronization time differences, transmission error rates, access node loading conditions, and the like. For example, a moving mobile mode may encounter regions where the signal quality provided by one access node drops and may therefore handover to another access node having better signal quality. For another example, the

10 signal quality provided to a stationary mobile node by a first access node may vary due to changing environmental conditions, triggering a handoff to a second access node.

Smooth handoffs between access nodes that operate according to different communication technologies, standards, and/or protocols may be difficult (or impossible) because of differences or incompatibilities between the different access nodes. The IEEE 802.21 standard has therefore been

15 proposed to enhance the user's experience in mobile networks by supporting handovers between access nodes of heterogeneous networks. In particular, the IEEE 802.21 standard, which is also referred to in the art as the Media Independent Handover (MIH) standard, defines a specification that provides link layer intelligence and other related network information to upper layers to optimize handovers between heterogeneous media. This includes links specified by 3GPP, 3GPP2 and both wired and wireless media in

20 the IEEE 802 family of specifications.

The MIH 802.21 protocol defines event services, command services, and information services. The Media Independent Information Service (MIIS) provides a framework and corresponding mechanisms by which a MIHF (Media Independent Handover Function) entity may discover and obtain network information existing within a geographical area to facilitate the handovers. The command service enables

25 higher layers to control the physical, data link, and logical link layers (also known as "lower layers"). The higher layers may also control the reconfiguration or selection of an appropriate link through a set of handover commands. Event services are used to transmit information regarding events between access nodes and mobile nodes. Events may indicate changes in state and/or transmission behavior of the physical, data link and logical link layers, or predict state changes of these layers. The event service may

30 also be used to indicate management actions or command status on part of a network or some such management entity.

Access nodes and/or mobile nodes may request that certain events be reported using an event registration or subscription message. For example, a mobile node may use remote event services to learn about network events, such as its loading condition, scheduled maintenance, and unavailability. Similarly,

35 the network can learn about various conditions observed by the mobile node, such as channel conditions, signal strength or BER, by requesting that the mobile node transmit this information as events. Radio

conditions can change very frequently, which may trigger frequent reporting of events resulting from these changes. Event registration may reduce the number and/or frequency of event reports by registering for events that are of interest to the node and also by conveying a threshold value associated with the requested event. The requested events are only reported when the threshold set
5 by the requesting node is exceeded.

In a conventional heterogeneous network, mobile nodes initiate network discovery, and then notifies the network of the existence of the mobile node. Once network discovery has taken place, the network may request that certain events be reported, e.g., using an event registration message that may be initiated by the network. The mobile node may provide confirmation of the
10 event registration in response to the event registration message. Similarly, the mobile node may initiate event registration, e.g., using an event registration message, if the mobile node wants to receive events from the network. The network and the mobile node may then form and store event context information based on the information included in the event registration message(s). However, transmission and acknowledgment of the event registration messages increases the
15 overhead associated with implementing media independent handovers.

SUMMARY OF THE INVENTION

The present invention is directed to addressing the effects of one or more of the problems set forth above. The following presents a simplified summary of the invention in order to provide a basic understanding of some aspects of the invention. This summary is not an
20 exhaustive overview of the invention. It is not intended to identify key or critical elements of the invention or to delineate the scope of the invention. Its sole purpose is to present some concepts in a simplified form as a prelude to the more detailed description that is discussed later.

In one embodiment of the present invention, a communication method is provided involving at least one mobile node and a heterogeneous network comprising a plurality of access
25 nodes. The method includes transferring event context information associated with a mobile node from a first access node associated with one access technology to a second access node associated with a different access technology. The event context information indicates an event context state of the mobile node and at least one trigger for reporting at least one event between a mobile node and a second access node following handoff of the mobile node to the second access node, the at
30 least one event indicating a change in state a transmission behaviour of at least one of a physical layer, a data link layer, or a logical link layer is for communication between the mobile node and the second access node following handoff of the mobile node to the second access node.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements, and in which:

Figure 1 conceptually illustrates a first exemplary embodiment of a heterogeneous communication system, in accordance with the present invention;

Figure 2 conceptually illustrates a second exemplary embodiment of a heterogeneous network, in accordance with the present invention;

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Figure 3 conceptually illustrates one exemplary embodiment of an access node and the mobile node, in accordance with the present invention; and

Figure 4 conceptually illustrates a first exemplary embodiment of a method of transferring an event context, in accordance with the present invention.

5 While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and are herein described in detail. It should be understood, however, that the description herein of specific embodiments is not intended to limit the invention to the particular forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as
10 defined by the appended claims.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

Illustrative embodiments of the invention are described below. In the interest of clarity, not all features of an actual implementation are described in this specification. It will of course be appreciated that in the development of any such actual embodiment, numerous implementation-specific decisions
15 should be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which will vary from one implementation to another. Moreover, it will be appreciated that such a development effort might be complex and time-consuming, but would nevertheless be a routine undertaking for those of ordinary skill in the art having the benefit of this disclosure.

