US 20060109818A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2006/0109818 A1

Ramanna et al. (43) Pub. Date: May 25, 2006

(54) METHOD AND SYSTEM FOR INTER-TECHNOLOGY ACTIVE HANDOFF OF A HYBRID COMMUNICATION DEVICE

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(21) Appl. No.: **11/272,934**

(22) Filed: **Nov. 14, 2005**

**Related U.S. Application Data**

(60) Provisional application No. 60/629,929, filed on Nov. 22, 2004.

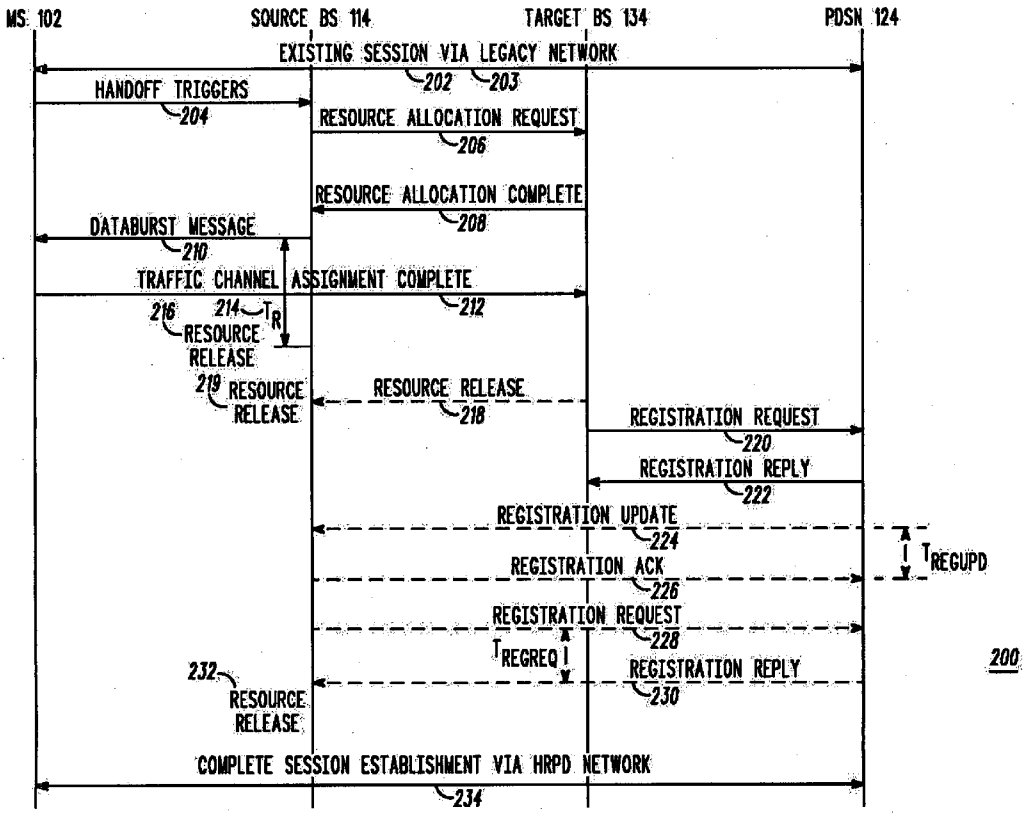
**Publication Classification**

(51) **Int. Cl.**
*H04Q 7/00* (2006.01)
*H04L 12/66* (2006.01)

(52) **U.S. Cl.** ..... **370/331**; 455/436; 370/352

(57) **ABSTRACT**

A communication system provides for a handoff of a hybrid mobile station (MS) between a legacy network implementing a non-high rate packet data (non-HRPD) communication technology and a network implementing a high rate packet data (HRPD) communication technology. In one embodiment, the legacy network receives a handoff trigger and redirects the MS to the HRPD network. In other embodiments, the legacy network (or HRPD network) receives a handoff trigger, obtains an allocation of HRPD network (or non-HRPD network) resources from the HRPD network (or non-HRPD network), and informs the MS of the allocated HRPD network (or non-HRPD network) resources. Subsequent to the establishment by the HRPD network (or non-HRPD network) of a traffic channel with the MS, the non-HRPD network (or HRPD network) releases non-HRPD network (or HRPD network) RF resources associated with the MS. In still other embodiments, the handoffs may be controlled by a Mobile Switching Center.



