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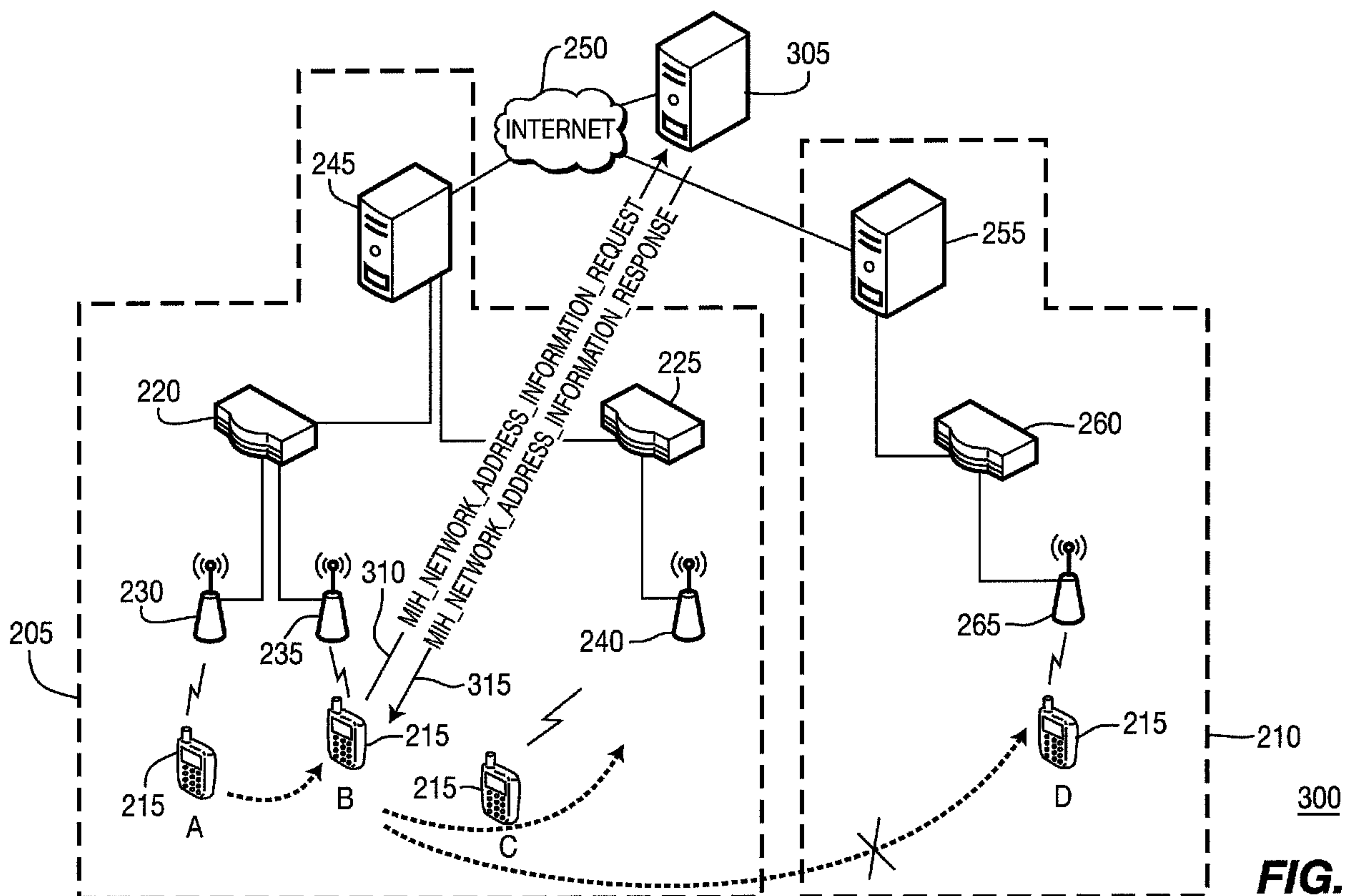
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(54) Titre : PROCEDE ET APPAREIL POUR IDENTIFIER DES CAPACITES DE PROTOCOLE DE RESEAU MOBILE

(54) Title: METHOD AND APPARATUS FOR IDENTIFYING MOBILE NETWORK PROTOCOL CAPABILITIES



(57) **Abrégé/Abstract:**

A method and apparatus for improving handover in an IEEE 802.21. compliant communication network. A query is transmitted from a wireless transmit/receive unit (WTRU) to a media independent handover (MIH) server (MIHS). The WTRU includes a target point of attachment (PoA) and/or a preferred mobile internet protocol (MIP) method. The WTRU receives a response from the MIHS indicating the MIP method supported by the target PoA. Based on the received response, the WTRU may make an informed decision regarding handover.