Portions of the present invention and corresponding detailed description are presented in terms of
20 software, or algorithms and symbolic representations of operations on data bits within a computer memory. These descriptions and representations are the ones by which those of ordinary skill in the art effectively convey the substance of their work to others of ordinary skill in the art. An algorithm, as the term is used here, and as it is used generally, is conceived to be a self-consistent sequence of steps leading to a desired
25 result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of optical, electrical, or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

It should be borne in mind, however, that all of these and similar terms are to be associated with
30 the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise, or as is apparent from the discussion, terms such as "processing" or "computing" or "calculating" or "determining" or "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical, electronic quantities within the computer system's registers and memories into

other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

Note also that the software implemented aspects of the invention are typically encoded on some form of program storage medium or implemented over some type of transmission medium. The program storage medium may be magnetic (e.g., a floppy disk or a hard drive) or optical (e.g., a compact disk read only memory, or "CD ROM"), and may be read only or random access. Similarly, the transmission medium may be wireless, twisted wire pairs, CAT5, coaxial cable, optical fiber, or some other suitable transmission medium known to the art. The invention is not limited by these aspects of any given implementation.

The present invention will now be described with reference to the attached figures. Various structures, systems and devices are schematically depicted in the drawings for purposes of explanation only and so as to not obscure the present invention with details that are well known to those skilled in the art. Nevertheless, the attached drawings are included to describe and explain illustrative examples of the present invention. The words and phrases used herein should be understood and interpreted to have a meaning consistent with the understanding of those words and phrases by those skilled in the relevant art. No special definition of a term or phrase, *i.e.*, a definition that is different from the ordinary and customary meaning as understood by those skilled in the art, is intended to be implied by consistent usage of the term or phrase herein. To the extent that a term or phrase is intended to have a special meaning, *i.e.*, a meaning other than that understood by skilled artisans, such a special definition will be expressly set forth in the specification in a definitional manner that directly and unequivocally provides the special definition for the term or phrase.

Figure 1 conceptually illustrates a first exemplary embodiment of a heterogeneous network 100. As used herein and in accordance with usage in the art, the term "heterogeneous network" will be understood to refer to a network that includes interconnected portions, networks, and/or subnets that operate according to different standards and/or protocols. The heterogeneous network 100 may include portions that operate according to different access technologies that implement different wired and/or wireless standards and/or protocols. For example, the heterogeneous network 100 may include wire-line communication systems, such as Internets, intranets, systems that operate according to IEEE 802.3 standards, and the like, as well as wireless communication systems that provide wireless connectivity according to the IEEE 802.11 or IEEE 802.15 standards, the Third Generation Partnership Project standards (3GPP, 3GPP2), the IEEE 802.16 or IEEE 802.20 standards, and the like.

The heterogeneous network 100 provides various communication services to one or more mobile nodes 105. Although a single mobile node 105 is shown in Figure 1, persons of ordinary skill in the art having benefit of the present disclosure should appreciate that the heterogeneous network 100 may provide communication services to any number of mobile nodes 105. Persons of ordinary skill in the art having

benefit of the present disclosure should also appreciate that the mobile node 105 may also be referred to using other terms such as "mobile unit," "mobile terminal," "access terminal," "subscriber terminal," "subscriber station," "mobile station," "user terminal," "terminal equipment," "user equipment," and the like. Exemplary mobile nodes 105 may include cellular telephones, personal data assistants, smart phones, text messaging devices, Global Positioning System devices, navigation systems, network interface cards, notebook computers, desktop computers, and the like.

The mobile node 105 supports multiple interfaces for one or more wire-line communication links and/or one or more wireless communication links, as will be discussed in detail below. In the illustrated embodiment, the mobile node 105 is multi-modal, *i.e.* the mobile node 105 is capable of supporting multiple radio standards and concurrently supporting connections on more than one radio interface. The mobile node 105 also may support media independent handover (MIH) functionality. In one embodiment, the mobile node 105 supports the IEEE 802.21 standard, which is also referred to in the art as the Media Independent Handover (MIH) standard. The MIH standard defines a specification that provides link layer intelligence and other related network information to upper layers to optimize handovers between heterogeneous media.

The heterogeneous network 100 also includes various networks 110 that are interconnected to form the heterogeneous network 100. The indices (1-4) may be dropped when referring to the networks 110 collectively. However, the indices may be used to indicate individual networks 110 or subsets of the networks 110. The same convention may be applied to other elements in the drawings that are referred to by a number and one or more identifying indices. Each of the networks 110 includes at least one access network 115. The access networks 115 include one or more access nodes (not shown in Figure 1) that may act as a Point of Attachment (or Point of Service) for the mobile node 105. The access nodes may be multi-modal, *i.e.* capable of supporting multiple radio standards and concurrently supporting connections on more than one radio interface.