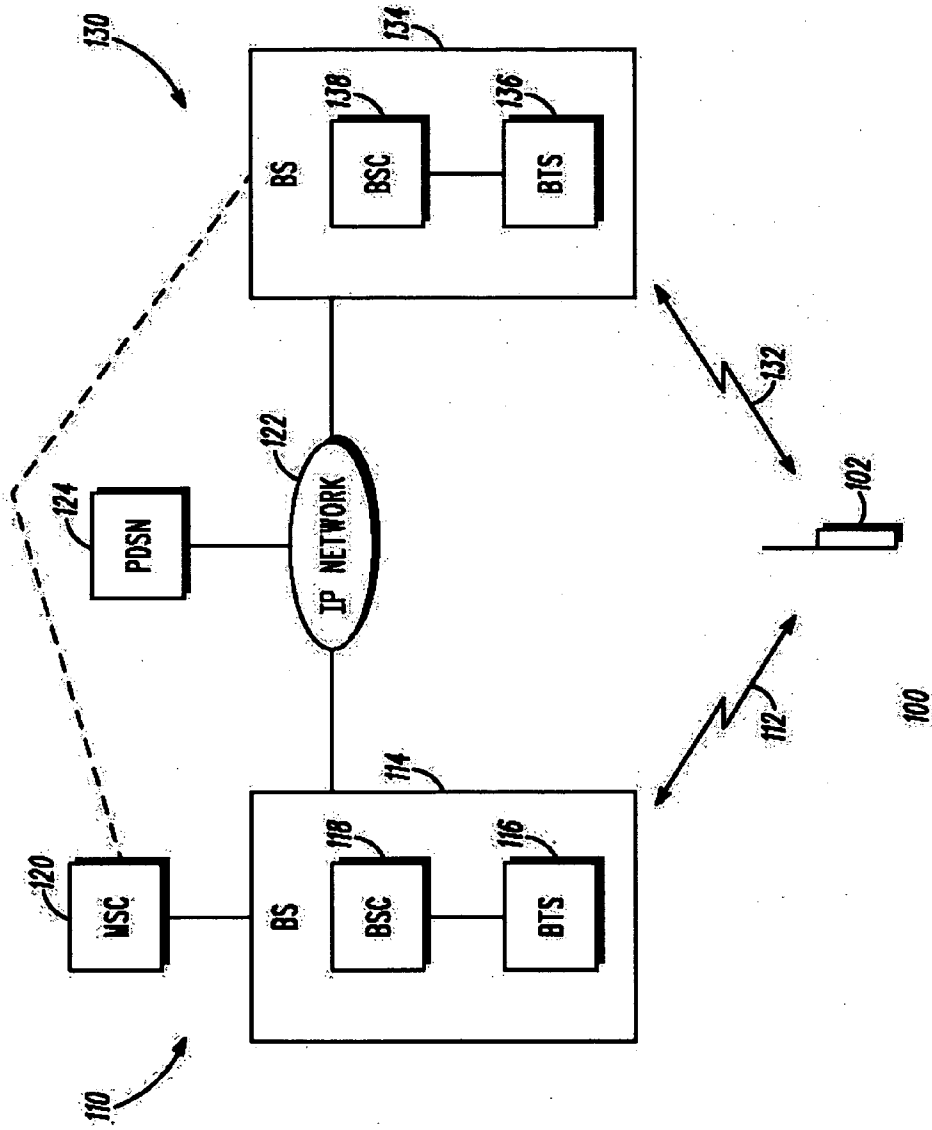

130
134
BS
138
BSC
136
BTS
132
122
IP NETWORK
124
PDSN
102
112
100
114
BS
118
BSC
116
BTS
120
MSC
110

FIG. 1

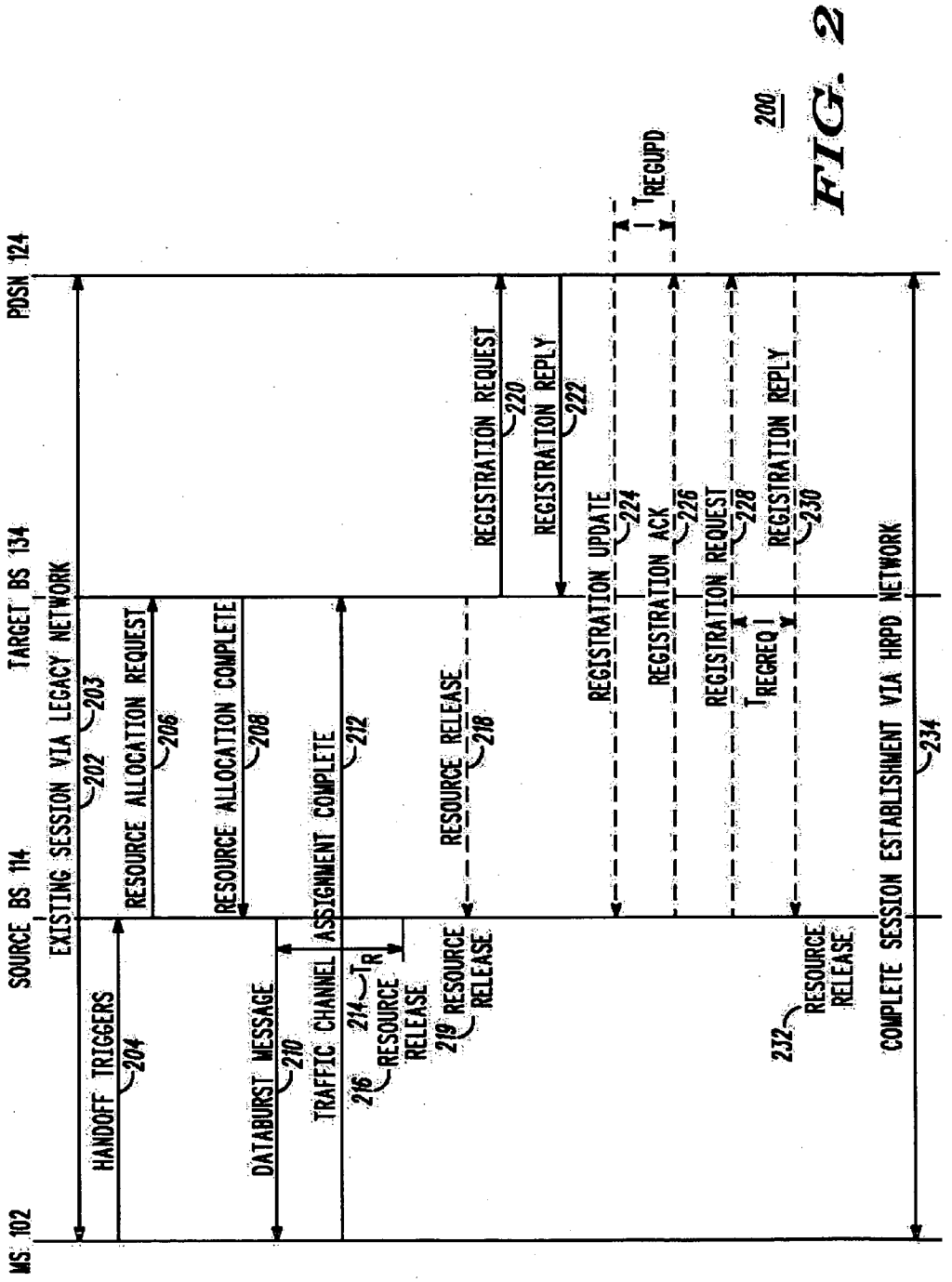
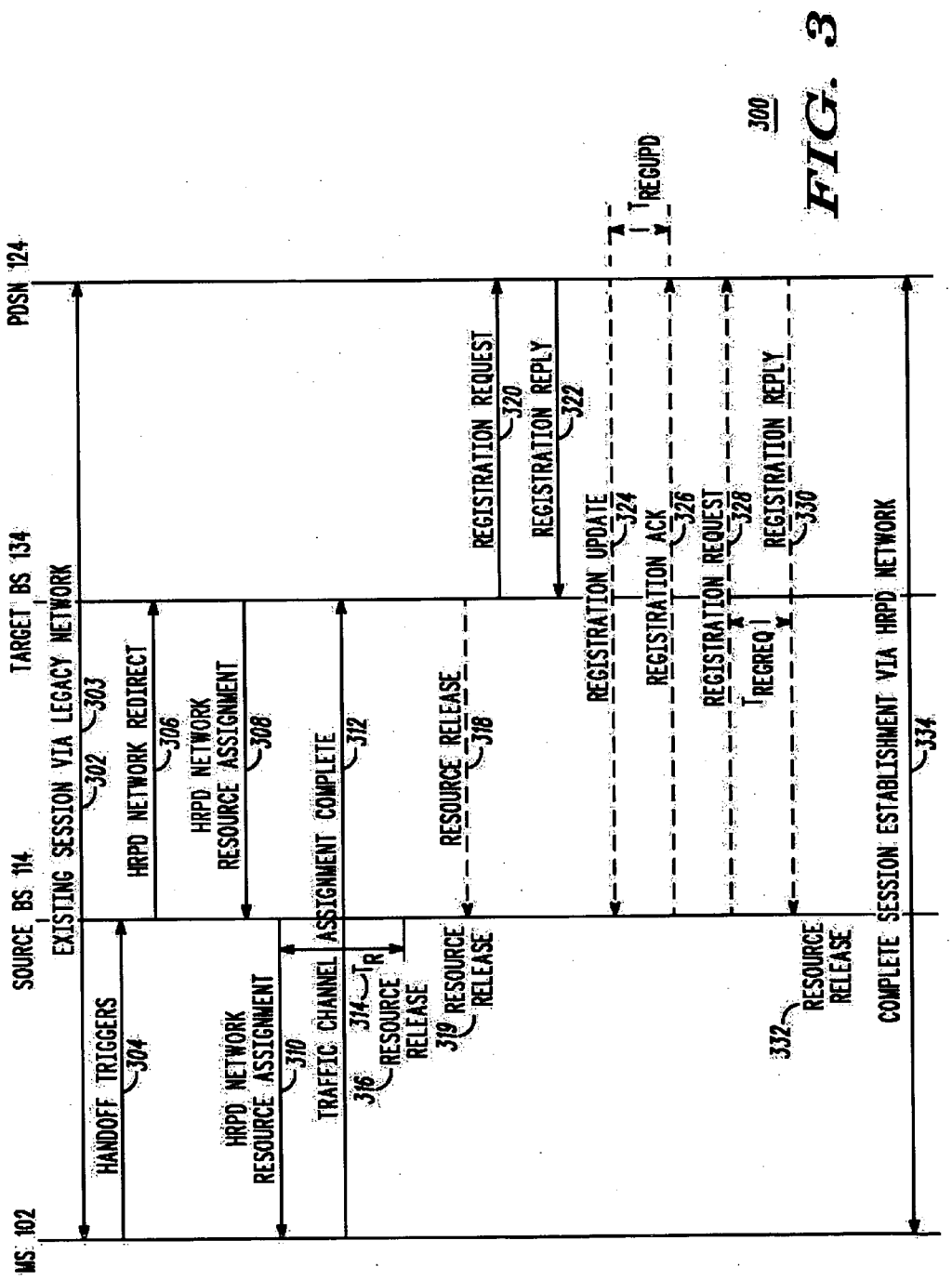
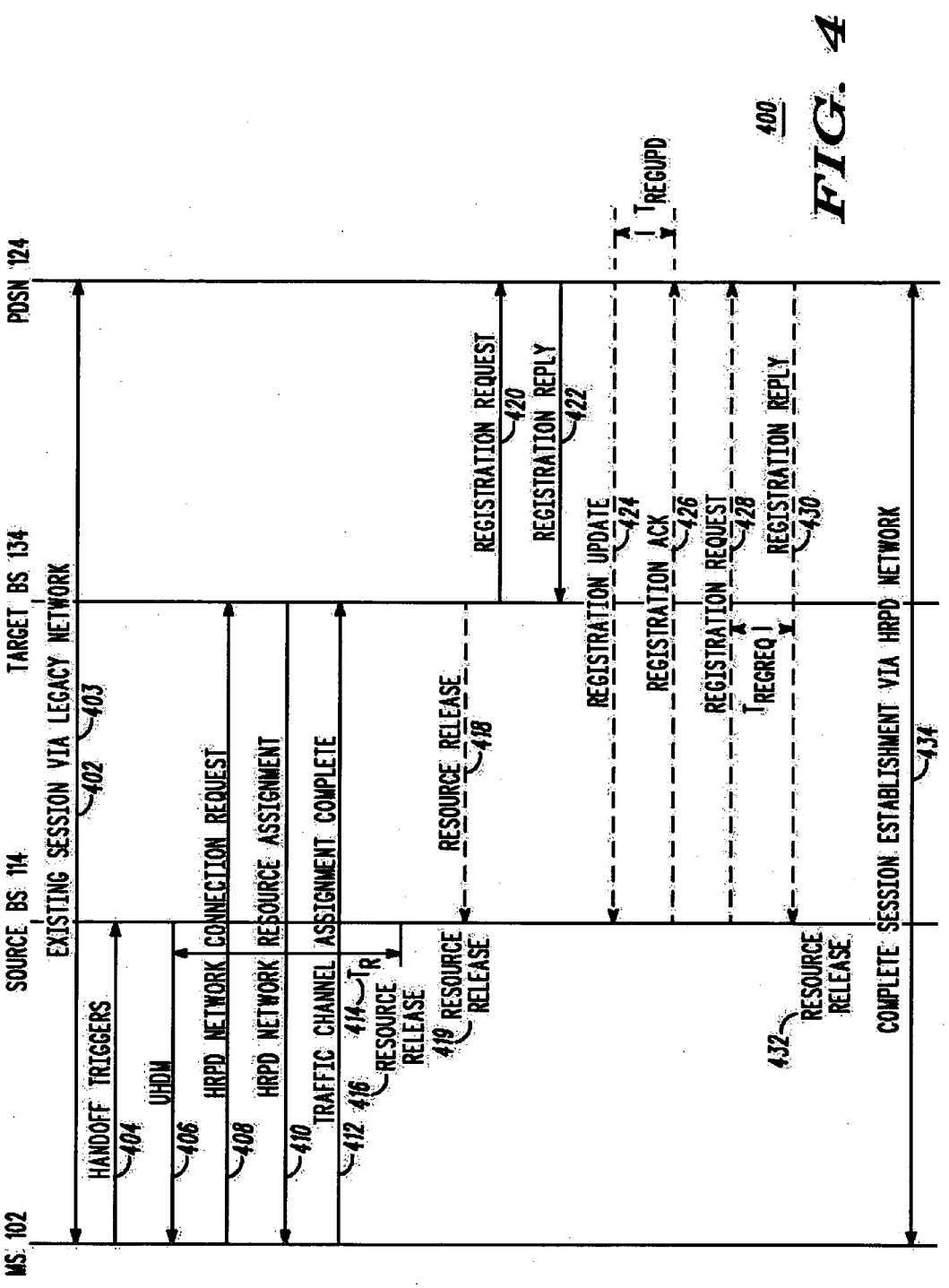

MS 102
SOURCE BS 114
TARGET BS 134
PDSN 124
EXISTING SESSION VIA LEGACY NETWORK
202
203
HANDOFF TRIGGERS
204
RESOURCE ALLOCATION REQUEST
206
RESOURCE ALLOCATION COMPLETE
208
DATABURST MESSAGE
210
TRAFFIC CHANNEL ASSIGNMENT COMPLETE
212
214
T_R
216
RESOURCE RELEASE
218
RESOURCE RELEASE
219
REGISTRATION REQUEST
220
REGISTRATION REPLY
222
REGISTRATION UPDATE
224
T_REGUPD
REGISTRATION ACK
226
REGISTRATION REQUEST
228
T_REGREQ
REGISTRATION REPLY
230
232
RESOURCE RELEASE
COMPLETE SESSION ESTABLISHMENT VIA HRPD NETWORK
234
200

FIG. 2


MS 102
SOURCE BS 114
TARGET BS 134
PDSN 124
EXISTING SESSION VIA LEGACY NETWORK
302
303
HRPD NETWORK REDIRECT
306
HRPD NETWORK RESOURCE ASSIGNMENT
308
ASSIGNMENT COMPLETE
312
RESOURCE RELEASE
318
REGISTRATION REQUEST
320
REGISTRATION REPLY
322
REGISTRATION UPDATE
324
REGISTRATION ACK
326
REGISTRATION REQUEST
328
REGISTRATION REPLY
330
T REGUPD
T REGREQ
HANDOFF TRIGGERS
304
HRPD NETWORK RESOURCE ASSIGNMENT
310
TRAFFIC CHANNEL
314
T R
316
RESOURCE RELEASE
319
RESOURCE RELEASE
332
RESOURCE RELEASE
COMPLETE SESSION ESTABLISHMENT VIA HRPD NETWORK
334

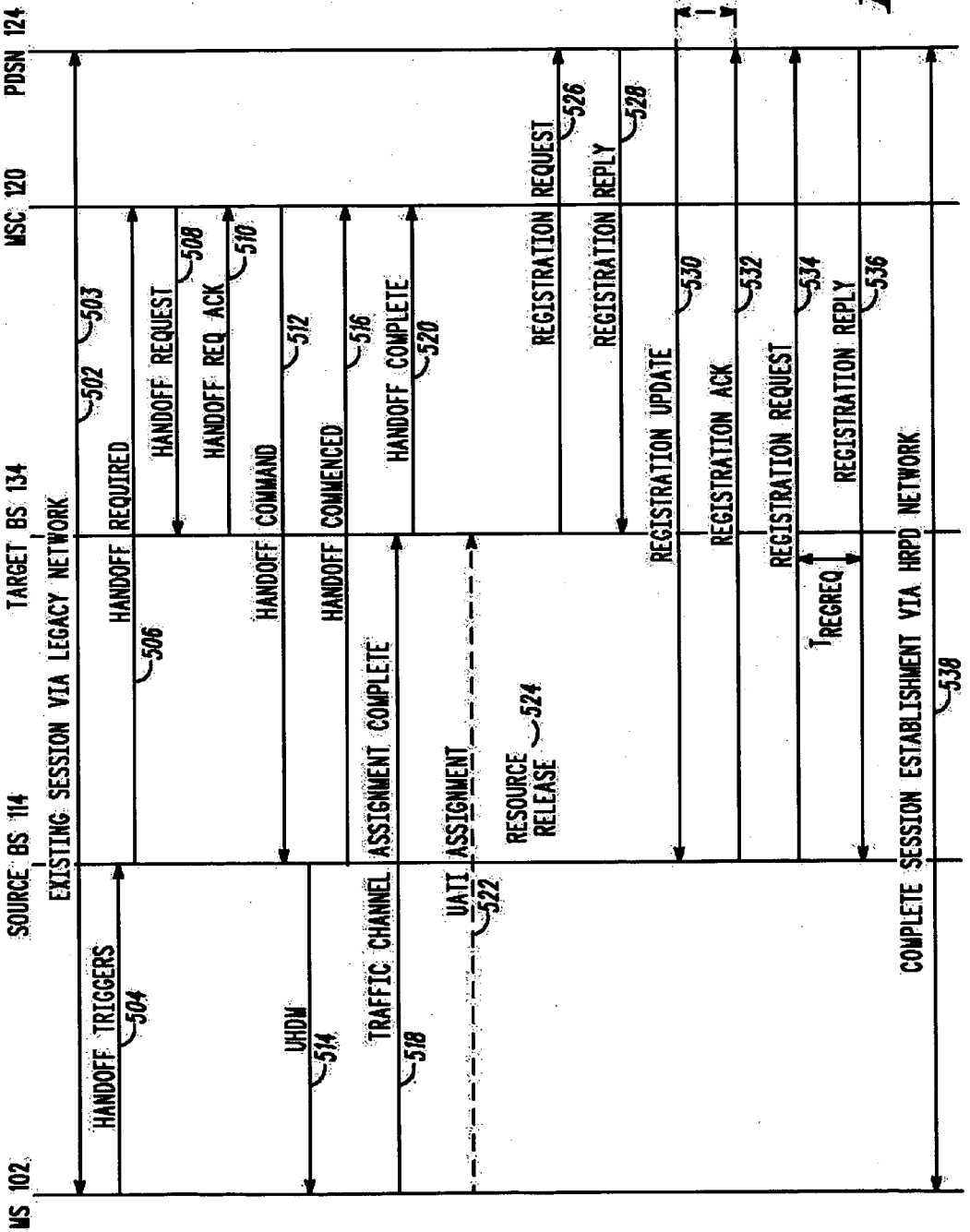
300

FIG. 3


MS 102
SOURCE BS 114
TARGET BS 134
PDSN 124
EXISTING SESSION VIA LEGACY NETWORK
402
403
HANDOFF TRIGGERS
404
UHDM
406
HRPD NETWORK CONNECTION REQUEST
408
HRPD NETWORK RESOURCE ASSIGNMENT
410
TRAFFIC CHANNEL ASSIGNMENT COMPLETE
412
414
T_R
416
RESOURCE RELEASE
419
RESOURCE RELEASE
418
REGISTRATION REQUEST
420
REGISTRATION REPLY
422
T_REGUPD
REGISTRATION UPDATE
424
REGISTRATION ACK
426
REGISTRATION REQUEST
428
T_REGREQ
REGISTRATION REPLY
430
RESOURCE RELEASE
432
COMPLETE SESSION ESTABLISHMENT VIA HRPD NETWORK
434