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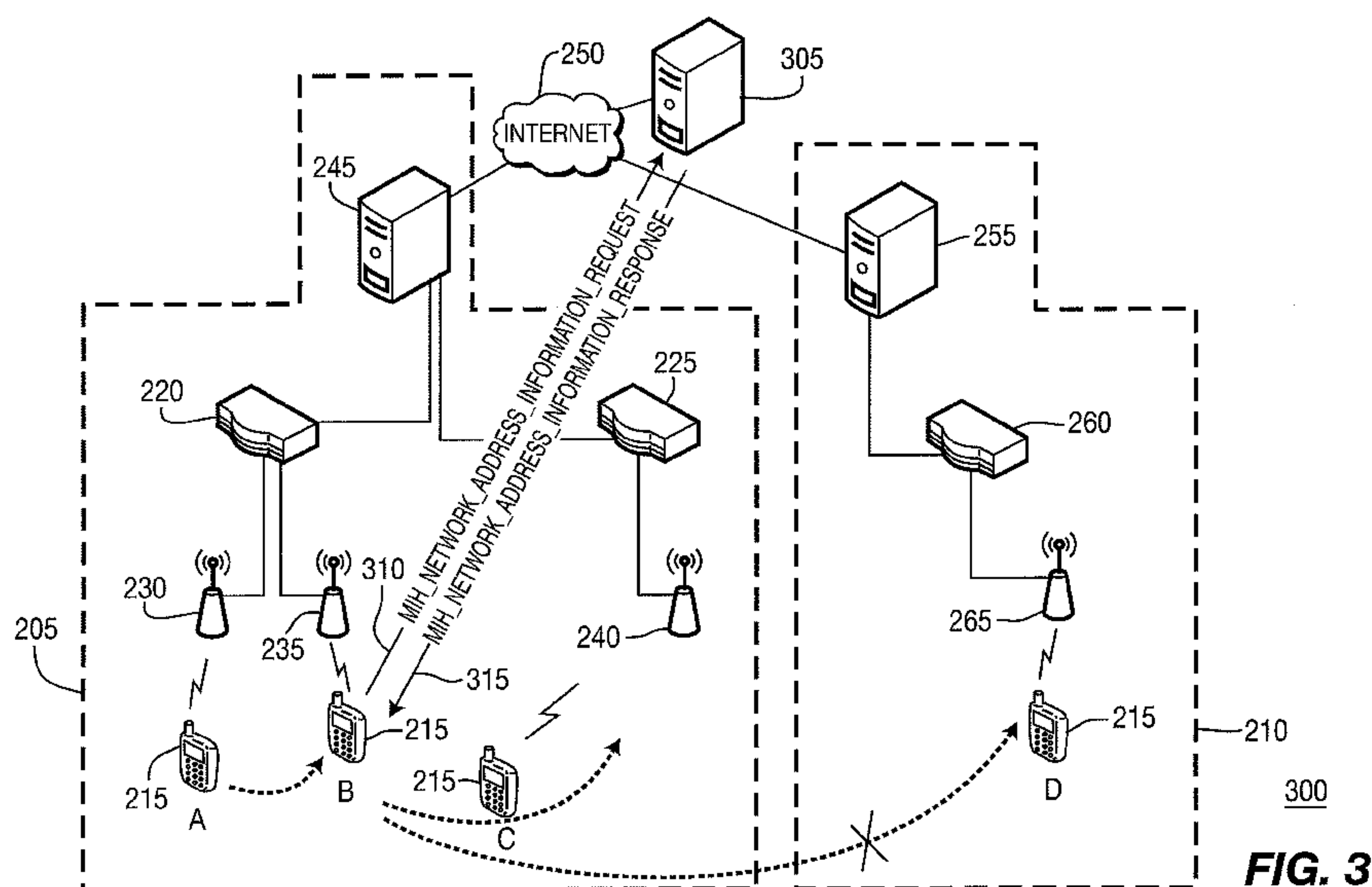


FIG. 3

(57) Abstract: A method and apparatus for improving handover in an IEEE 802.21. compliant communication network. A query is transmitted from a wireless transmit/receive unit (WTRU) to a media independent handover (MIH) server (MIHS). The WTRU includes a target point of attachment (PoA) and/or a preferred mobile internet protocol (MIP) method. The WTRU receives a response from the MIHS indicating the MIP method supported by the target PoA. Based on the received response, the WTRU may make an informed decision regarding handover.

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[0001] METHOD AND APPARATUS FOR IDENTIFYING
MOBILE NETWORK PROTOCOL CAPABILITIES

[0002] TECHNOLOGY FIELD

[0003] This subject matter disclosed herein is generally related to wireless communication systems.

[0004] BACKGROUND

[0005] The IEEE 802.21 standard defines mechanisms and procedures that aid in the execution and management of inter-system handovers. IEEE 802.21 defines three main services available to Mobility Management applications, such as Client Mobile Internet Protocol (Client MIP) or Proxy MIP. Referring to Figure 1, these services are the Event Service 100, the Information Service 105 and the Command Service 110. These services aid in the management of handover operations, system discovery and system selection by providing information and triggers from lower layers 115 to upper layers 120 via a media independent handover (MIH) function 125.

[0006] Within the context of the command service 110, functionality is defined for querying an MIH compatible node to determine the node's Internet Protocol (IP) capabilities. This is accomplished via the MIH_Network_Address_Information Request message sent from a wireless transmit/receive unit (WTRU) and the MIH_Network_Address_Information Response message sent from the MIH compatible node.

[0007] Certain systems, such as the Third Generation Partnership Project Long Term Evolution (3GPP LTE) system, utilize a hybrid mobility schema where both client MIP and proxy MIP are used. Proxy MIP is preferred because of its well known advantages such as elimination of over-the-air (OTA) tunnelling overhead, greater flexibility, and reduced latency. However, in a roaming scenario it is highly likely that a WTRU will encounter networks that do not support proxy MIP. In this scenario, client MIP is used.

[0008] Under the current IEEE 802.21 standard, a WTRU is unable to determine whether an accessible network provides support for localized mobility procedures (such as proxy MIP) or only conventional mobility procedures (such as client MIP). This information is an important criterion in network selection. Selection of a network with undesirable mobility management procedures will result in sub-optimal mobility scenarios. Furthermore, if a WTRU is able to determine the MIP characteristics of a network, the WTRU may trigger IEEE 802.21 procedures to improve mobility handling.

[0009] SUMMARY

[0010] A method and apparatus for improving handover in IEEE 802.21 compliant communications. A query is transmitted from a WTRU to a MIH server (MIHS). The WTRU includes a target point of attachment (PoA) and/or a preferred MIP method. The WTRU receives a response from the MIHS indicating the MIP method supported by the target PoA. Based on the received response, the WTRU may make an informed decision regarding handover.

[0011] BRIEF DESCRIPTION OF THE DRAWINGS

[0012] A more detailed understanding of the invention may be had from the following description, given by way of example and to be understood in conjunction with the accompanying drawings wherein:

[0013] Figure 1 is a block diagram of MIH services;

[0014] Figure 2 shows a wireless communication system in which a WTRU is unable to obtain mobility management information regarding diverse networks located therein;

[0015] Figure 3 shows an enhanced network of Figure 2, in which a WTRU may query a MIH server and receive mobility management information regarding diverse networks located therein;

[0016] Figure 4 is a diagram of a
MIH_Network_Address_Information_Request message disclosed herein;

[0017] Figure 5 is a diagram of a
MIH_Network_Address_Information_Response message disclosed herein; and

[0018] Figure 6 is a block diagram of a WTRU and an access point
configured to transmit and receive the messages of Figure 4 and Figure 5.