In the illustrated embodiment, the heterogeneous network 100 includes a home core network 110(3) that acts as the home network for the mobile node 105. Accordingly, the mobile node 105 may access the home core network 110(3), as well as other networks connected to the home core network 110(3), by forming a communication link with an access node in a cellular access network 115(3). As shown in Figure 1, the home core network 110(3) may be coupled to an information server that includes an information database, a home Authentication, Authorization, and Accounting (HAAA) server, and a Home Agent (HA). However, in alternative embodiments, the heterogeneous network 100 may also implement proxy mobile Internet protocol (MIP). Techniques for configuration, operation, and/or maintenance of these elements are known in the art and in the interest of clarity only those aspects of the configuration, operation, and/or maintenance of these elements that are relevant to the present invention will be discussed further herein.

The heterogeneous network 100 also includes visited core networks 110(1, 2, 4) that may be communicatively coupled with the home core network 110(3). In the illustrated embodiment, the visited core networks 110(1, 2, 4) include a wireless local area network (WLAN) that may be accessed via an access node that acts as a Point of Attachment (PoA) in the access network 115(1), a WiMAX network
5 that may be accessed via an access node that acts as a PoA in the access network 115(2), and a wire-line network that operates according to the IEEE 802.3 standards and may be accessed via an 802.3 access node PoA in the access network 115(4). However, any number or type of visited core networks 110(1, 2, 4) may be included in alternative embodiment of the heterogeneous network 100. As shown in Figure 1, the visited core networks 110(1, 2, 4) may be coupled to an information server that includes an information
10 database, a visited Authentication, Authorization, and Accounting (VAAA) server, and a Foreign Agent (FA). Techniques for configuration, operation, and/or maintenance of these elements are known in the art and in the interest of clarity only those aspects of the configuration, operation, and/or maintenance of these elements that are relevant to the present invention will be discussed further herein.

In the illustrated embodiment, the heterogeneous network 100 supports media independent
15 handoff functionality, such as the IEEE 802.21 MIH standard, which enables the mobile node 105 to hand off between access networks 115 that operate according to heterogeneous standard and/or protocols. For example, break-then-make and/or make-before-break handovers may be used to hand off the mobile node 105 between two of the access networks 115. The heterogeneous network 100, the access networks 115, and the mobile node 105 may therefore support various information services, event services, and command
20 services that may be used to implement media independent handovers. Some (or all) of the event services associated with the mobile node 105 may remain the same when the mobile node 105 hands off from one access network 115 (or node therein) to another. The event context (or a portion thereof) associated with the mobile node 105 may therefore be transferred from one access node in the source access network 115 to an access node in the target access network 115 in response to determining that the mobile node 105 is
25 associated with the target access network 115. As used herein, the term "event context" will be understood to refer to the information and/or states used to identify the events associated with the mobile node 105 and to support reporting of these events. In one embodiment, the event context includes an event registration and/or subscription context.

Figure 2 conceptually illustrates a second exemplary embodiment of a heterogeneous network
30 200. In the illustrated embodiment, the heterogeneous network 200 includes a home core network 205 and a visited core network 210 that are communicatively coupled. Although a single visited core network 210 is shown in Figure 2, persons of ordinary skill in the art having benefit of the present disclosure should appreciate that the heterogeneous network 200 may include any number of visited core networks 210. The home core network 205 and the visited core network 210 are communicatively coupled to corresponding
35 access networks 215. Although the home core network 205 and the visited core network 210 shown in Figure 2 are each coupled to one corresponding access network 215, persons of ordinary skill in the art having benefit of the present disclosure should appreciate that the home core network 205 and/or the

visited core network 210 may be communicatively coupled using any type of wired or wireless connection between the core network 205 and any number of access networks 215 and may also be communicatively coupled to each other through a service level agreement

5 Each of the access networks 215 includes one or more access nodes 220. The access nodes 220 may be any type of device used for providing access to the home core network 205 and/or the visited core network 210. Exemplary access nodes 220 include base stations, base station routers, access points, routers, hubs, and the like. The access nodes 220 may operate according to any standard or protocol including, but not limited to wire-line standards such as the IEEE 802.3 standards and wireless communication standards such as the IEEE 802.11 or IEEE 802.15 standards, the Third Generation
10 Partnership Project standards (3GPP, 3GPP2), the IEEE 802.16 or 802.20 standards, and the like.

A mobile node 225 may form communication links with access nodes 220 in either (or both) of the access networks 215. In the illustrated embodiment, the mobile node 225 has (or had) a communication link 230 with the access node 220(2) in the access network 215(1). The mobile node 225 is also in the process of forming (or has already formed) a communication link 235 with the access node
15 220(3) in the access network 210(2). For example, the mobile node 225 may be in soft make-before-break handover mode from the access node 220(2) to the access node 220(3), in which case the communication links 230, 235 may be present concurrently. For another example, the mobile node 225 may be in hard handover (*e.g.*, break-before-make) from the access node 220(2) to the access node 220(3), in which case the communication link 230 may be torn down before the communication link 235 is formed.