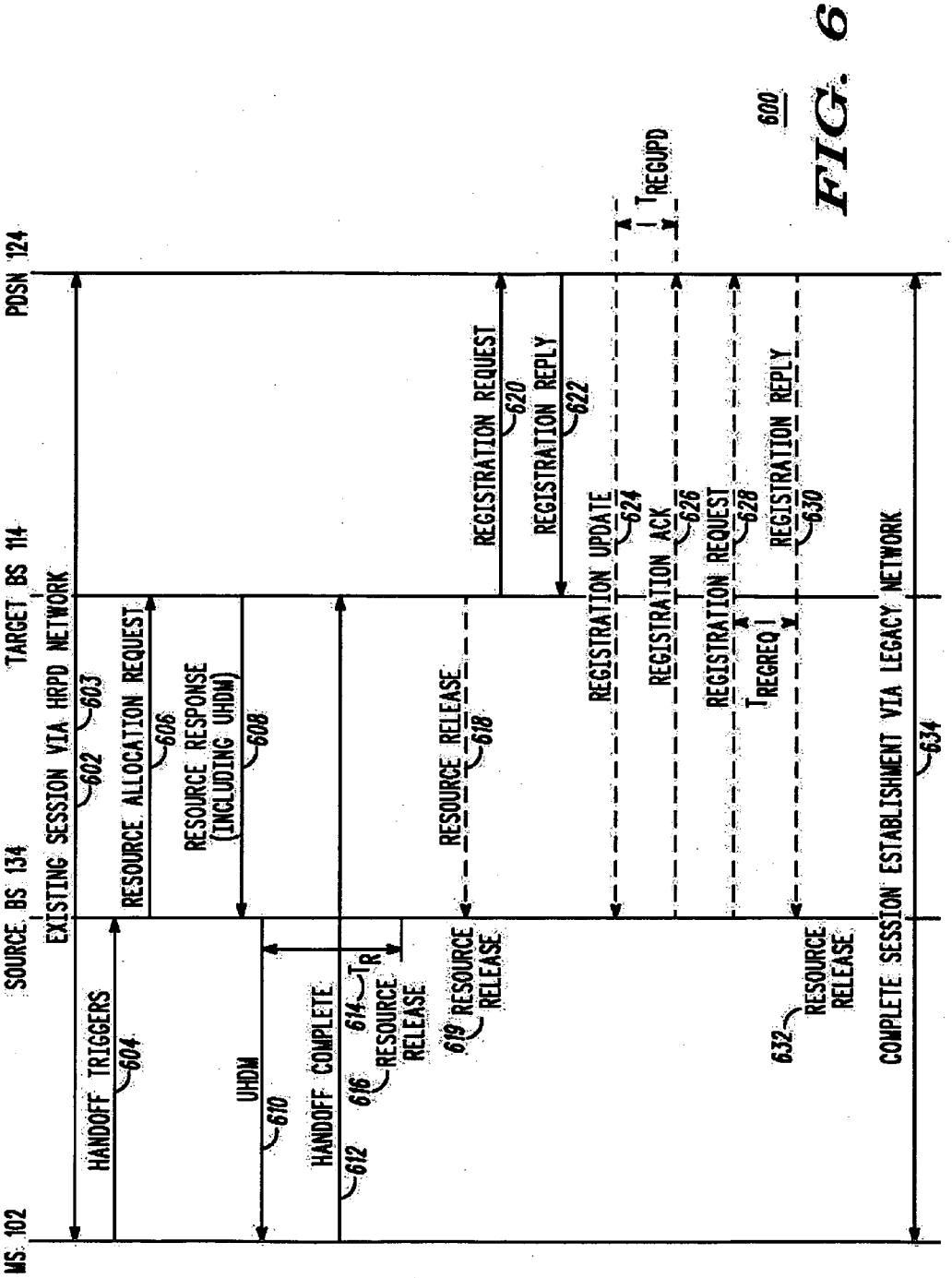
400

FIG. 4


MS 102
SOURCE BS 114
TARGET BS 134
MSC 120
PDSN 124
EXISTING SESSION VIA LEGACY NETWORK
HANDOFF TRIGGERS
504
HANDOFF REQUIRED
502
503
506
HANDOFF REQUEST
508
HANDOFF REQ ACK
510
HANDOFF COMMAND
512
UHDM
514
HANDOFF COMMENCED
516
TRAFFIC CHANNEL ASSIGNMENT COMPLETE
518
HANDOFF COMPLETE
520
UATI ASSIGNMENT
522
RESOURCE RELEASE
524
REGISTRATION REQUEST
526
REGISTRATION REPLY
528
REGISTRATION UPDATE
530
T_REGUPD
REGISTRATION ACK
532
REGISTRATION REQUEST
534
T_REGREQ
REGISTRATION REPLY
536
COMPLETE SESSION ESTABLISHMENT VIA HRPD NETWORK
538

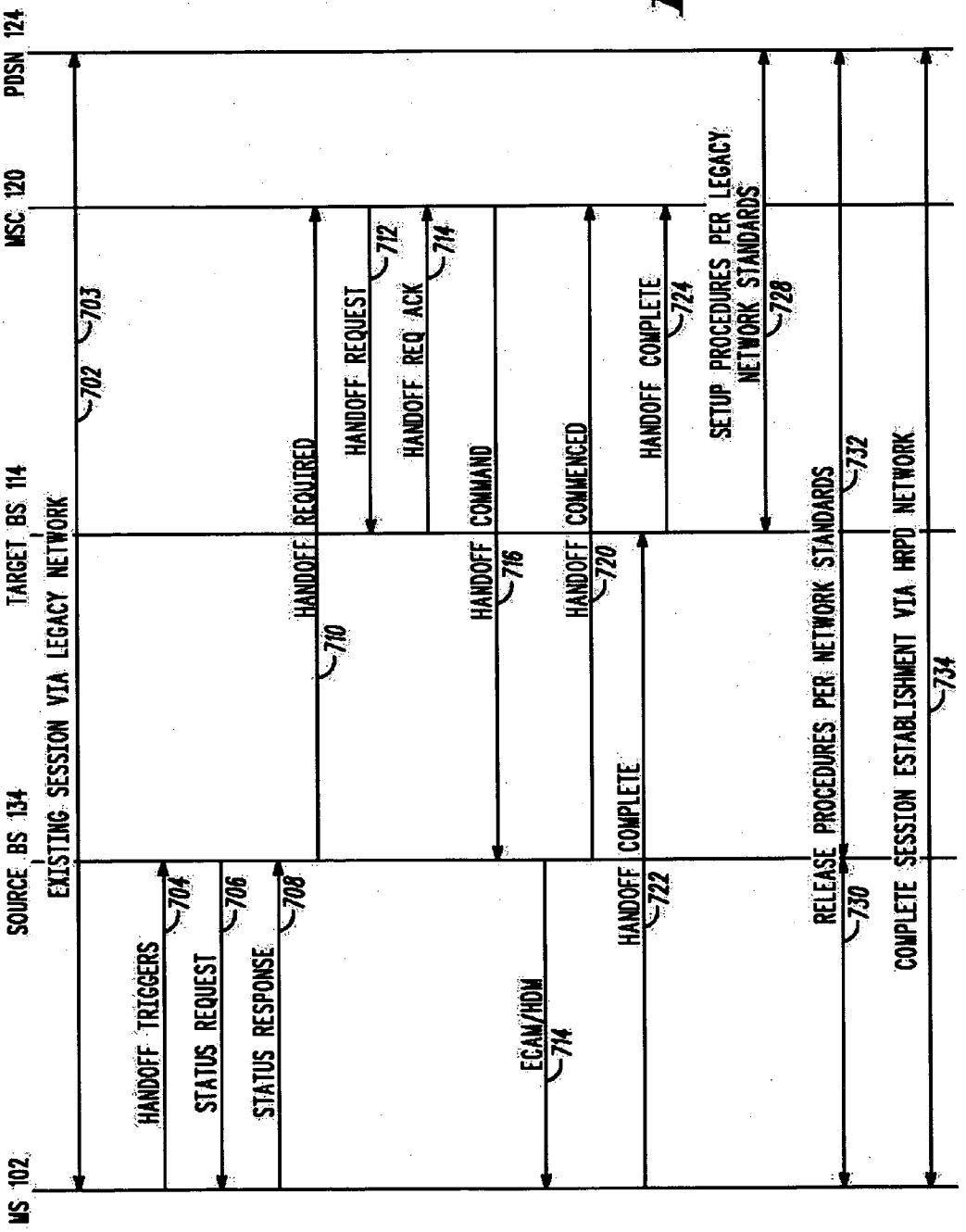
500

FIG. 5


MS 102
SOURCE BS 134
TARGET BS 114
PDSN 124
EXISTING SESSION VIA HRPD NETWORK
602
603
HANDOFF TRIGGERS
604
RESOURCE ALLOCATION REQUEST
606
RESOURCE RESPONSE (INCLUDING UHDM)
608
UHDM
610
HANDOFF COMPLETE
612
614
TR
RESOURCE RELEASE
616
RESOURCE RELEASE
618
619
REGISTRATION REQUEST
620
REGISTRATION REPLY
622
REGISTRATION UPDATE
624
TREGUPD
REGISTRATION ACK
626
REGISTRATION REQUEST
628
TREGREQ
REGISTRATION REPLY
630
RESOURCE RELEASE
632
COMPLETE SESSION ESTABLISHMENT VIA LEGACY NETWORK
634

600

FIG. 6


MS 102
SOURCE BS 134
TARGET BS 114
MSC 120
PDSN 124
EXISTING SESSION VIA LEGACY NETWORK
HANDOFF TRIGGERS
STATUS REQUEST
STATUS RESPONSE
HANDOFF REQUIRED
HANDOFF REQUEST
HANDOFF REQ ACK
HANDOFF COMMAND
HANDOFF COMMENCED
HANDOFF COMPLETE
SETUP PROCEDURES PER LEGACY NETWORK STANDARDS
ECAM/HDM
HANDOFF COMPLETE
RELEASE PROCEDURES PER NETWORK STANDARDS
COMPLETE SESSION ESTABLISHMENT VIA HRPD NETWORK
702
703
704
706
708
710
712
714
716
720
722
724
728
730
732
734

700

FIG. 7

# METHOD AND SYSTEM FOR INTER-TECHNOLOGY ACTIVE HANDOFF OF A HYBRID COMMUNICATION DEVICE

## CROSS REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority from provisional application Ser. No. 60/629,929, entitled "METHOD AND SYSTEM FOR INTER-TECHNOLOGY ACTIVE HANDOFF OF A HYBRID COMMUNICATION DEVICE," filed Nov. 23, 2004, which is commonly owned and incorporated herein by reference in its entirety.

## FIELD OF THE INVENTION

[0002] The present invention relates generally to wireless communication systems, and more specifically to handoff of a hybrid communication device between a High Rate Packet Data (HRPD) cellular communication system and a second generation (2G) cellular communication system.