[0019] DETAILED DESCRIPTION

[0020] When referred to herein, the terminology "wireless transmit/receive unit (WTRU)" includes but is not limited to a user equipment (UE), a mobile node, mobile station (STA), 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 "access point" includes but is not limited to a Node-B, a site controller, a base station (BS), or any other type of interfacing device capable of operating in a wireless environment.

[0021] A solution to the aforementioned problem is to provide a WTRU with information regarding the MIP capabilities of a network. The network is preferably a prospective network to which the WTRU is considering a handover to. In one embodiment, a request message includes an identifier of a network that is the target network for handover. An associated response message includes MIP capabilities of the identified network.

[0022] Figure 2 is a communication system 200 including two distinct networks 205 and 210 where mobility management information is not available to WTRU 215. Network 205 includes multiple network routers (220, 225) and three access points 230, 235, and 240. A server 245 of the first network 205 communicates with the network routers 220, 225 and servers of other networks via the Internet 250, for example. The second network 210 also includes a server 255, a network router 260, and an access point 265. It is noted that the first network 205 and second network 210 may be of the same or different type.

[0023] In the communication system 200, localized mobility management protocols, such as proxy MIP, are supported only in the first network 205. When WTRU 215 is communicating with access points 230, 235, and 240 (locations A,

B, and C, respectively), localized mobility management is available for inter-access point handovers. However, second network 210 does not support localized mobility management protocols and instead supports only client MIP. When WTRU 215 is in communication with the second network 210 (position D) via access point 265, WTRU 215 will perform client MIP procedures, including Client originated MIP Binding Update procedures. This client MIP procedure may potentially delay handover of the WTRU 215 to access point 265 in the second network 210.

[0024] Referring to Figure 3, a wireless communication system 300 includes all of the elements identified above with respect to Figure 2 as well as an MIH server (MIHS) 305 accessible via the Internet 250. The MIHS 305 controls various aspects of MIH and coordinates services between WTRUs and various networks. When WTRU 215 is associated with access point 240, the WTRU 215 may query the MIHS 305 to determine the capabilities of surrounding networks. This may be achieved via the MIH_Network_Address_Information_Request message 310, sent from the WTRU 215 to the MIHS 305. The prospective point of attachment (PoA) in the prospective network (second network 210) may be identified in the message 310, in this scenario access point 265. In response, the MIHS 305 provides information regarding the characteristics of the prospective network (second network 210), such as whether proxy MIP is supported. The MIHS 305 responds to the MIH_Network_Address_Information_Request message 310 by sending a MIH_Network_Address_Information_Response message 315 including the requested information.

[0025] Alternatively, the MIH_Network_Address_Information_Request message 310 may simply indicate the MIP preferences of the WTRU 215. In this scenario, the MIHS 305 will identify networks that are capable of supporting the WTRU's 215 MIP preference. Based on the information received from the MIHS 305 in the MIH_Network_Address_Information_Response message 315, the WTRU 215 may choose access point 240 or access point 265, depending on supported MIP services and preference.

[0026] Referring to Figure 4, the MIH_Network_Address_Information Request message 400 includes a Source ID field 405, a Destination ID field 410, a Current Link ID field 415, a New PoA Identifier field 420, a Target PoA Identifier List field 425, a Current IP Configuration Method field 430, a Current dynamic host control protocol (DHCP) Server Address field 435, a Current Foreign Agent (FA) Address field 440, a Current Access Router Address field 445, and a Requested MIP Mobility Method field 450.

[0027] The Source ID field 405 indicates the originator of the message. The Destination ID field 410 indicates a remote MIH function that will be the destination of the request. The Current Link ID field 415 indicates the source link for handover. The New PoA Identifier field 420 indicates a new point of attachment identity. The Target PoA Identifier List field 425 includes a listing of potential points of attachment that the WTRU is considering for handover. Optionally, the list of potential points of attachment is sorted by preference, with most preferred points of attachment listed ahead of least preferred. The Current IP Configuration Method field 430 indicates current IP configuration methods. In one embodiment, this field is an optional field. The current DHCP Server Address field 435 indicates the IP address of a current DHCP Server. In one embodiment, this field is only included when the WTRU is using a dynamic address configuration. In another embodiment, this field is optional. The Current Foreign Agent (FA) Address field 440 indicates the IP address of a current FA. In one embodiment, this field is only included when the WTRU is using MIPv4. The Current Access Router Address field 445 indicates the IP address of a current access router. In one embodiment, this field is only included when the WTRU is using IPv6. In another embodiment, this field is optional. The Requested MIP Mobility Method field 450 identifies a WTRU preferred MIP mobility method. The MIH_Network_Address_Information Request message 400 may include all of the above described fields, or any sub-set of these fields, in any combination.

[0028] In one embodiment, the Requested MIP Mobility Method field 450 includes a Proxy Mobile IPv6 indicator at bit 14. Table 1 below illustrates one embodiment of the Requested MIP Mobility Method field 450.

Requested MIP Mobility Method	Bit map	Bits 0-31	Bit 0: IPv4 static Bit 1: IPv4 dynamic Bit 2: Mobile IPv4 with FA (FA- CoA) Bit 3: Mobile IPv4 without FA (Co-located CoA) Bits 4-10: Reserved for IPv4 address configuration Bit 11: IPv6 stateless address configuration Bit 12: IPv6 stateful address configuration Bit 13: IPv6 manual configuration Bit 14: Proxy Mobile IPv6
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Table 1

[0029] Referring to Figure 5, the MIH_Network_Address_Information Response message 500 includes a Source ID field 505, a Destination ID field 510, a Current Link ID field 515, a New PoA Identifier field 520, an IP Configuration Method field 525, a DHCP Server Address field 530, an Access Router Address field 535, and a Result Code field 540.

[0030] The Source ID field 505 indicates the originator of the message. The Destination ID field 510 indicates a MIH function that will be the destination of the message (i.e., the WTRU MIH). The Current Link ID field 515 indicates the source link for handover. The New PoA Identifier field 520 indicates the point of attachment of a new access network to which handover initiation is considered. The IP Configuration Method field 525 indicates the IP configuration method of the point of attachment identified in the PoA Identifier field 510. The DHCP Server Address field 530 indicates the DHCP server IP address of the point of attachment identified in the PoA Identifier field 510. The Access Router Address field 535 indicates the IP address of the access router associated with the point of attachment identified in the PoA Identifier field 510.