20 Event context information may be transferred from the access node 220(2) to the access node 220(3), as indicated by the arrow 240. In one embodiment, the event context information is transferred between the two MIH capable nodes using MIH-to-MIH communication, as will be discussed in detail below. The event registration and/or subscription context information may include states and/or information that were established and used to identify and/or report events associated with the mobile node
25 225 and the access node 220(2). In one embodiment, the event context information may be transferred from the access network 210(2) to the access node 220(3) in response to determining that the mobile node 225 has been associated with the access node 220(3). For example, the access node 220(3) may receive information indicating that the mobile node 225 has been handed off to the access node 220(3). The hand off information may be received from the mobile node 225 and/or the access network 220(2).

30 In one embodiment, the mobile node 225 may select the access node 220(3) to be the controlling or command node, *i.e.*, the node that provides command services. The mobile node 225 provides a registration message that informs the access node 220(3) that it is to act as the controlling node for the mobile node 225. For example, the registration message may include information that informs the access node 220(3) of any pertinent policies, such as handover policies, which have been downloaded or pre-
35 provisioned to the mobile node 225 by a service provider. In one embodiment, the access node 220(3)

may determine that the mobile node 225 has been associated with the access node 220(3) based on reception of the registration request message from the mobile node 225. Accordingly, the access node 220(3) may request that event context information associated with the mobile node 225 be transferred from the access node 220(2) to the access node 220(3) in response to receiving the registration request message
5 from the mobile node 225.

Figure 3 conceptually illustrates one exemplary embodiment of a source access node 300 and the target access node 305. In the illustrated embodiment, the source access node 300 and the target access node 305 support media independent handovers. For example, the source access node 300 and the target access node 305 may be configured to support the IEEE 802.21 Media Independent Handover standards.
10 Accordingly, the various layers implemented in the source access node 300 and/or the target access node 305 may be divided into higher layers 310, media independent handover layers 315, and lower layers 320. The layers 310, 315, 320 may be implemented in any combination of hardware, firmware, and/or software.

As used herein and in accordance with usage in the art, the term "media independent handover layer" will be understood to refer to a generic link layer that implements intelligence that is independent of
15 the specifics of radio interfaces both at the terminal and at the network. The media independent handover layer 315 therefore provides a generic interface between the higher layers or MIH users in the mobility-management protocol stack and existing media-specific link layers, such as those specified by 3GPP, 3GPP2 and the IEEE 802 family of standards. The media independent handover layer 315 may provide services to the upper layers 310 through a single technology-independent interface (e.g., an MIH Service
20 Access Point or SAP) and may obtain services from the lower layers 320 through a variety of technology-dependent interfaces (media-specific SAPs).

As used herein and in accordance with usage in the art, the term "higher layer" will be understood to refer to a layer or layers 310 that make use of the services provided by the media independent handoff (MIH) functionality layers 315 and hence higher layers may also be referred to as MIH users. Examples of
25 higher layers 310 are the layers or functions that implement connectivity, such as the Internet Protocol (IP), Mobile IP mobility management, Session Initiation Protocol (SIP), the Transmission Control Protocol (TCP), the User Datagram Protocol (UDP), application layers, and the like.

As used herein and in accordance with usage in the art, the term "lower layers" will be understood to refer to layers located at OSI Level 2 and below across different media specific technology standards supported by the IEEE 802.21 specification. As an example, lower layers 320 defined in the IEEE 802.11
30 specification are the Media Access Control (MAC) layer and the physical (PHY) layer. For another example, the lower layers 320 defined by the 3GPP standards are the MAC and PHY layers. The lower layers 320 may also include logical link control layers such as 802.2 LLC or 3GPP RLC. The MIH functionality may use the services provided by these layers.

The media independent handover layers 315 may provide various services that may be utilized by the higher layers 310 and/or the lower layers 320. Exemplary services include information services (indicated by the arrow 325), command services (indicated by the arrow 330), and event services (indicated by the arrow 335). In the interest of clarity, only one set of the arrows 325, 330, 335 have been indicated by numerals in Figure 3. In one embodiment, the media independent handover layers 315 provide asynchronous and/or synchronous services through well defined SAPs for link layers 320 and MIH users 310. In the case of a system with multiple network interfaces of arbitrary type, the upper layers 310 may use the event service, command service and information service provided by MIH to manage, determine, and control the state of the underlying interfaces. The information services, command services, and event services are defined in more detail below.

As used herein and in accordance with usage in the art, the term "information service" will be understood to refer to operations and/or algorithms (as well as the messages, protocols, and/or code used to implement these operations and algorithms) that provides a framework and corresponding mechanisms by which a Media Independent Handover Function (MIHF) entity may discover and obtain network information existing within a geographical area to facilitate initial connectivity or the handovers. Information services may provide a set of information elements (IEs), the information structure and its representation, and a query/response type of mechanism for information transfer. This contrasts with the asynchronous push model of information transfer for the event service. The information may be present in an information server (not shown) and the MIH Function 315 may access the information from the information server. The information may be made available via both lower layers 320 and higher layers 310.