## BACKGROUND OF THE INVENTION

[0003] The evolution of cellular communications has resulted in a proliferation of networks of different technologies and corresponding different air interfaces. As a result, during the course of a single call, a wireless mobile station may roam among multiple networks, wherein each such network implements a different technology than the other networks of the multiple networks. Among the different network technologies are high rate packet data (HRPD) Code Division Multiple Access (CDMA) technologies, such as CDMA 2000 1XEV-DO (1X Evolution Data Optimized) or packet switched CDMA 1XRTT (1X Radio Transmission Technology), that are capable of providing high rate packet data communication services, and conventional, or legacy, CDMA cellular communication technologies, such as a CDMA 1X.

[0004] As the mobile station roams among a HRPD CDMA communication network and a legacy CDMA communication network, it may be beneficial to system performance to handoff the mobile station from the former network to the latter network or from the latter network to the former network. For example, the channel conditions associated one such network may be more favorable than the channel conditions associated with the other such network due to such factors as fading, adjacent and co-channel interference, and available power at a serving base station (BS) or radio access network (RAN). By way of another example, an operator of both a packet switched CDMA network and a circuit switched CDMA network may desire to move the mobile station from one such network and to the other such network for purposes of system loading.

[0005] Currently, the only defined method for executing a handoff between a HRPD CDMA network and a legacy CDMA network is an execution of a dormant hard handoff, wherein a mobile station must go dormant and drop a radio resource of a network of a first CDMA technology and then acquire a radio resource of a network of a second CDMA technology. A result is a brief period of time during which the mobile station is not actively engaged in a communication session with either network. Further, when executing a dormant hard handoff there is no linkage between the two networks as the mobile station must drop the first network and acquire the second network without any assistance from the BS or RAN of either network. As a result, voice/data traffic may be lost during the handoff, resulting in poor system performance and efficiency and disgruntled end users.

[0006] Therefore, a need exists for a method and apparatus for an active hard handoff of a communication session between a legacy CDMA network and a high rate packet data CDMA 2000 network that minimizes an amount of time that a mobile station is not actively engaged in a communication session with either network during a handoff

## BRIEF DESCRIPTION OF THE DRAWINGS

[0007] **FIG. 1** is a block diagram of a wireless communication system in accordance with an embodiment of the present invention.

[0008] **FIG. 2** is a signal flow diagram illustrating a handoff of a communication session from a legacy network of **FIG. 1** to a high rate packet data network of **FIG. 1** in accordance with various embodiments of the present invention.

[0009] **FIG. 3** is a signal flow diagram illustrating a handoff of a communication session from a legacy network of **FIG. 1** to a high rate packet data network of **FIG. 1** in accordance with other embodiments of the present invention.

[0010] **FIG. 4** is a signal flow diagram illustrating a handoff of a communication session from a legacy network of FIG. I to a high rate packet data network of **FIG. 1** in accordance with other embodiments of the present invention.

[0011] **FIG. 5** is a signal flow diagram illustrating a handoff of a communication session from a legacy network of **FIG. 1** to a high rate packet data network of **FIG. 1** in accordance with other embodiments of the present invention.

[0012] **FIG. 6** is a signal flow diagram illustrating a handoff of a communication session from a high rate packet data network of **FIG. 1** to a legacy network of **FIG. 1** in accordance with other embodiments of the present invention.

[0013] **FIG. 7** is a signal flow diagram illustrating a handoff of a communication session from a high rate packet data network of **FIG. 1** to a legacy network of **FIG. 1** in accordance with other embodiments of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

[0014] To address the need that exists for a method and apparatus for an active hard handoff of a communication session between a legacy CDMA **2000** network and a high rate packet data CDMA **2000** network that minimizes an amount of time that a mobile station is not actively engaged in a communication session with either network during a handoff, a communication system is provided that provides for a handoff of a hybrid mobile station (MS) between a legacy network implementing a non-high rate packet data (non-HRPD) communication technology and a network implementing a high rate packet data (HRPD) communica-

tion technology. With respect to a handoff of the MS from the non-HRPD network to the HRPD network, in one embodiment of the present invention the non-HRPD network receives a handoff trigger and redirects the MS to the HRPD network. In another embodiment of the present invention, in response to receiving the handoff trigger, the non-HRPD network obtains an allocation of HRPD network resources from the HRPD network, and informs the MS of the allocated HRPD network resources. Subsequent to the establishment by the HRPD network of a traffic channel with the MS, the non-HRPD network releases non-HRPD network RF resources associated with the MS.

[0015] With respect to a handoff of the MS from the HRPD network to the non-HRPD network, in yet another embodiment of the present invention the HRPD network receives a handoff trigger, obtains an allocation of non-HRPD network resources from the non-HRPD network, and informs the MS of the allocated non-HRPD network resources. Subsequent to the establishment by the non-HRPD network of a traffic channel with the MS, the HRPD network releases HRPD network radio frequency (RF) resources associated with the MS. In still other embodiments of the present invention, the handoffs may be controlled by a Mobile Switching Center.

[0016] Generally, an embodiment of the present invention encompasses a method for a handoff of a hybrid MS from a network implementing a non-HRPD communication technology to a network implementing an HRPD communication technology. The method includes conveying forward link bearer traffic to, and receiving reverse link bearer traffic from, the MS via RF resources associated with the non-HRPD network. The method further includes receiving, by the non-HRPD network, a handoff trigger, in response to receiving the handoff trigger, requesting, by the non-HRPD network of the HRPD network, an allocation of HRPD network resources, in response to the request, receiving by the non-HRPD network from the HRPD network, an allocation of HRPD network resources, and informing the MS, by the non-HRPD network, of the allocated HRPD network resources. The method further includes establishing, by the HRPD network, a traffic channel with the MS based on the allocated HRPD network resources and, subsequent to the establishment by the HRPD network of a traffic channel with the MS, releasing, by the non-HRPD network, the RF resources of the non-HRPD network.

[0017] Another embodiment of the present invention encompasses a method for a handoff of a hybrid MS from a network implementing a non-HRPD communication technology to a network implementing an HRPD communication technology. The method includes conveying forward link bearer traffic to, and receiving reverse link bearer traffic from, the MS via RF resources associated with the non-HRPD network. The method further includes receiving, by the non-HRPD network, a handoff trigger, in response to receiving the handoff trigger, conveying a message to the MS that redirects the MS to the HRPD network, receiving, by the HRPD network from the MS and in response to the conveyance of the redirection message, a connection request, and in response to receiving the connection request, conveying, by HRPD network to the MS, an allocation of HRPD network resources. The method further includes establishing, by the HRPD network, a traffic channel with the MS based on the allocated HRPD network resources and subsequent to the establishment by the HRPD network of a traffic channel with the MS, releasing, by the non-HRPD network, the RF resources of the non-HRPD network.

[0018] Yet another embodiment of the present invention encompasses a method for a handoff of a hybrid MS from a network comprising a Mobile Switching Center (MSC) and implementing a non-HRPD communication technology to a network implementing an HRPD communication technology. The method includes conveying forward link bearer traffic to, and receiving reverse link bearer traffic from, the MS via RF resources associated with the non-HRPD network, receiving, by the non-HRPD network, a handoff trigger, and in response to receiving the handoff trigger, conveying a message to the MSC requesting a handoff of the MS. The method further includes, in response to receiving the request, obtaining, by the MSC, an allocation of RF resources by the HRPD network and informing the MS, by the non-HRPD network, of the RF resources allocated by the HRPD network. The method further includes establishing, by the HRPD network, a traffic channel with the MS based on the RF resources allocated by the HRPD network; and subsequent to the establishment by the HRPD network of a traffic channel with the MS, releasing, by the non-HRPD network, the RF resources of the non-HRPD network.

[0019] Still another embodiment of the present invention encompasses a method for a handoff of a hybrid MS from a network implementing an HRPD communication technology to a network implementing a non-HRPD communication technology. The method includes conveying forward link bearer traffic to, and receiving reverse link bearer traffic from, the MS via RF resources associated with the HRPD network. The method further includes receiving, by the HRPD network, a handoff trigger, in response to receiving the handoff trigger, requesting, by the HRPD network of the non-HRPD network, an allocation of non-HRPD network resources, in response to the request, receiving, by the HRPD network from the non-HRPD network, an allocation of non- HRPD network resources, and informing the MS, by the HRPD network, of the allocated non-HRPD network resources. The method further includes establishing, by the non- HRPD network, a traffic channel with the MS based on the allocated non-HRPD network resources and subsequent to the establishment by the non-HRPD network of a traffic channel with the MS, releasing, by the HRPD network, the RF resources of the HRPD network.

[0020] Yet another embodiment of the present invention encompasses a method for a handoff of a hybrid MS from a network implementing an HRPD communication technology to a network comprising an MSC and implementing a non-HRPD communication technology. The method includes conveying forward link bearer traffic to, and receiving reverse link bearer traffic from, the MS via radio frequency (RF) resources associated with the HRPD network, receiving, by the HRPD network, a handoff trigger, and in response to receiving the handoff trigger, conveying a message to the MSC requesting a handoff of the MS. The method further includes, in response to receiving the request, obtaining, by the MSC, an allocation of RF resources by the non-HRPD network, informing the HRPD network, by the MSC, of the RF resources allocated by the non-HRPD network, and informing the MS, by the HRPD network, of the RF resources allocated by the non-HRPD network. The method further includes establishing, by the

non-HRPD network, a traffic channel with the MS based on the RF resources allocated by the non-HRPD network and subsequent to the establishment by the non-HRPD network of a traffic channel with the MS, releasing, by the HRPD network, the RF resources of the HRPD network.

[0021] Still another embodiment of the present invention encompasses a system for a handoff of a hybrid MS from a network implementing a non-HRPD communication technology to a network implementing an HRPD communication technology. The system includes a non-HRPD base station in communication with an HRPD base station. The non-HRPD base station is configured to convey forward link bearer traffic to and receive reverse link bearer traffic from the MS via non-HRPD network RF resources, receive a handoff trigger, in response to receiving the handoff trigger, request an allocation of HRPD network resources, in response to the request, receive an allocation of HRPD network resources, inform the MS of the allocated HRPD network resources, and release the non-HRPD network RF resources subsequent to an establishment of a traffic channel with the MS by the HRPD base station. The HRPD base station is configured to receive the request for allocation of HRPD network resources, in response to receiving the request, convey an allocation of HRPD network resources, and establish a traffic channel with the MS based on the allocated HRPD network resources.

[0022] Yet another embodiment of the present invention encompasses a system for a handoff of a hybrid MS from a network implementing a non-HRPD communication technology to a network implementing an HRPD communication technology. The system includes a non-HRPD base station in communication with an HRPD base station. The non-HRPD base station is configured to convey forward link bearer traffic to, and receiving reverse link bearer traffic from, the MS via RF resources associated with the non-HRPD network, receive a handoff trigger; in response to receiving the handoff trigger, convey a message to the MS that redirects the MS to the HRPD base station, and release the non-HRPD network RF resources subsequent to an establishment of a traffic channel with the MS by the HRPD base station. The HRPD base station is configured to receive a connection request in response to the conveyance by the non-HRPD base station of the redirection message, in response to receiving the connection request, convey to the MS an allocation of HRPD network resources, and establish a traffic channel with the MS based on the allocated HRPD network resources.

[0023] Still another embodiment of the present invention encompasses a system for a handoff of a hybrid MS from a network implementing a non-HRPD communication technology to a network implementing an HRPD communication technology. The system includes a non-HRPD base station and an HRPD base station that are each in communication with the MSC. The non-HRPD base station is configured to convey forward link bearer traffic to, and receives reverse link bearer traffic from, the MS via RF resources associated with the non-HRPD network, receive a handoff trigger, in response to receiving the handoff trigger, convey a message to the MSC requesting a handoff of the MS, in response to conveying the message to the MSC, receive information concerning an allocation of HRPD network RF resources from the MSC, inform the MS of the RF resources allocated by the HRPD network, and subsequent to the establishment by the HRPD network of a traffic channel with the mobile station, release the RF resources of the non-HRPD network. The MSC is configured to, in response to receiving the request for a handoff of the MS, obtain an allocation of RF resources from the HRPD network and inform the non-HRPD base station of the allocated RF resources. The HRPD base station is configured to establish a traffic channel with the MS based on the RF resources allocated by the HRPD network.