The Result Code field 540 indicates a result code associated with the message. The MIH_Network_Address_Information Response message 500 may include all of the above described fields, or any sub-set of these fields, in any combination.

[0031] In one embodiment, the IP Configuration Method field 525 includes a Proxy Mobile IPv6 indicator at bit 14. Table 2 below illustrates one embodiment of the IP Configuration Method field 525.

IP Configuration Method	Bit map	Bits 0-31	Bit 0: IPv4 static Bit 1: IPv4 dynamic Bit 2: Mobile IPv4 with FA (FA-CoA) Bit 3: Mobile IPv4 without FA (Co-located CoA) Bits 4-10: Reserved for IPv4 address configuration Bit 11: IPv6 stateless address configuration Bit 12: IPv6 stateful address configuration Bit 13: IPv6 manual configuration Bit 14: Proxy Mobile IPv6
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Table 2

[0032] Proxy MIP is currently defined as Network-based Localized Mobility Management (NETLMM) support for internet protocol version 6 (IPv6) capable networks. However, the evolution of NETLMM will likely lead to support of legacy internet protocol version 4 (IPv4) networks. In another embodiment, support of IPv4 proxy MIP may be indicated in the messages described above. This would similarly allow a WTRU to select the best handover target during network selection. Additional reserved bits could be used to request and advertise IPv4 functionality.

[0033] Figure 6 is a WTRU 600 and access point 605 configured to transmit and receive MIH_Network_Address_Information Request and MIH_Network_Address_Information Response messages, as described above. WTRU 600 includes a processor 610, an MIH function 615, and a plurality of transceivers 620a...620n. The processor 610 and MIH function 615 are

configured to generate and process a MIH_Network_Address_Information Request message as described above. The plurality of transceivers 620a...620n are configured to communicate in a plurality of different types of wireless communication systems using various radio access technologies, and to transmit a MIH_Network_Address_Information Request message as described above.

[0034] Access point 605 includes a processor 625, an MIH function 630, and a transceiver 635. The access point 605 communicates with WTRU 600 via air interface 640. The processor 625 of the access point 605 processes received MIH_Network_Address_Information Request message from WTRU 600 via air interface 640 and transceiver 635. The processor 625, in combination with the MIH function 630, of access point 605 forwards received MIH_Network_Address_Information Request message to MIHS 645 and receives MIH_Network_Address_Information Response messages from the MIHS 645. Received MIH_Network_Address_Information_Response messages are forwarded to the WTRU 600 via air interface 640.

[0035] Although the features and elements of the present invention are described in the embodiments in particular combinations, each feature or element can be used alone without the other features and elements of the embodiments or in various combinations with or without other features and elements of the present invention. The methods or flow charts provided in the present invention may be implemented in a computer program, software, or firmware tangibly embodied in a computer-readable storage medium for execution by a general purpose computer or a processor. Examples of computer-readable storage mediums include a read only memory (ROM), a random access memory (RAM), a register, cache memory, semiconductor memory devices, magnetic media such as internal hard disks and removable disks, magneto-optical media, and optical media such as CD-ROM disks, and digital versatile disks (DVDs).

[0036] 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.

[0037] 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) module.

[0038] Embodiments.

1. A method for providing enhanced connection between a wireless transmit/receive unit (WTRU) and an information network.
2. The method of embodiment 1 wherein the method comprises:
transmitting a query from the WTRU to a server.
3. A method of any one of the preceding embodiments, wherein the method comprises:
receiving at the WTRU a response to the query from the server; the response indicating at least one available network and capability of the available network to the WTRU.
4. A method of any one of the preceding embodiments, wherein the method comprises:
establishing a communication link between the WTRU and the available network if the capability satisfies a predetermined mobility requirement.
5. A method of any one of the preceding embodiments, wherein the method comprises:

if no available network capability satisfies the requirement, establishing a link between the WTRU and a network and applying a procedure to at least partially satisfy the requirement.

6. A method of any one of the preceding embodiments, wherein the requirement is reduction of a handover time to a minimum.

7. A method of any one of the preceding embodiments, wherein the method comprises:

WTRU providing a target point of attachment (PoA).

8. A method of any one of the preceding embodiments, wherein the method comprises:

the WTRU specifying a mobile protocol configuration method.

9. A method of any one of the preceding embodiments, wherein the method comprises:

WTRU choosing an access point based on information retrieved by the WTRU from the server.

10. A method of any one of the preceding embodiments, wherein the capabilities of the network are capabilities with regard to a protocol for information exchange.

11. A method of any one of the preceding embodiments, wherein the protocol is Internet Protocol (IP).

12. A method of any one of the preceding embodiments, wherein the Internet Protocol is Client Mobile IP (Client MIP).

13. A method of any one of the preceding embodiments, wherein the method comprises: the Internet Protocol is Proxy Mobile IP (Proxy MIP).

14. A method of any one of the preceding embodiments, wherein the method is carried out within the context of the IEEE 802.21 standard.

15. A method of any one of the preceding embodiments, wherein the MIH_Network_Address_Information Request message of the IEEE 802.21 standard is enhanced by adding a list of target access point identifiers.

16. A method of any one of the preceding embodiments, wherein the MIH_Network_Address_Information Request message of the IEEE 802.21 standard is enhanced by adding a requested MIP mobility method.

17. A method of any one of the preceding embodiments, wherein the MIH_Network_Address_information Response message of the IEEE 802.21 standard is enhanced by adding an IP configuration method.

18. A method of any one of the preceding embodiments, wherein the requested MIP mobility method is defined by the table:

Requested MIP Mobility Method	Bit map	0-31	Bit 0: IPv4 static Bit 1: IPv4 dynamic Bit 2: Mobile IPv4 with FA (FA-CoA) Bit 3: Mobile IPv4 without FA (Co- located CoA) Bit 4-B10: Reserver for IPv4 address configuration Bit 11: IPv6 stateless address configuration Bit 12: IPv6 stateful address configuration Bit 13: IPv6 manual configuration Bit 14: Proxy Mobile IPv6
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wherein IPv4 and IPv6 are Internet Protocol version 4 and version 6, respectively.