As used herein and in accordance with usage in the art, the term "command service" will be understood to refer to operations and/or algorithms (as well as the messages, protocols, and/or code used to implement these operations and algorithms) that enable mobility management or higher layers 310 to control the physical, data link, and logical link layers (collectively known as lower layers 320). The higher layers 310 may also control the reconfiguration or selection of an appropriate link through a set of handover commands that may be considered part of the command services. Commands may be invoked from the mobility management function or upper layers 310 (MIH Commands) as well as from the MIH Function 315 (Link Commands). The destination of a command may be the MIH Function 315 or any lower layer 320. The recipient of a command may be located within the stack that originated the command, or within a remote stack. In case of local commands, messages typically propagate from the upper layers 310 (e.g., from a policy engine implemented in the upper layers 310) to the MIH Function 315 and then from MIH Function 315 to lower layers 320. In case of remote commands, messages may propagate from upper layers 310 via MIH Function 315 in one stack to the MIH Function 315 in a peer stack (with the use of the MIH Protocol). Commands may then be further propagated to any lower layer 320.

As used herein and in accordance with usage in the art, the term "event service" will be understood to refer to operations and/or algorithms (as well as the messages, protocols, and/or code used to implement these operations and algorithms) that enable identification of events and the transmission of information associated with or indicative of the events, such as event context information. Events may indicate changes in state and transmission behavior of the physical, data link and logical link layers, or predict state changes of these layers. The Event Service may also be used to indicate management actions or command status on part of network or some such management entity. Events may originate from the MIH Function (MIH Events) or any lower layer (Link Events). The destination of an event may be the MIH Function, any upper layer entity, or any MIH user. The recipient of the event may be located within the stack that originated the event or within a remote stack. In case of local events, messages typically propagate from the lower layers 320 (PHY, MAC, GMM...) to the MIH Function 315 and from MIH Function 315 to any upper layer 310. In case of remote events, messages propagate from the MIH Function 315 in one stack to the MIH Function 315 in the peer stack. Events may then be further propagated to any upper layer 310.

When a mobile node (not shown in Figure 3) becomes associated with the target access node 305, event context information associated with the mobile node is transferred to the target access node 305. In the illustrated embodiment, the mobile node has been (or is in the process of being) handed off from the source access node 300 to the target access node 305, e.g., using a soft handoff or a hard handoff. The event context information is transferred from the MIH Function 315 in the source stack of the source access node 300 to the MIH Function 315 in the target stack of the target access node 305. As discussed above, in one embodiment, transfer of the event context information may be triggered by reception of a registration request message from the mobile node or by a request from the target access node 305 upon learning from access node 300 or network 200 that the mobile is transitioning to access node (305)

Figure 4 conceptually illustrates one exemplary embodiment of a method 400 of transferring event context information. In the illustrated embodiment, association or pending association of a mobile node with a target access node may be determined (at 405), e.g., in response to receiving information indicating handoff of the mobile node from a source access node to the target access node and/or reception of a registration request message from the mobile node. The event context information may then be transferred (at 410) to the target access node. For example, when the mobile node is being handed off to the target access node, the event context information may be transferred (at 410) from the source access node to the target access node. For another example, the event context information may be transferred (at 410) to the target access node in response to the transfer of a session identifier associated with the event reporting session in the source access node to the target access node. In one embodiment, events indicated by the event context information may be registered with a media independent handoff function in the mobile node

The mobile node and/or the target access node may then monitor events and provide (at 415) event reports based upon the transferred event context information. For example, the mobile node and/or the target access node may determine that a certain event has exceeded a threshold indicated in the transferred event context information and may provide (at 415) an event report in response to the event exceeding the specified threshold. In one embodiment, the mobile node and/or the target access node may form an event session identifier based on the transferred event context information. The source access node may also transmit a deregistration message to the mobile node indicating that the target access node will receive event reports.

The particular embodiments disclosed above are illustrative only, as the invention may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below. It is therefore evident that the particular embodiments disclosed above may be altered or modified and all such variations are considered within the scope and spirit of the invention. Accordingly, the protection sought herein is as set forth in the claims below.

CLAIMSWHAT IS CLAIMED:

1. A communication method involving at least one mobile node and a heterogeneous network comprising a plurality of access nodes, comprising:

transferring event context information associated with a mobile node from a first access node to a second access node, the event context information indicating an event context state of the mobile node and at least one trigger for reporting at least one event between the mobile node and the second access node following handoff of the mobile node to the second access node, said at least one event indicating a change in state or a transmission behavior of at least one of a physical layer, a data link layer, or a logical link layer used for communication between the mobile node and the second access node following handoff of the mobile node to the second access node.