[0024] Yet another embodiment of the present invention encompasses a system for a handoff of a hybrid MS from a network implementing an HRPD communication technology to a network implementing a non-HRPD communication technology. The system includes an HRPD base station in communication with a non-HRPD base station. The HRPD base station is configured to convey forward link bearer traffic to, and receive reverse link bearer traffic from, the MS via radio frequency (RF) resources associated with the HRPD network, receive a handoff trigger, in response to receiving the handoff trigger, request an allocation of non-HRPD network resources, in response to the request, receive an allocation of non-HRPD network resources, and inform the MS of the allocated non-HRPD network resources, and subsequent to an establishment of a traffic channel of the non-HRPD network with the MS, release the RF resources of the HRPD network. The non-HRPD base station is configured to receive a request from the HRPD base station for an allocation of non-HRPD network resources, in response to receiving the request, convey an allocation of non-HRPD network resources to the HRPD base station, and establish a traffic channel with the MS based on the allocated HRPD network resources.

[0025] Still another embodiment of the present invention encompasses a system for a handoff of a hybrid MS from a network implementing an HRPD communication technology to a network comprising an MSC and implementing a non-HRPD communication technology. The system includes an HRPD base station and a non-HRPD base station that are each in communication with the MSC. The HRPD base station is configured to convey forward link bearer traffic to, and receive reverse link bearer traffic from, the MS via RF resources associated with the HRPD network, receive a handoff trigger, in response to receiving the handoff trigger, convey a message to the MSC requesting a handoff of the MS, in response to requesting a handoff of the MS, receiving an allocation of non-HRPD network RF resources, inform the MS of the allocated non- HRPD network RF resources and, subsequent to an establishment by a non-HRPD base station of a traffic channel with the MS, release the RF resources of the HRPD network. The MSC is configured to, in response to receiving the request for a handoff of the MS, obtain an allocation of RF resources from the non-HRPD network and inform the HRPD base station of the RF resources allocated by the non-HRPD network. The non-HRPD base station is configured to establish a traffic channel with the MSbased on the RF resources allocated by the non-HRPD network.

[0026] Turning now to the drawings, the present invention may be more fully described with reference to **FIGS. 1-7**. **FIG. 1** is a block diagram of a wireless communication system **100** in accordance with an embodiment of the present invention. Communication system **100** includes a first, legacy CDMA (Code Division Multiple Access) net-

work **110** that implements a non-high rate packet data (non-HRPD) communication technology and a second, high rate packet data (HRPD) CDMA **2000** network **130** that implements an HRPD communication technology. Each of network **110** and network **130** includes a respective Base Station **114**, **134** that comprises a respective Base Transceiver Station (BTS) **116**, **136** coupled to a respective Base Station Controller (BSC) **118**, **138**. Network **110** further includes a Mobile Switching Center (MSC) **120** that is coupled to BS **114**, and in particular to BSC **118**. MSC **120** may be further coupled to BS **134**, and in particular to BSC **138**. Networks **110** and **130**, and more particularly BSs **114** and **134**, are each further coupled to a Packet Data Serving Node (PDSN) **124** and via the PDSN to an external network (not shown) for an exchange of communications with distant parties external to communication system **100**.

[**0027**] MSC **120** is coupled to a Home Location Register (HLR) (not shown) and a Visited Location Register (VLR) (not shown). As is known in the art, the HLR and VLR includes mobility and provisioning information associated with each mobile station subscribed to and/or registered for the services of the MSC's associated network **110**, such as a profile of the mobile station, including the capabilities of the mobile station, and a BS currently serving the mobile station. BSs **114** and **134** each provides wireless communication services to the mobile stations located in a coverage area of the BS via a respective air interface **112**, **132**. Each air interface **112**, **132** includes a forward link that includes at least one forward link traffic channel and at least one forward link control channel. Each air interface **112**, **132** further includes a reverse link that includes at least one reverse link traffic channel, at least one reverse link signaling channel, and an access channel. Each of the forward link and reverse link of air interface **132** further comprises a channel that is dedicated to legacy network-type messaging, that is, to an exchange of 3G1X (Third generation 1X) messages when the legacy network is a CDMA 1X system, in an HRPD system, such as a CDMA 2000 1XEV-DO system. For ease of reference, this channel is referred to herein as a 3G1X channel.

[**0028**] Each of network **110** and network **130**, and more particularly BSs **114** and **134**, communicate with each other, and with Packet Data Serving Node (PDSN) **124**, via an Internet Protocol (IP)-based network **122**. In various embodiments of the present invention, BSs **114** and **134** may communicate via a proprietary interface, a new 'A' interface, or via a well-known intersystem protocol, such as the protocol described in the 3GPP2 (Third Generation Partnership Project 2) TIA-41 (Telecommunications Industry Association-41) standard, that is, 3GPP2 N.S0005. The TIA-41 standard provides standardized intersystem procedures for mobility management in cellular systems and prescribes messaging among Mobile Switching Centers, Home Location Registers (HLRs), Visited Location Registers (VLRs), Authentication, Authorization, and Accounting functionality (AAAs), and other core network elements of cellular systems in order to provide services to mobile stations when interaction is required between different cellular systems. In another embodiment of the present invention, BSs **114** and **134** may communicate via an extension of an A1 interface by providing a connection between the BSs via MSC **120**.

[**0029**] Communication system **100** further includes a wireless mobile station (MS) **102**, for example but not limited to a cellular telephone, a radiotelephone, or a Personal Digital Assistant (PDA), personal computer (PC), or laptop computer equipped for wireless voice communications. In various communications systems, mobile station **102** may also be referred to as an access terminal (AT). Mobile station **102** comprises a hybrid terminal that is capable of engaging in a voice or data call with both legacy CDMA network **110** and HRPD CDMA **2000** network **130**. For example, in one embodiment of the present invention, mobile station **102** may include a separate transceiver for operation in each of legacy network **110** and HRPD network **130**, thereby allowing the mobile station to concurrently transmit or receive in each of the two networks.

[**0030**] In order for mobile station **102** to engage in a voice call with a distant party via one or more of network **110** and network **130**, each of mobile station **102** and networks **110** and **130** operates in accordance with well-known wireless telecommunications protocols. Preferably, legacy network **110** is a CDMA 1X system that operates in accordance with the CDMA 1X standards. Further, HRPD network **130** preferably is a CDMA 2000 1XEV-DO (1X Evolution Data Optimized) system that operates in accordance with the 3GPP2 and TIA/EIA (Telecommunications Industry Association/Electronic Industries Association) IS-856 and 3GPP2 C.S0024 standards, which provide compatibility standards for CDMA 2000 1XEV-DO systems.

[**0031**] Further, each of air interfaces **112** and **132**, and correspondingly each of network **110**, network **130**, and mobile station **102**, preferably operates in accordance with the TIA/EIA (Telecommunications Industry Association/Electronic Industries Association) IS-2001 (3GPP2 A.S0011 to A.S0017 Inter Operability Specification, or IOS) standards, which provide a compatibility standard for cellular mobile telecommunications systems that operate as a CDMA 2000 system, such as 1X, 1XEV-DO, 1XEV-DV, and 1XRTT, or any other technology supported by a TIA-2001 based Access Network. In addition, mobile station **102**, air interface **132**, and BS **134** preferably further operates in accordance with the 3GPP2 A.S0008-0 v3.0 and 3GPP2 A.S0007-A v1.0 Inter Operability Specifications (IOS) for a High Rate Packet Data (HRPD) access network. To ensure compatibility, radio system parameters and call processing procedures are specified by the standards, including call processing steps that are executed by an MS and a base station serving the MS and between the BS and associated infrastructure in order to establish a call or execute a handoff.

[**0032**] In communication system **100**, mobile station **102** may roam through the system when the mobile station is engaged in a voice or data communication session. As a result of the roaming, situations may arise where it is desirable to hand off mobile station **102** from legacy network **110** to HRPD network **130** or from HRPD network **130** to legacy network **110**. For example and as is known in the art, while roaming in communication system **100** and being serviced by BS **114**, mobile station **102** may receive a stronger signal from BS **134** or, while being serviced by BS **134**, mobile station **102** may receive a stronger signal from BS **114**. Typically signal strengths are determined by a mobile station, such as mobile station **102**, measuring a pilot channel associated with each of the serving BS and one or more neighbor BSs. When a pilot channel of a serving BS is

weaker than a threshold value and a pilot channel of a neighbor BS, this typically indicates a desirability of a handoff.

[0033] By way of another example, location-based information may be used by BS **114** or BS **134** to determine if MS **102** is approaching a coverage area better served by the other BS (that is, BS **114** or **134** may employ edge-sensing finctionality to determine whether a handoff is appropriate). BS **114** or **134** may then initiate a handoff to the other BS for MS **102**.

[0034] By way of yet another example, the costs associated with operating mobile station **102** on network **110** may be different from the costs associated with operating mobile station **102** on network **130**. In turn, an operator (or operators) of networks **110** and **130** may charge a different fee for use of each network. As a result, a user of mobile station **102** may program into the subscriber a directive to operate on the lower cost network whenever the mobile station is able to obtain a traffic channel in the lower cost network. When mobile station **102** is engaged in a voice call in a higher cost network and is able to obtain a traffic channel in the lower cost network, the mobile station, or the user of the mobile station if the user is informed of the availability of a traffic channel in the lower cost network, may initiate a handoff to the lower cost network.

[0035] By way of still another example, for load leveling purposes, for network cost consideration purposes, or due to a need to clear traffic channels in a coverage area in order to facilitate emergency communications, an operator of a communication system such as communication system **100** may find it desirable to move a mobile station, such as mobile station **102**, that is actively engaged in a voice call in a first network, such as network **110** or network **130**, to the other network.

[0036] In order to facilitate a handoff of a mobile station such as mobile station **102**, communication system **100** provides a method and apparatus for an active handoff of mobile station **102** from legacy network **110** to HRPD network **130** or from network **130** to network **110** when the mobile station is actively engaged in a communication session. Referring now to **FIG. 2**, a signal flow diagram **200** is provided that depicts a handoff executed by communication system **100** in handing off a communication session from legacy network **110** to HRPD network **130** in accordance with a first embodiment of the present invention.

[0037] Signal flow diagram **200** begins when mobile station **102** is actively engaged **202**, **203** in a communication session with a distant party via legacy network **110**. In order to participate in the communication session via legacy network **110**, mobile station **102** must already be registered with the legacy network. Registration procedures are well-known in the art and will not be described in detail herein except to note that when a mobile station registers with a network, the network stores in an associated HLR or VLR, or an associated Foreign Agent (FA) or Home Agent (HA), whichever is appropriate, an identification of a BS associated with the network and serving the mobile station.

[0038] As part of the communication session, mobile station **102** conveys **202** reverse link frames comprising bearer traffic to PDSN **124** via a reverse link traffic channel of air interface **112**, BS **114**, and IP network **122** for routing to the distant party via an external network (not shown). Further, when PDSN **124** receives bearer traffic from the distant party and intended for mobile station **102**, the PDSN routes **203** the voice information to BS **114** via IP network **122** and the BS conveys forward link frames comprising the bearer traffic to mobile station **102** via a forward link traffic channel of air interface **112**.

[0039] While mobile station **102** is engaged in the communication session with BS **114**, the BS receives **204** a message that triggers a handoff of the mobile station. The handoff trigger message may be based on, among other considerations, any one or more of signal strength measurements of the respective pilot channels, a location of the mobile station, network cost or load considerations, and a directive of a user of the mobile station. For example, while activated in networks **110** and **130**, mobile station **102** may monitor pilot channels associated with multiple BSs, such as BSs **114** and **134**. In one such embodiment of the present invention, based on the monitored pilot channels, mobile station **102** may determine that the call should be handed off from BS **114** to HRPD network **130**, and more particularly to BS **134**. Mobile station **102** may then convey a handoff trigger message, preferably a HANDOFF REQUEST message as described in detail in the IOS specifications, to BS **114** that instructs the BS to initiate a handoff. The message may further notify BS **114** of a target network or BS, that is, network **130** or BS **134**, and/or BS **114** may determine the target network and/or BS by reference to MSC **120**, which determines the target network and/or BS by reference to at least one of the HLR and VLR coupled to the MSC. In other embodiments of the present invention, mobile station **102** may convey a handoff trigger message such as a HANDOFF REQUEST message in response being instructed by a user of the mobile station to request a handoff to network **130** or in response to self-determining to transfer networks based on cost considerations.