18. A method of any one of the preceding embodiments, wherein the IP configuration method is defined by the table:

IP Configuration Method	Bit map	0-31	Bit 0: IPv4 static Bit 1: IPv4 dynamic Bit 2: Mobile IPv4 with FA (FA-CoA) Bit 3: Mobile IPv4 without FA (Co-located CoA) Bit 4-B10: Reserver for IPv4 address configuration Bit 11: IPv6 stateless address configuration Bit 12: IPv6 stateful address configuration Bit 13: IPv6 manual configuration Bit 14: Proxy Mobile IPv6
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wherein IPv4 and IPv6 are Internet Protocol version 4 and version 6, respectively.

19. A method of any one of the preceding embodiments, wherein the method comprises: using additional reserved bits for advertising support of NETLMM IPv4.

20. A method of any one of the preceding embodiments, wherein the method comprises: using additional reserved bits for advertising support of DS-MIP6.

21. A wireless transmit receive unit for performing the method of any one of the preceding embodiments.

22. A media independent handover function for performing at least part of the method of any one of the preceding embodiments.

23. An access router for performing at least part of the method of any one of the preceding embodiments.

24. A wireless communication system configure to perform at least part of the method of any one of the preceding embodiments.

CLAIMS:

1. A wireless transmit/receive unit (WTRU) for obtaining mobile internet protocol (MIP) information regarding a target point of attachment, the WTRU comprising:

a processor configured to generate a query including an identification of the target point of attachment and an identification of a preferred MIP method of the WTRU;

a transmitter configured to transmit the query to a media independent handover (MIH) server; and

a receiver configured to receive a response from the MIH server, the response including an identification of the target point of attachment and an identification of a MIP configuration method of the target point of attachment.

2. The WTRU of claim 1, wherein the processor is further configured to determine whether to handoff to the target point of attachment based on the MIP configuration method of the target point of attachment.

3. The WTRU of claim 1, wherein the preferred MIP method of the WTRU is client MIP or proxy MIP.

4. The WTRU of claim 1, wherein the identification of the preferred MIP method of the WTRU is included in a Requested MIP Mobility Method field in the query.

5. The WTRU of claim 1, wherein the identification of the MIP configuration method of the target point of attachment is included in an IP Configuration Method field in the response.

6. A method for use in a wireless transmit/receive unit (WTRU) for obtaining mobile internet protocol (MIP) information regarding a target point of attachment, the method comprising:

transmitting a query to a media independent handover (MIH) server, the query including an identification of the target point of attachment and an identification of a preferred MIP method of the WTRU;

receiving a response from the MIH server, the response including an identification of the target point of attachment and an identification of a MIP configuration method of the target point of attachment.

7. The method of claim 6, further comprising:

determining whether to handoff to the target point of attachment based on the MIP configuration method of the target point of attachment

8. The method of claim 6, wherein the preferred MIP method of the WTRU is client MIP or proxy MIP.

9. The method of claim 6, wherein the identification of the preferred MIP method of the WTRU is included in a Requested MIP Mobility Method field in the query.

10. The method of claim 6, wherein the identification of the MIP configuration method of the target point of attachment is included in an IP Configuration Method field in the response.

11. An access point (AP) for providing mobile internet protocol (MIP) information regarding a target point of attachment, the AP comprising:

a receiver configured to receive a query from a wireless transmit/receive unit (WTRU), the query including an identification of the target point of attachment and an identification of a preferred MIP method of the WTRU;

a processor configured to forward the query to a media independent handover (MIH) server and to receive a response to the query from the MIH server; and

a transmitter configured to transmit the response to the WTRU, the response including an identification of the target point of attachment and MIP configuration method of the target point of attachment.

12. The AP of claim 11, wherein the preferred MIP method of the WTRU is client MIP or proxy MIP.

13. The AP of claim 12, wherein the preferred MIP method of the WTRU is Proxy Mobile IPv4 or Proxy Mobile IPv6.

14. The AP of claim 11, wherein the identification of the preferred MIP method of the WTRU is included in a Requested MIP Mobility Method field in the query.

15. The AP of claim 11, wherein the identification of the MIP configuration method of the target point of attachment is included in an IP Configuration Method field in the response.

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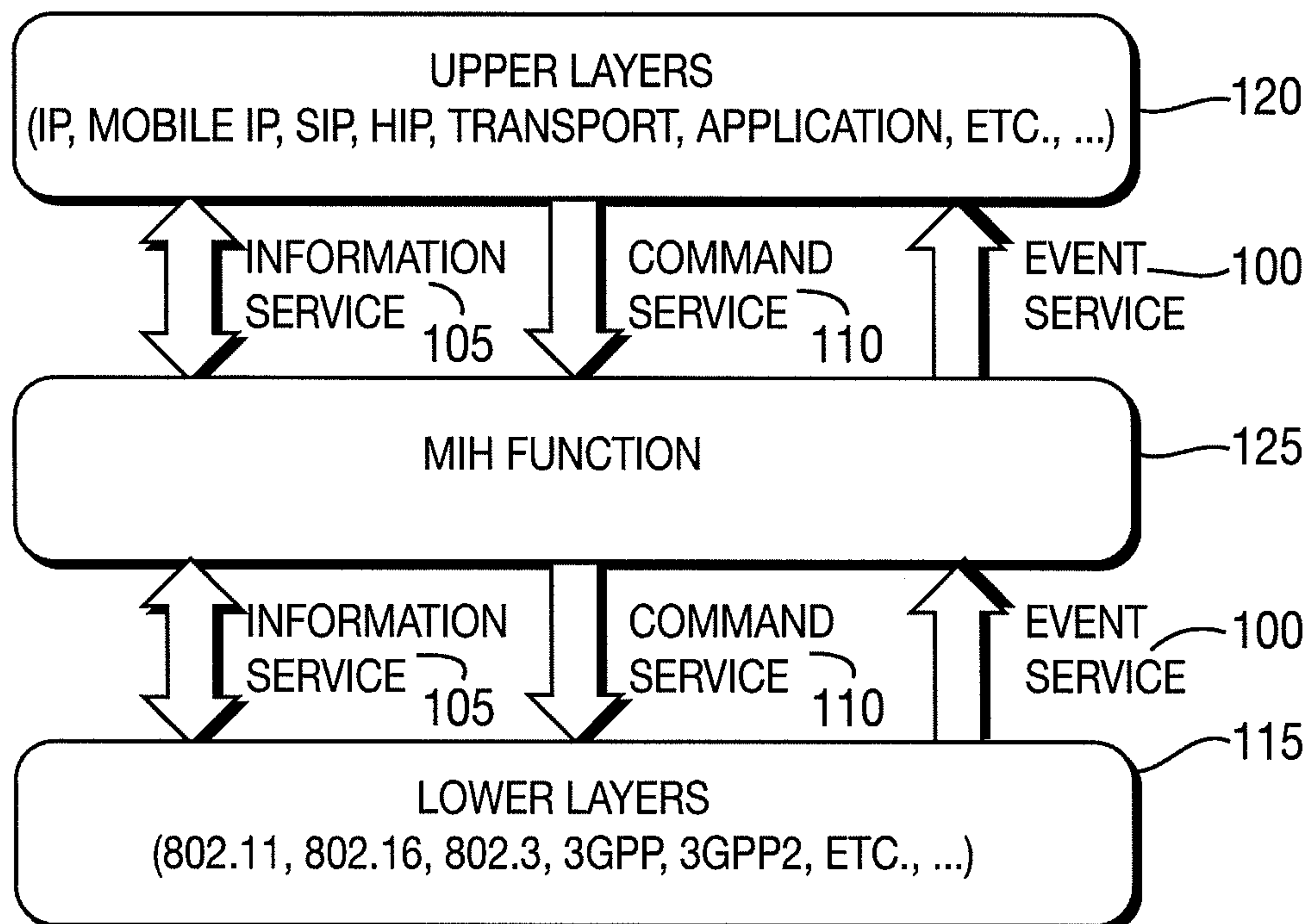