2. The communication method of claim 1, wherein transferring the event context information to the second access node comprises transferring the event context information to the second access node in response to determining that the mobile node is associated with the second access node.

3. The communication method of claim 2, comprising determining that the mobile node is associated with or pending association with the second access node.

4. The communication method of claim 3, wherein determining that the mobile node is associated with or pending association with the second access node comprises accessing information indicative of a handoff of the mobile node from the first to the second access node.

5. The communication method of claim 3, wherein determining that the mobile node is associated with the second access node comprises determining that the mobile node is associated with the second access node based on a registration request message provided to the second access node by the mobile node.

6. The communication method of claim 5, comprising receiving the registration request message.

7. The communication method of claim 6, wherein receiving the registration request message comprises receiving a registration request message indicating that the second access node is the controlling access node for the mobile node.

8. The communication method of claim 1, wherein transferring the event context information comprises transferring the event context information from a media independent handover layer in the first access node to a media independent handover layer in the second access node.

9. The communication method of claim 1, wherein transferring the event context information comprises transferring event context information associated with the mobile node and the first access node, the event context information having been previously established for communication between the mobile node and the first access node to indicate said at least one trigger for reporting said at least one event between the mobile node and the first access node.

10. The communication method of claim 1, comprising forming at least one event report based on the transferred event context information.

11. The communication method of claim 1, comprising forming at least one event session identifier based on the transferred event context information.

12. The communication method of claim 1, comprising transmitting a deregistration message from the first access node to the mobile node indicating that the second access node will receive event reports.

13. The communication method of claim 1, comprising registering events indicated by the event context information with a media independent handoff function or layer in the mobile node.

14. The communication method being substantially as hereinbefore described with reference to any one of the embodiments as that embodiment is shown in the accompanying drawings.

DATED this twenty-fifth Day of January, 2011

Lucent Technologies Inc.