[0040] In still other embodiments of the present invention, the handoff trigger message may comprise a pilot strength measurement report conveyed by the mobile station to BS **114**. For example, based on the monitored pilot channels, mobile station may determine to convey a pilot strength measurement report to BS **114** that reports the strength of the monitored pilots. Based on the received pilot strength measurement report and in accordance with well-known procedures, BS **114** may then determine to handoff mobile station to a target BS, that is, BS **134**.

[0041] In yet other embodiments of the present invention, the handoff trigger message may comprise mobile station **102** location information received by network **110** from any of mobile station **102**, other network elements within network **110**, or a satellite system, or may comprise instructions that are internally generated by network **110** and that instruct BS **114** to handoff the mobile station. For example, an operator of network **110** may generate handoff instructions based on cost considerations or load considerations with respect to the operation of network **110** or based on a need to free up channels in network **110** due to an imminent or a pending emergency situation.

[0042] In response to receiving the handoff trigger message, BS **114** conveys **206** a resource allocation request to the target BS, that is, BS **134**, via IP network **122**. When only target network **130** has been identified by network **110**, then

network **130** is aware of an appropriate BS as is known in the art and routes the request to the appropriate BS, that is, BS **134**. The resource allocation request identifies the mobile station, that is, mobile station **102**, requesting the handoff and fturther requests that BS **134** allocate traffic channels to the identified mobile station. In response to receiving the resource allocation request, BS **134** allocates a forward link traffic channel and a reverse link traffic channel in air interface **132** to mobile station **102** and conveys **208** a legacy network resource allocation complete message to BS **114**. The resource allocation complete message is a legacy network message, such as a Handoff Command message, that informs of the allocated forward link and reverse link traffic channels by encapsulating a HRPD traffic channel assignment message, for example, a DO_CH_ASSIGNMENT message, as a payload of the message.

[**0043**] In response to receiving the legacy network resource allocation complete message, BS **114** informs **210** mobile station **102** of the traffic channels allocated to the mobile station in air interface **132**. Preferably, BS **114** informs mobile station **102** of the allocated traffic channels by parsing the resource allocation complete message to retrieve the payload, that is, the HRPD traffic channel assignment message, and then encapsulating the HRPD traffic channel assignment message received from BS **134** as the payload in a conventional legacy network message, for example, a legacy network message delivery mechanism such as Data Burst Message (DBM). In response to receiving the legacy network message from BS **114**, mobile station **102** parses the message, recognizes the payload as comprising an HRPD traffic channel assignment message, and identifies the traffic channels allocated to the mobile station in air interface **132** based on the encapsulated HRPD traffic channel assignment message. Mobile station **102** then attempts to acquire the identified traffic channels in accordance with well-known channel acquisition techniques. Upon successfully acquiring the traffic channels, mobile station **102** informs **212** BS **134** that the mobile station has successfully acquired the traffic channels allocated at BS **134**, preferably by conveying a traffic channel assignment complete message to the BS.

[**0044**] After mobile station **102** has successfully acquired the traffic channels associated with BS **134**, BS **114** releases the resources allocated by the BS to mobile station **102**. In one variation of the first embodiment of the present invention, the release of the resources allocated by BS **114** to mobile station **102** may be timer-based. That is, when BS **114** conveys the legacy network data burst message to mobile station **102**, BS **114** further starts **214** a release timer, TR, associated with, and preferably located in, the BS. The release timer is used by BS **114** to determine when to release the resources, such as radio frequency (RF) resources in air interface **112** and signal processing resources in BTS **116**, allocated by the BS to mobile station **102**. As a result, the release timer counts down a quantity of time that is predetermined to be sufficient for a hybrid mobile station, such as mobile station **102**, to successfully acquire traffic channels allocated to the mobile station by a BS other than BS **114** as part of an inter-technology handoff. In response to an expiration of release timer $T_R$, BS **114** releases **216** the resources allocated by the BS to mobile station **102**.

[**0045**] In another variation of the first embodiment of the present invention, instead of a timer-based release of resources by BS **114**, BS **114** may release the resources allocated by the BS to mobile station **102** based on information received from BS **134**. That is, when BS **134** is informed **212** by mobile station **102** that the mobile station has successfully acquired the allocated traffic channels at the BS, BS **134** then informs **218** BS **114** of a successful handoff, preferably by conveying a RESOURCE RELEASE message to BS **114**. In response to being informed of the successful handoff, BS **114** releases **219** the resources allocated by BS **114** to mobile station **102**.

[**0046**] In response to receiving the traffic channel assignment complete message, BS **134** completes the establishment of a bearer path for mobile station **102** in HRPD network **130** by registering the mobile station with PDSN **124** and setting up a new tunnel to the PDSN. Preferably, BS **134** registers the mobile station and sets up a new tunnel by conveying **220** an A11 REGISTRATION REQUEST message to the PDSN. The A11 REGISTRATION REQUEST identifies the mobile station and requests the set up of the tunnel. In response to receiving the A11 REGISTRATION REQUEST, PDSN **124** allocates a connection to BS **134** and informs the BS of the allocated connection, preferably by conveying **222** an A11 REGISTRATION REPLY to the BS. The establishment of communication session between PDSN **124** and mobile station **102** via BS **134** is then completed **234** in accordance with well-known techniques.

[**0047**] In still another variation of the first embodiment of the present invention, BS **114** may release the resources allocated by the BS to mobile station **102** based on information received by BS **114** from PDSN **124**. That is, when PDSN **124** receives **220** the A11 REGISTRATION REQUEST message from BS **134**, the PDSN conveys **224** a REGISTRATION UPDATE message to BS **114** which identifies mobile station **102** and instructs the BS to request an update of registration information concerning mobile station **102**. In response to receiving the REGISTRATION UPDATE message, BS **114** requests **228** updated registration information from PDSN **124** for mobile station **102**, preferably by conveying a REGISTRATION REQUEST message to PDSN **124**. BS **114** may further acknowledge **226** the REGISTRATION UPDATE message, for example by conveying a REGISTRATION ACK message back to the PDSN. In response to receiving the request for updated registration information for mobile station **102**, PDSN **124** then informs BS **114** of the successful handoff of the mobile station to BS **134**, preferably by conveying a REGISTRATION REPLY message to BS **114** that informs that the mobile station is now serviced by BS **134**. In response to being informed of the successful handoff of mobile station **102**, BS **114** releases **232** the resources allocated by BS **114** to the mobile station.

[**0048**] In a second embodiment of the present invention, instead of BS **114** informing mobile station **102** of the traffic channels allocated to the mobile station in HRPD air interface **132** by encapsulating a HRPD traffic channel assignment message in a conventional legacy network message, BS **114** may inform mobile station **102** of the traffic channels allocated to the mobile station in HRPD air interface **132** via a legacy network message dedicated to providing HRPD traffic channel information. Referring now to **FIG. 3**, a signal flow diagram **300** is provided that depicts of a handoff executed by communication system **100** in handing off a

communication session from legacy network **110** to HRPD network **130** in accordance with the second embodiment of the present invention.

[**0049**] Similar to signal flow diagram **200**, signal flow diagram **300** begins when mobile station **102** is actively engaged **302**, **303** in a communication session with a distant party via legacy network **110**. At this point in time, mobile station **102** is already registered with the legacy network and monitors pilot channels associated with base stations other than BS **114**, such as BS **134**. As part of the communication session, mobile station **102** conveys **302** reverse link frames comprising bearer traffic to PDSN **124** via a reverse link traffic channel of air interface **112**, BS **114**, and IP network **122** for routing to the distant party via an external network (not shown). Further, when PDSN **124** receives bearer traffic from the distant party and intended for mobile station **102**, the PDSN routes **303** the voice information to BS **114** via IP network **122** and the BS conveys forward link frames comprising the bearer traffic to mobile station **102** via a forward link traffic channel of air interface **112**.

[**0050**] At some point in time during the course of the communication session, BS **114** receives **304** a handoff trigger message indicating a need or desire to handoff mobile station **102**. Such handoff trigger messages are described in greater detail above and will not be further described in detail. In response to receiving the handoff trigger message, BS **114** conveys **306** an HRPD network redirect message, such as a DO_REDIRECT message, to target network **130** and via the target network to the target HRPD network BS, that is, BS **134**, via IP network **122**. The redirect message identifies the mobile station, that is, mobile station **102**, requesting the handoff and further requests that BS **134** allocate traffic channels to the identified mobile station. In response to receiving the redirect message, BS **134** allocates a forward link traffic channel and a reverse link traffic channel in air interface **132** to mobile station **102** and conveys **308** an HRPD network resource assignment message to BS **114** that informs of the allocated forward link and reverse link traffic channels.

[**0051**] In response to receiving the HRPD network resource assignment message, BS **114** conveys **310** a legacy network HRPD resource assignment message to mobile station **102**. The legacy network HRPD resource assignment message is a legacy network message that is dedicated to providing HRPD traffic channel information and includes information, for example, in a message type data field in a header of the message, identifying the message as a HRPD traffic channel information message. The legacy network HRPD resource assignment message informs mobile station **102** of the HRPD resources assigned to the mobile station, that is, of the forward link traffic channel and the reverse link traffic channel allocated to the mobile station in air interface **132**. In response to receiving the legacy network HRPD resource assignment message from BS **114**, mobile station **102** identifies the traffic channels allocated to the mobile station in air interface **132**. Mobile station **102** then attempts to acquire the identified traffic channels in accordance with well-known channel acquisition techniques.

[**0052**] Again similar to signal flow diagram **200**, upon successfully acquiring the traffic channels, mobile station **102** informs **312** BS **134** that the mobile station has successfully acquired the traffic channels allocated at BS **134**, preferably by conveying a traffic channel assignment complete message to the BS. In addition, at some point in time after mobile station **102** has successfully acquired the traffic channels allocated at BS **134**, BS **114** releases (**316**, **319**, **332**) the resources allocated by the BS to mobile station **102**. As described herein in greater detail with respect to signal flow diagram **200**, the release of the resources allocated by BS **114** to mobile station **102** may be timer-based (**314**, **316**), may be based on information received from BS **134** (**318**, **319**), such as a RESOURCE RELEASE message conveyed by BS **134** to BS **114**, or may be based on information conveyed to BS **114** by PDSN **124** (**324**, **328**, **330**). For example, and as described in greater detail above, in the last instance, in response to receiving (at **320**) a REGISTRATION REQUEST message, PDSN **124** may convey **324** a REGISTRATION UPDATE message to BS **114**. In response to receiving the REGISTRATION UPDATE message, BS **114** may convey **328** a REGISTRATION REQUEST message to the PDSN. In response to receiving the REGISTRATION REQUEST message, PDSN **124** may convey **330** a REGISTRATION REPLY message to BS **114**. In response to receiving the REGISTRATION REPLY message, BS **114** may release the resources allocated to mobile station **102**. Once again, in the last instance, BS **114** may further acknowledge **326** the REGISTRATION UPDATE message, for example by conveying a REGISTRATION ACK message back to the PDSN.

[**0053**] Further, and again similar to signal flow diagram **200**, in response to being informed (at **312**) that the mobile station has successfully acquired the traffic channels allocated at BS **134**, BS **134** completes the establishment of a bearer path for mobile station **102** in HRPD network **130** by registering the mobile station with PDSN **124** and setting up a new tunnel to the PDSN. Preferably, BS **134** registers the mobile station and sets up a new tunnel by conveying **320** an A11 REGISTRATION REQUEST message to the PDSN. In response to receiving the A11 REGISTRATION REQUEST, PDSN **124** allocates a connection to BS **134** and informs the BS of the allocated connection, preferably by conveying **322** an A11 REGISTRATION REPLY to the BS. The establishment of communication session between PDSN **124** and mobile station **102** via BS **134** is then completed **334** in accordance with well-known techniques.

[**0054**] In a third embodiment of the present invention, instead of BS **114** informing mobile station **102** of the traffic channels allocated to the mobile station in HRPD air interface **132** by encapsulating a HRPD traffic channel assignment message in a conventional legacy network message or by conveying a legacy network message dedicated to providing HRPD traffic channel information, BS **114** may re-direct mobile station to HRPD network **130**, that is, to BS **134**, upon being notified of the mobile station's desire to initiate a handoff. Referring now to **FIG. 4**, a signal flow diagram **400** is provided that depicts a handoff executed by communication system **100** in handing off a communication session from legacy network **110** to HRPD network **130** in accordance with the third embodiment of the present invention.