FIG. 1
PRIOR ART

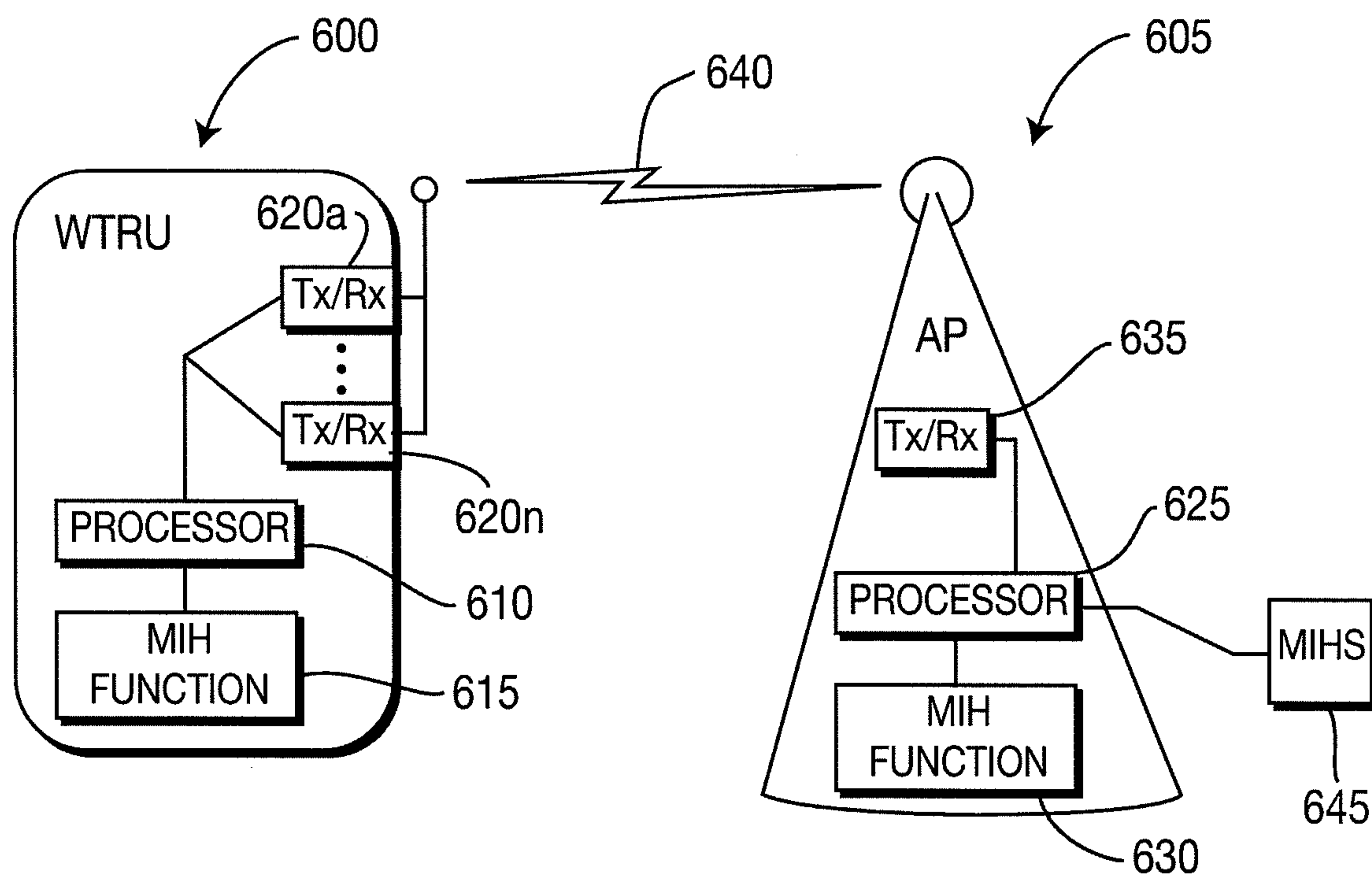


FIG. 6

2/4

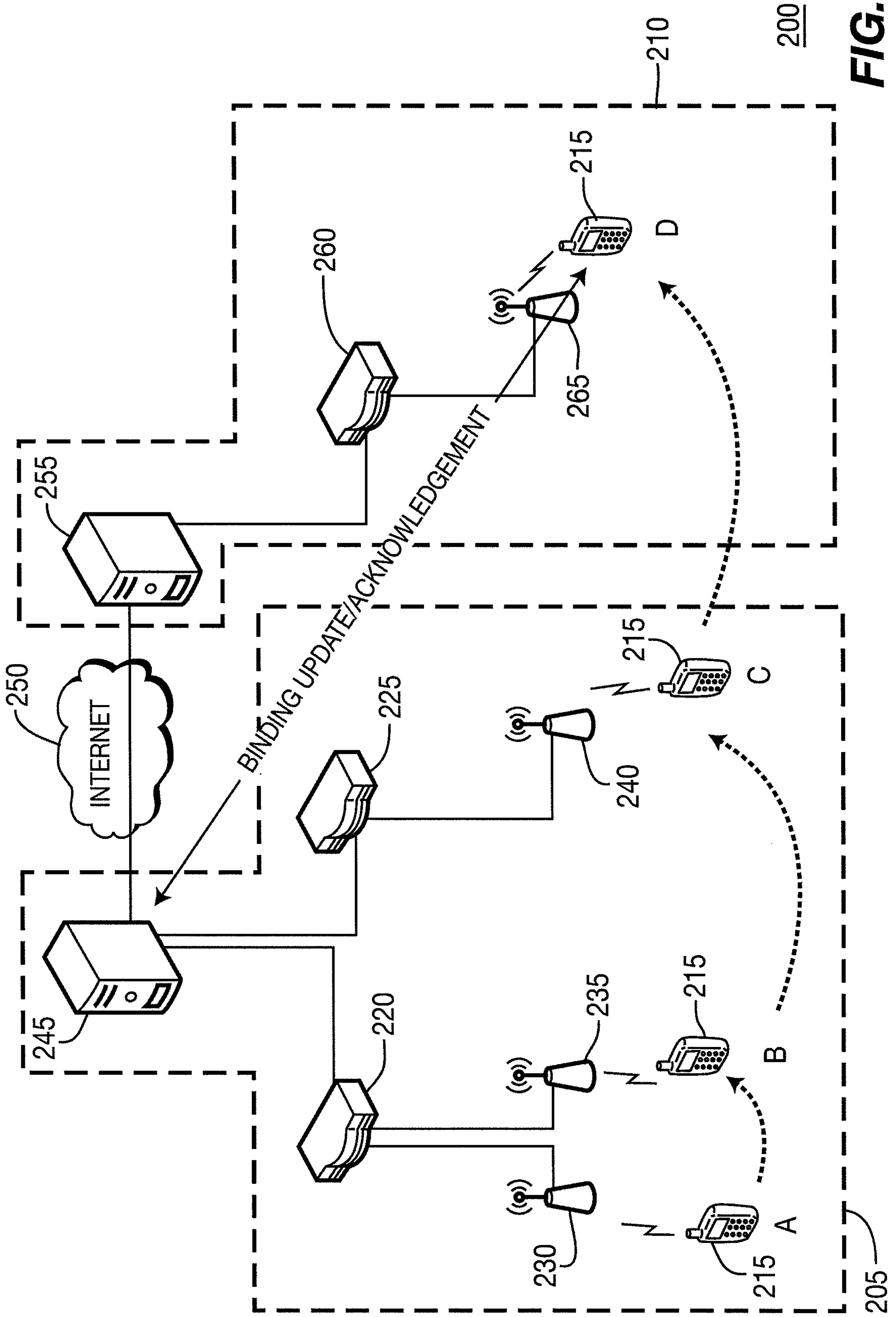