Patent Attorneys for the Applicant

SPRUSON & FERGUSON

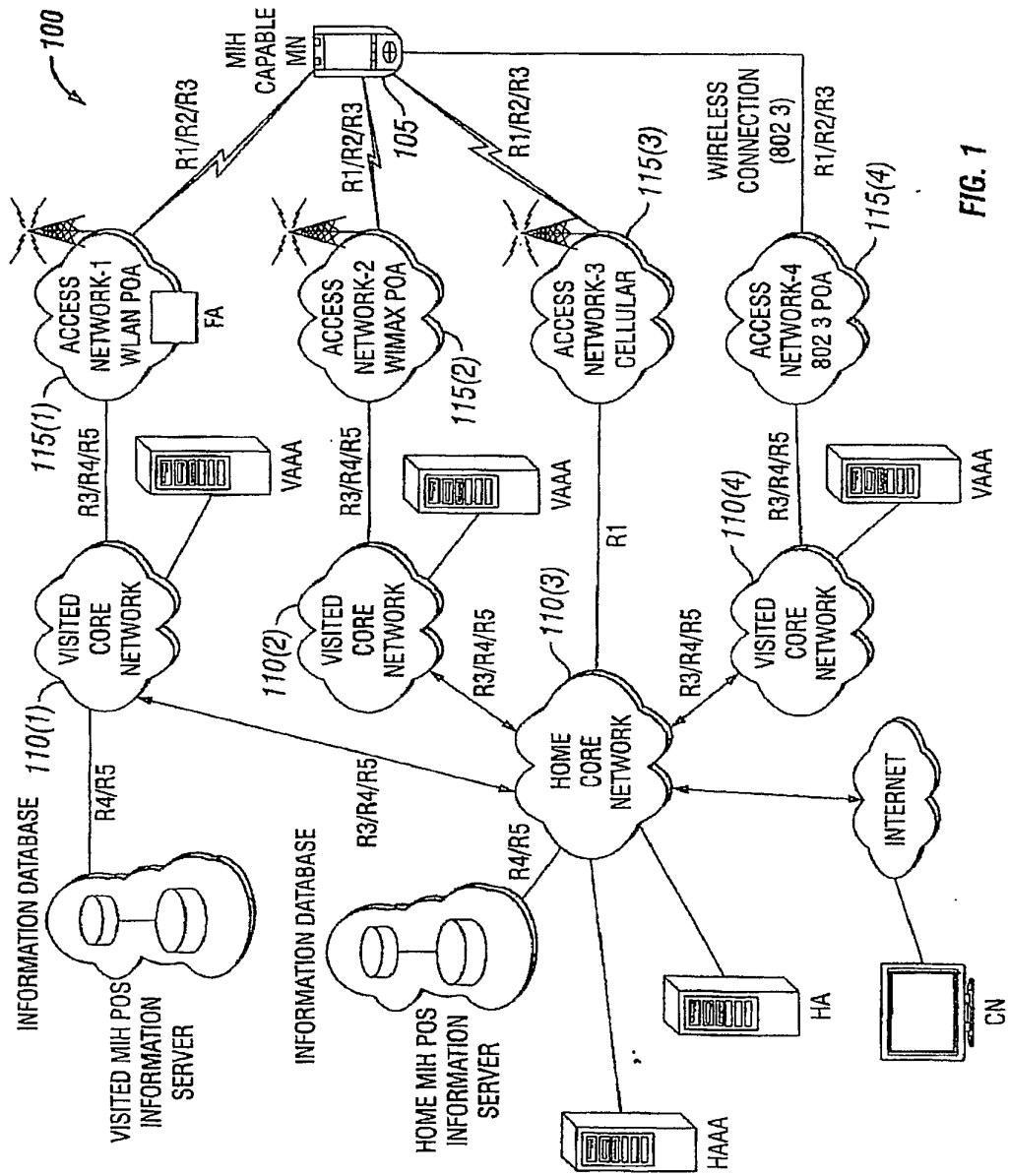


FIG. 1

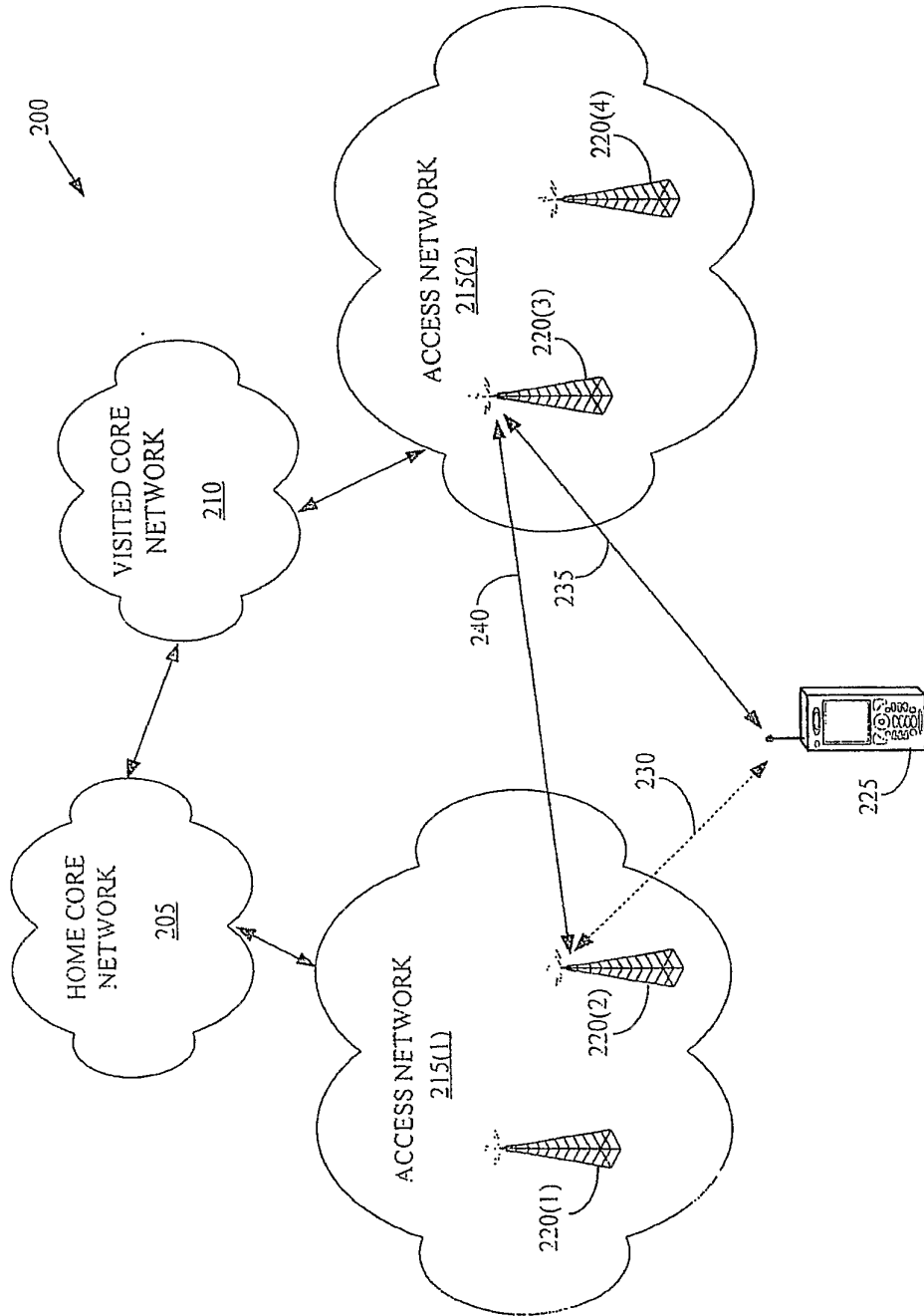