[**0055**] Similar to signal flow diagrams **200** and **300**, signal flow diagram **400** begins when mobile station **102** is actively engaged **402**, **403** in a communication session with a distant party via legacy network **110**. At this point in time, mobile station **102** is already registered with the legacy network and

monitors pilot channels associated with base stations other than BS **114**, such as BS **134**. As part of the communication session, mobile station **102** conveys **402** reverse link frames comprising bearer traffic to PDSN **124** via a reverse link traffic channel of air interface **112**, BS **114**, and IP network **122** for routing to the distant party via an external network (not shown). Further, when PDSN **124** receives bearer traffic from the distant party and intended for mobile station **102**, the PDSN routes **403** the voice information to BS **114** via IP network **122** and the BS conveys forward link frames comprising the bearer traffic to mobile station **102** via a forward link traffic channel of air interface **112**.

[**0056**] At some point in time during the course of the communication session, BS **114** receives a handoff trigger message **404** indicating a need or desire to handoff mobile station **102**. Such handoff trigger messages are described in greater detail above and will not be further described in detail. In response to receiving the handoff trigger message, BS **114** conveys **406** a message to mobile station **102** that redirects the mobile station to target HRPD network **130** and/or target BS **134**. In one variation of the third embodiment of the present invention, the notification received by BS **114** from mobile station **102** may notify the BS of the target network and/or BS. In another variation of the third embodiment of the present invention, BS **114** may determine the target network and/or BS by reference to MSC **120**, which determines the target network and/or BS by reference to at least one of the HLR and VLR coupled to the MSC. Preferably, the redirection message comprises a modified version of a Universal Handoff Direction Message (UHDM), as described in the 3GPP2 C.S0005.C standard, which standard is hereby incorporated by reference herein, which message is modified to include additional data fields that provide HRPD redirection information, such as identifiers associated with target network **130** or BS **134** and/or one or more of a control channel and access channel associated with the target network or BS. When only target network **130** is identified, the target network may then route messages received from BS **114** or mobile station **102** to target BS **134**.

[**0057**] In response to receiving the redirection message, mobile station **102** requests **408** an assignment of resources from target BS **134**, preferably by conveying an HRPD network connection request directly to the BS via air interface **132**. Connection requests are well-known in the art and will not be described in greater detail herein. In response to receiving the HRPD network connection request, BS **134** allocates a forward link traffic channel and a reverse link traffic channel in air interface **132** to mobile station **102** and conveys **410** an HRPD network resource assignment message directly to mobile station **102** via the forward link of air interface **132**, which message informs of the allocated forward link and reverse link traffic channels. In response to receiving the HRPD network resource assignment message from BS **114**, mobile station **102** identifies the traffic channels allocated to the mobile station in air interface **132**. Mobile station **102** then attempts to acquire the identified traffic channels in accordance with well-known channel acquisition techniques.

[**0058**] Again similar to signal flow diagrams **200** and **300**, upon successfully acquiring the traffic channels, mobile station **102** informs **412** BS **134** that the mobile station has successfully acquired the traffic channels allocated at BS **134**, preferably by conveying a traffic channel assignment complete message to the BS. In addition, at some point in time after mobile station **102** has successfully acquired the traffic channels allocated at BS **134**, BS **114** releases (**416**, **419**, **432**) the resources allocated by the BS to mobile station **102**. As described herein in greater detail with respect to signal flow diagram **200**, the release of the resources allocated by BS **114** to mobile station **102** may be timer-based (**414**, **416**), may be based on information received from BS **134** (**418**, **419**), such as a RESOURCE RELEASE message conveyed by BS **134** to BS **114**, or may be based on information conveyed to BS **114** by PDSN **124** (**424**, **428**, **430**). For example, and as described in greater detail above, in the last instance, in response to receiving (at **420**) a REGISTRATION REQUEST message, PDSN **124** may convey **424** a REGISTRATION UPDATE message to BS **114**. In response to receiving the REGISTRATION UPDATE message, BS **114** may convey **428** a REGISTRATION REQUEST message to the PDSN. In response to receiving the REGISTRATION REQUEST message, PDSN **124** may convey **430** a REGISTRATION REPLY message to BS **114**. Once again, in the last instance, BS **114** may further acknowledge **426** the REGISTRATION UPDATE message, for example by conveying a REGISTRATION ACK message back to the PDSN.

[**0059**] Further, and again similar to signal flow diagrams **200** and **300**, in response to being informed (at **412**) that the mobile station has successfully acquired the traffic channels allocated at BS **134**, BS **134** completes the establishment of a bearer path for mobile station **102** in HRPD network **130** by registering the mobile station with PDSN **124** and setting up a new tunnel to the PDSN. Preferably, BS **134** registers the mobile station and sets up a new tunnel by conveying **420** an A11 REGISTRATION REQUEST message to the PDSN. In response to receiving the A11 REGISTRATION REQUEST, PDSN **124** allocates a connection to BS **134** and informs the BS of the allocated connection, preferably by conveying **422** an A11 REGISTRATION REPLY to the BS. The establishment of communication session between PDSN **124** and mobile station **102** via BS **134** is then completed **434** in accordance with well-known techniques.

[**0060**] In a fourth embodiment of the present invention, a handoff from legacy network **110** to HRPD network **130** may controlled by MSC **120**. Referring now to **FIG. 5**, a signal flow diagram **500** is provided that depicts a handoff executed by communication system **100** in handing off a communication session from legacy network **110** to HRPD network **130** in accordance with the fourth embodiment of the present invention. Signal flow diagram **500** begins when mobile station **102** is actively engaged **502**, **503** in a communication session with a distant party via legacy network **110**. At this point in time, mobile station **102** is already registered with the legacy network and monitors pilot channels associated with base stations other than BS **114**, such as BS **134**. As part of the communication session, mobile station **102** conveys **502** reverse link frames comprising bearer traffic to PDSN **124** via a reverse link traffic channel of air interface **112**, BS **114**, and IP network **122** for routing to the distant party via an external network (not shown). Further, when PDSN **124** receives bearer traffic from the distant party and intended for mobile station **102**, the PDSN routes **503** the voice information to BS **114** via IP network

122 and the BS conveys forward link frames comprising the bearer traffic to mobile station 102 via a forward link traffic channel of air interface 112.

[0061] At some point in time during the course of the communication session, BS 114 receives a handoff trigger message 504 indicating a need or desire to handoff mobile station 102. Such handoff trigger messages are described in greater detail above and will not be further described in detail. In response to receiving the handoff trigger message, BS 114 conveys 506 a message, preferably a HANDOFF REQUIRED message, to MSC 120 that requests a handoff of mobile station 102. In response to receiving the handoff request from BS 114, MSC 120 retrieves HRPD communication session parameters, such as PDSN IP and mobile capability information, from HRPD network 130, and in particular BS 134. However, in a variation of the fourth embodiment, MSC 120 may retrieve the HRPD communication session parameters from any HRPD network BS.

[0062] MSC 120 further obtains an allocation of RF resources from HRPD network 130, including forward link and reverse link traffic channels in air interface 132, for mobile station 102. Preferably, MSC 120, which is in communication with BS 134 in this instance, requests 508 the resources from an HRPD network BS, that is, BS 134, for a handoff of mobile station 102, for example, by conveying a HANDOFF REQUEST to BS 134. In response to receiving the resource request from MSC 120, BS 134 allocates HRPD network resources to the handoff, including a forward link traffic channel and a reverse link traffic channel in air interface 132. BS 134 then conveys 510 an acknowledgement, preferably a HANDOFF REQUEST ACK, to MSC 120 that informs of the allocated resources, including the forward link and reverse link traffic channels allocated in air interface 132. MSC 120 then instructs 512 BS 114 to initiate a handoff of mobile station 102, which instruction further informs of the HRPD network resources allocated by BS 134. Preferably, the handoff instruction comprises a modified version of a HANDOFF COMMAND message, which message is modified to include data fields that identify the allocated HRPD network resources.

[0063] In response to receiving the handoff instruction, BS 114 conveys 514 a message to mobile station 102 that redirects the mobile station to target HRPD network 130 and target BS 134. Preferably, the redirection message comprises a modified version of a Universal Handoff Direction Message (UHDM), which message is modified to include additional data fields that provide HRPD network redirection information, such as identifiers associated with target BS 134 and/or one or more of a control channel and access channel associated with the target BS, and to further include some or all of the HRPD network resources allocated by BS 134. In addition, BS 114 informs 516 MSC 120 that the handoff has commenced, preferably by conveying a HANDOFF COMMENCED message to the MSC.

[0064] In response to receiving the redirection message from BS 114, mobile station 102 identifies the traffic channels allocated to the mobile station in air interface 132. Mobile station 102 then attempts to acquire the identified traffic channels in accordance with well-known channel acquisition techniques. Upon successfully acquiring the traffic channels, mobile station 102 informs 518 BS 134 that the mobile station has successfully acquired the traffic channels allocated at BS 134, preferably by conveying a traffic channel assignment complete message to the BS. In response to being informed that mobile station 102 has successfully acquired the traffic channels allocated at BS 134, BS 134 informs MSC 120 that the handoff is complete, preferably by conveying a HANDOFF COMPLETE message to the MSC. In addition, when BS 134 is not the same HRPD network BS as the HRPD BS that supplied the HRPD communication session parameters to BS 114, BS 134 further performs 522 a Unicast Address Terminal Identifier (UATI) assignment, that is, a unicast address assigned to mobile station 102 per the Address Management Protocol defined in the 3GPP2 C.S0024-0 standard, which standard is hereby incorporated by reference herein

[0065] At some point in time after mobile station 102 has successfully acquired the traffic channels allocated at BS 134, BS 114 releases 524 the resources allocated by the BS to mobile station 102. For example, as described above in greater detail, the release of the resources allocated by BS 114 to mobile station 102 may be timer-based, or the release of the resources may be based upon an exchange of messages, pursuant to known legacy network resource release protocols, between the BS and the mobile station after the mobile station has successfully acquired the traffic channels allocated at BS 134.

[0066] Similar to signal flow diagrams 200, 300, and 400, in response to being informed (at 518) that the mobile station has successfully acquired the traffic channels allocated at BS 134, BS 134 completes the establishment of a bearer path for mobile station 102 in HRPD network 130 by registering the mobile station with PDSN 124 and setting up a new tunnel to the PDSN. Preferably, BS 134 registers the mobile station and sets up a new tunnel by conveying 526 an A11 REGISTRATION REQUEST message to the PDSN. In response to receiving the All REGISTRATION REQUEST, PDSN 124 allocates a connection to BS 134 and informs the BS of the allocated connection, preferably by conveying 528 an All REGISTRATION REPLY to the BS.

[0067] PDSN 124 then instructs 530 BS 114 to request an update of registration information concerning mobile station 102, preferably by conveying a REGISTRATION UPDATE message to the BS that further identifies mobile station 102. In response to receiving the REGISTRATION UPDATE message, BS 114 then requests 534 updated registration information from PDSN 124 for mobile station 102, preferably by conveying a REGISTRATION REQUEST message to PDSN 124. BS 114 may further acknowledge 532 the REGISTRATION UPDATE message, for example by conveying a REGISTRATION ACK message back to the PDSN. In response to receiving the request for updated registration information for mobile station 102, PDSN 124 then informs 536 BS 114 of the successful handoff of the mobile station to BS 134, preferably by conveying a REGISTRATION REPLY message to BS 114. If BS 114 has not yet released the resources allocated by BS 114 to mobile station 102, BS 114 may now release such resources. The establishment of communication session between PDSN 124 and mobile station 102 via BS 134 is then completed 538 in accordance with well-known techniques.