FIG. 2

3/4

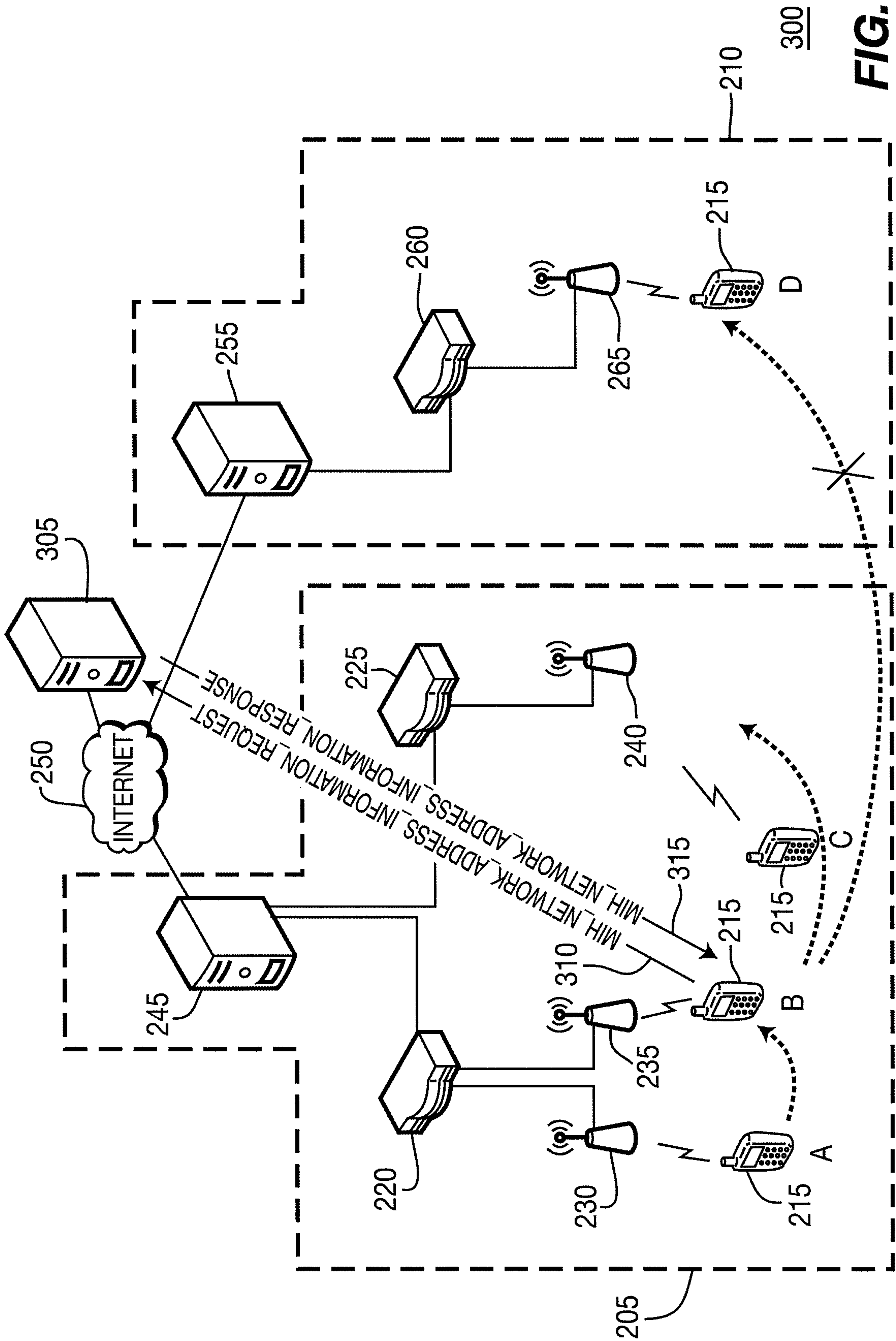
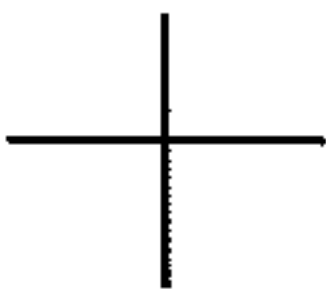