Figure 2

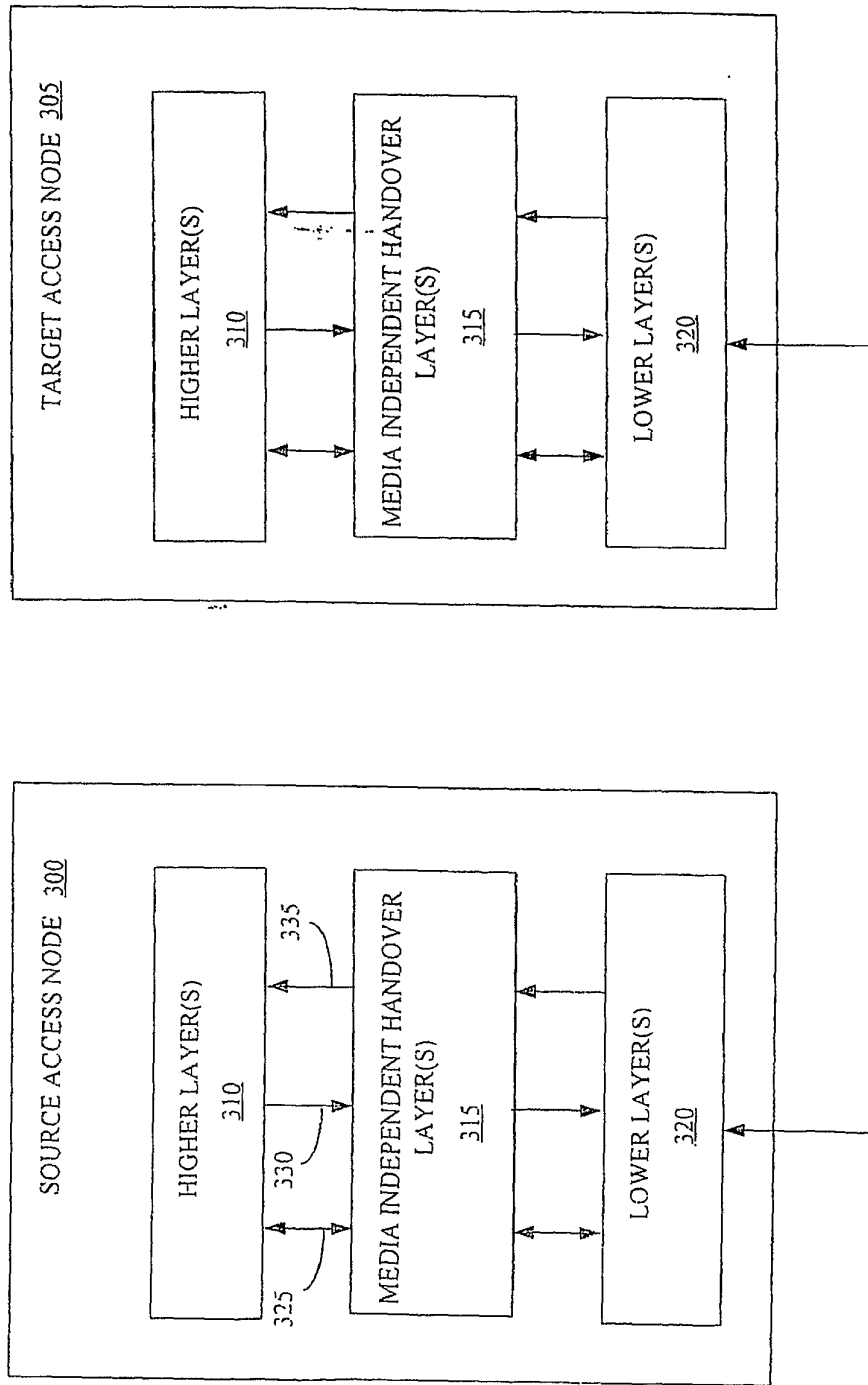


Figure 3

400 ↘

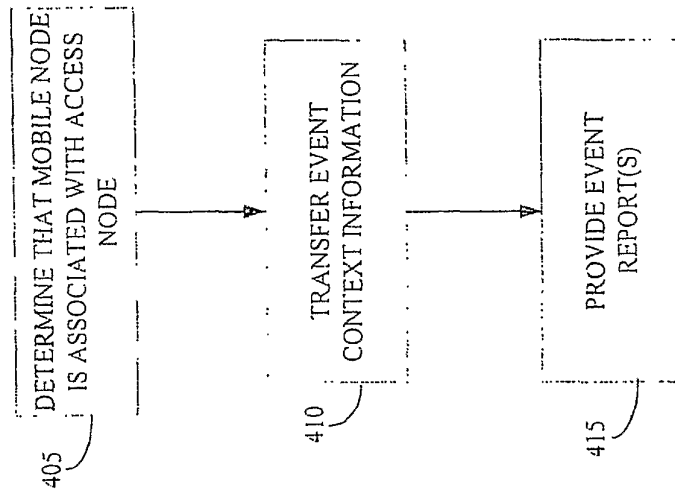


Figure 4