FIG. 3



405	410	415	420	425	430	435	440	445	450
SOURCE ID	DESTINATION ID	CURRENT LINK ID	NEW PoA IDENTIFIER	TARGET PoA IDENTIFIER LIST	CURRENT IP CONFIGURATION METHOD	CURRENT DHCP SERVER ADDRESS	CURRENT FA ADDRESS	CURRENT ACCESS ROUTER ADDRESS	REQUESTED MIP MOBILITY METHOD

400
FIG. 4

505	510	515	520	525	530	535	540
SOURCE ID	DESTINATION ID	CURRENT LINK ID	NEW PoA IDENTIFIER	IP CONFIGURATION METHOD	DHCP SERVER ADDRESS	ACCESS ROUTER ADDRESS	RESULT CODE

500
FIG. 5



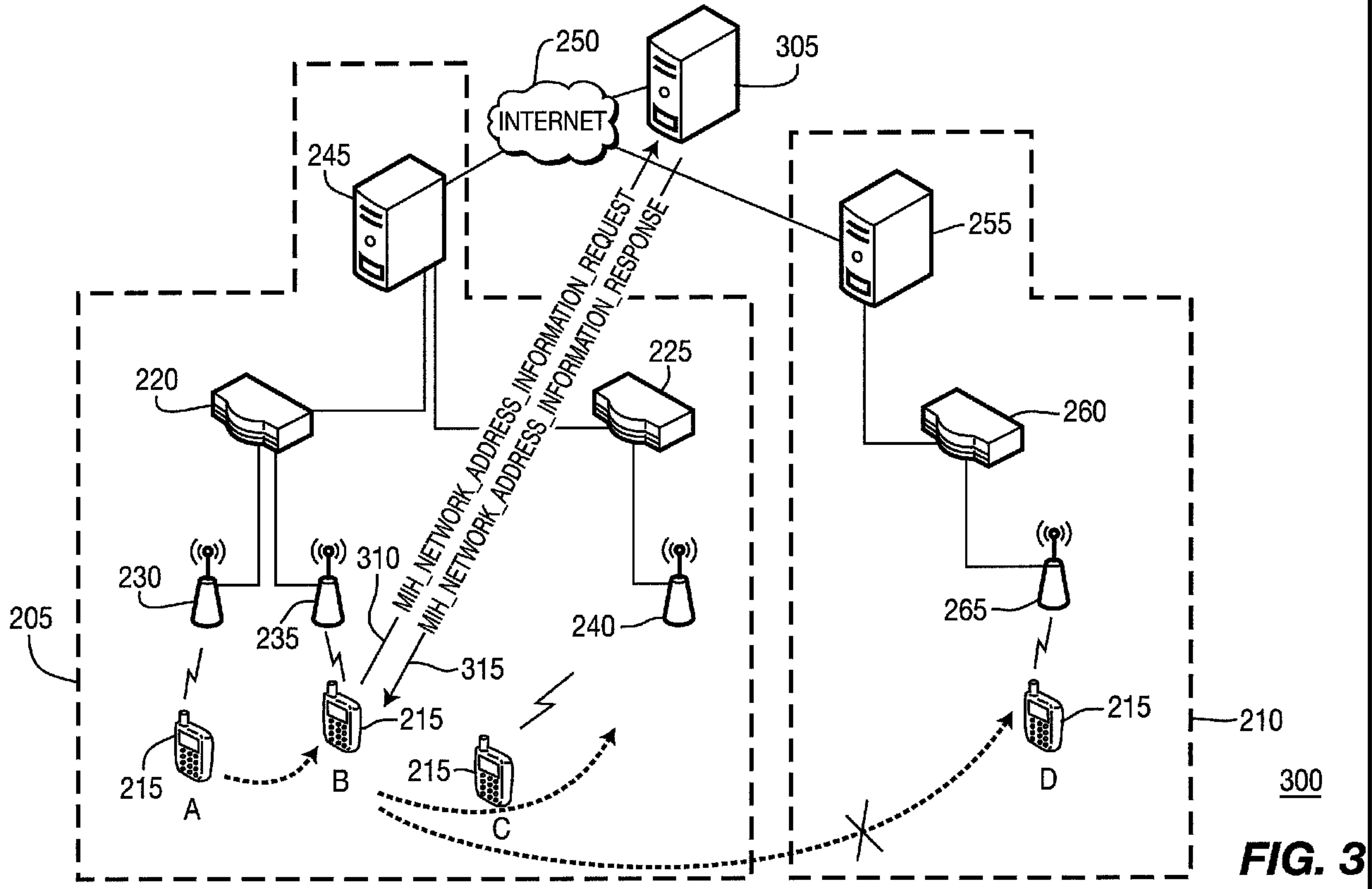


FIG. 3