[0068] Thus by use of a redirection message, an encapsulation of an HRPD network message in a legacy network message, or a legacy network message that is dedicated to

providing HRPD traffic channel information, communication system **100** provides for a handoff of hybrid mobile station **102** from legacy, or non-HRPD, network **110** to HRPD network **130**. In various embodiments of the present invention, legacy network **110** receives a handoff trigger and, in response to receiving the handoff trigger, requests an allocation of HRPD network RF resources from HRPD network **130**. In response to the receiving the request, HRPD network **130** allocates RF resources to mobile station **102** and informs legacy network **110** of the allocated RF resources via an HRPD network message. Legacy network **110** then informs mobile station **102** of the allocated HRPD RF resources by encapsulating the HRPD network message in a legacy network message or by use of a legacy network message that is dedicated to providing HRPD traffic channel information. Based on the allocated HRPD RF resources, mobile station **102** then establishes a traffic channel with HRPD network **130**. Subsequent to the establishment of the traffic channel, legacy network **110** releases non-HRPD network RF resources associated with the mobile station. The release may be timer-based or may be based on a message received by legacy network **110** from HRPD base station **134** or from PDSN **124**.

[**0069**] In yet other embodiments of the present invention, in response to receiving the handoff trigger, legacy network **110** may redirect mobile station **102** to HRPD network **130** instead of obtaining an allocation of HRPD RF resources from HRPD network **130** and informing the mobile station of the allocated RF resources. In still another embodiment of the present invention, the handoff may be controlled by MSC **120** instead of by messaging exchanged between the legacy and HRPD base stations **114**, **134**.

[**0070**] Referring now to **FIG. 6**, a signal flow diagram **600** is provided that depicts a handoff executed by communication system **100** in handing off a communication session from HRPD network **130** to legacy network **110** in accordance with a fifth embodiment of the present invention. Signal flow diagram **600** begins when mobile station **102** is actively engaged **602**, **603** in a communication session with a distant party via HRPD network **130**. In order to participate in the communication session via HRPD network **130**, mobile station **102** must already be registered with the HRPD network.

[**0071**] As part of the communication session, mobile station **102** conveys **602** reverse link frames comprising bearer traffic to PDSN **124** via a reverse link traffic channel of air interface **132**, BS **134**, and IP network **122** for routing to the distant party via an external network (not shown). Further, when PDSN **124** receives bearer traffic from the distant party and intended for mobile station **102**, the PDSN routes **603** the voice information to BS **134** via IP network **122** and the BS conveys forward link frames comprising the bearer traffic to mobile station **102** via a forward link traffic channel of air interface **132**. At this point in time, mobile station **102** is further registered with the legacy network and monitors pilot channels associated with base stations other than BS **134**, such as BS **114**.

[**0072**] At some point in time during the course of the communication session, BS **134** receives **604** a handoff trigger message indicating a need or desire to handoff mobile station **102**. Such handoff trigger messages are described in greater detail above and will not be further described in detail. In response to receiving the handoff trigger message, BS **134** conveys **606** a resource request message to the target network **110** via IP network **122**, and via the target network to the target BS, that is, BS **114**. For example, the resource request message may identify the target BS or target network **130** may route the resource request message to the target BS by reference to one or more of the HLR and/or VLR associated with MSC **120**. The resource request message identifies the mobile station, that is, mobile station **102**, requesting the handoff and further requests that the target network **110** allocate resources, including traffic channels, to the identified mobile station.

[**0073**] In response to receiving the resource request message, BS **114** allocates a forward link traffic channel and a reverse link traffic channel in air interface **112** to mobile station **102**. BS **114** then informs **608** BS **134** of the allocated channels by conveying a legacy network resource response message to BS **134**. Preferably, the resource response message includes a handoff direction message, preferably a modified version of a UHDM that is modified to include additional data fields that provide information such as identifiers associated with target BS **114**, the traffic channels allocated by BS **114** to the mobile station, and one or more of a control channel and access channel associated with the BS **114**. For example, the resource response message may comprise a modified version of a legacy network STATUS REQUEST message, which message is modified to include the modified UHDM.

[**0074**] In response to receiving the resource response message, BS **134** informs **610** mobile station **102** of the traffic channels allocated to the mobile station in air interface **132**. Preferably, BS **134** informs mobile station **102** of the allocated traffic channels by parsing the resource response message to retrieve the handoff direction message (for example, the modified UHDM), and then encapsulating the handoff direction message in a HRPD network message, for example, encapsulating the UHDM message as the payload in an HRPD data burst message that is conveyed via a dedicated forward link traffic channel of air interface **132** or encapsulating the UHDM message in a control message that is conveyed via a forward link control channel of air interface **132**. In response to receiving the HRPD network message from BS **134**, mobile station **102**. parses the message, recognizes the UHDM message, and identifies the traffic channels allocated to the mobile station in air interface **132** based on the UHDM message. Mobile station **102** then attempts to acquire the identified traffic channels in accordance with well-known channel acquisition techniques.

[**0075**] Upon successfully acquiring the traffic channels, mobile station **102** informs **612** BS **114** that the mobile station has successfully acquiring the traffic channels allocated at BS **134**, preferably by conveying a handoff complete message. In addition, at some point in time after mobile station **102** has successfully acquired the traffic channels allocated at BS **114**, BS **134** releases (**616**, **619**, **632**) the resources allocated by the BS to mobile station **102**. Similar to the release of resources described herein in greater detail with respect to signal flow diagram **200** and BS **114**, the release of the resources allocated by BS **134** to mobile station **102** may be timer-based (**614**, **616**), that is, based on a release timer, $T_R$, associated with, and located in, BS **134**, may be based on information received from BS **114** (**618**, **619**), such as a RESOURCE RELEASE message conveyed

by BS **114** to BS **134**, or may be based on information conveyed to BS **134** by PDSN **124** (**624**, **628**, **630**).

[**0076**] For example and similar to the release procedure described with respect to signal flow diagram **400** above, when BS **134** informs mobile station **102** of the traffic channels allocated to the mobile station in air interface **132** (at **610**), BS **134** may start release timer $T_R$. The release timer is used by BS **134** to determine when to release the resources, such as RF resources in air interface **132** and signal processing resources in BTS **136**, allocated by the BS to mobile station **102**. As a result, the release timer counts down a quantity of time that is predetermined to be sufficient for a hybrid mobile station, such as mobile station **102**, to successfully acquire traffic channels allocated to the mobile station by a BS other than BS **134** as part of an inter-technology handoff. In response to an expiration of release timer $T_R$, BS **134** releases **616** the resources allocated by the BS to mobile station **102**.

[**0077**] By way of another example, when BS **114** is informed **612** by mobile station **102** that the mobile station has successfully acquiring the allocated traffic channels at the BS, BS **114** then informs **618** BS **134** of a successful handoff, preferably by conveying a RESOURCE RELEASE message to BS **134**. In response to being informed of the successful handoff, BS **134** releases **619** the resources allocated by BS **134** to mobile station **102**.

[**0078**] By way of yet another example, in response to receiving (at **620**) a REGISTRATION REQUEST message from BS **114**, PDSN **124** may convey **624** a REGISTRATION UPDATE message to BS **134**. In response to receiving the REGISTRATION UPDATE message, BS **134** may convey **628** a REGISTRATION REQUEST message to the PDSN. In response to receiving the REGISTRATION REQUEST message, PDSN **124** may convey **630** a REGISTRATION REPLY message to BS **134**. In response to receiving the REGISTRATION REPLY message, BS **134** may release the resources allocated to mobile station **102**. BS **134** may further acknowledge **626** the REGISTRATION UPDATE message, for example by conveying a REGISTRATION ACK message back to the PDSN.

[**0079**] Further, in response to being informed (at **612**) that mobile station **102** has successfully acquired the traffic channels allocated at BS **114**, BS **114** completes the establishment of a bearer path for mobile station **102** in HRPD network **130** by registering the mobile station with PDSN **124** and setting up a new tunnel to the PDSN. Preferably, BS **114** registers the mobile station and sets up a new tunnel by conveying **620** an All REGISTRATION REQUEST message to the PDSN. In response to receiving the A11 REGISTRATION REQUEST, PDSN **124** allocates a connection to BS **114** and informs the BS of the allocated connection, preferably by conveying **622** an A11 REGISTRATION REPLY to the BS. The establishment of communication session between PDSN **124** and mobile station **102** via BS **114** is then completed **634** in accordance with well-known techniques.

[**0080**] In a sixth embodiment of the present invention, a handoff of mobile station **102** from HRPD network **130** to legacy network **110** also may controlled by MSC **120**. Referring now to **FIG. 7**, a signal flow diagram **700** is provided that depicts a handoff executed by communication system **100** in handing off a communication session from HRPD network **130** to legacy network **110** in accordance with the sixth embodiment of the present invention. Signal flow diagram **500** begins when mobile station **102** is actively engaged **702**, **703** in a communication session with a distant party via HRPD network **130**. At this point in time, mobile station **102** is already registered with the HRPD network. As part of the communication session, mobile station **102** conveys **702** reverse link frames comprising bearer traffic to PDSN **124** via a reverse link traffic channel of air interface **132**, BS **134**, and IP network **122** for routing to the distant party via an external network (not shown). Further, when PDSN **124** receives bearer traffic from the distant party and intended for mobile station **102**, the PDSN routes **703** the voice information to BS **134** via IP network **122** and the BS conveys forward link frames comprising the bearer traffic to mobile station **102** via a forward link traffic channel of air interface **132**. At this point in time, mobile station **102** is further registered with the legacy network and monitors pilot channels associated with base stations other than BS **134**, such as BS **114**.

[**0081**] At some point in time during the course of the communication session, BS **134** receives **604** a handoff trigger message indicating a need or desire to handoff mobile station **102**. Such handoff trigger messages are described in greater detail above and will not be further described in detail. In response to receiving the handoff trigger message, BS **134** requests **706** the capabilities of mobile station **102** from the mobile station, such as the radio configurations and data rates supported by the mobile station. Preferably, BS **134** requests the capabilities of mobile station **102** by conveying, to the mobile station, a legacy network STATUS REQUEST message via the 3G1X channel of the forward link of air interface **132**. In response to the capability request, mobile station **102** conveys **708** its capabilities to BS **134**, preferably by conveying a legacy network STATUS RESPONSE message via the 3G1X channel of the reverse link of air interface **132** to the BS.

[**0082**] In response receiving the capabilities of mobile station **102**, BS **134** informs **710** MSC **120** that a handoff of mobile station **102** is required, preferably by conveying a HANDOFF REQUIRED message to the MSC. In response to receiving the handoff required message from BS **134**, MSC **120** retrieves legacy communication session parameters, such as PDSN IP and mobile capability information, from legacy network **110**, and in particular BS **114**. However, in a variation of the sixth embodiment, MSC **120** may retrieve the legacy communication session parameters from any legacy network BS. MSC **120** then requests **712** resources, including forward link and reverse link traffic channels in air interface **112**, from a legacy BS, that is, BS **114**, for a handoff of mobile station **102**. Preferably, the resource request comprises an MSC originated HANDOFF REQUEST as is known in the art.

[**0083**] In response to receiving the resource request from MSC **120**, BS **114** allocates legacy network resources to the handoff, including a forward link traffic channel and a reverse link traffic channel in air interface **112**. BS **114** then conveys **714** an acknowledgement, preferably a HANDOFF REQUEST ACK, to MSC **120** that informs of the allocated resources, including the forward link and reverse link traffic channels allocated in air interface **112**. MSC **120** then instructs **716** BS **134** to initiate a handoff of mobile station **102**, which instruction further informs of the legacy network

resources allocated by BS **114**. Preferably, the handoff instruction comprises a modified version of a HANDOFF COMMAND message, which message is modified to include data fields that identify the allocated legacy network resources.

[**0084**] In response to receiving the handoff instruction, BS **134** conveys **718** a message to mobile station **102** that redirects the mobile station to target HRPD network **130** and target BS **134**. Preferably, the redirection message comprises a modified version of a Handoff Direction Message (HDM) or an Enhanced Channel Assignment Message (ECAM), which messages are modified to include additional data fields that provide legacy network redirection information, such as identifiers associated with target BS **114** and/or one or more of a control channel and access channel associated with the target BS, and to further include some or all of the legacy network resources allocated by BS **114**. In addition, BS **134** informs **720** MSC **120** that the handoff has commenced, preferably by conveying a HANDOFF COMMENCED message to the MSC.

[**0085**] In response to receiving the redirection message from BS **134**, mobile station **102** identifies the traffic channels allocated to the mobile station in air interface **112**. Mobile station **102** then attempts to acquire the identified traffic channels in accordance with well-known channel acquisition techniques. Upon successfully acquiring the traffic channels, mobile station **102** informs **722** BS **114** that the mobile station has successfully acquired the traffic channels allocated at BS **114** and that the handoff is complete, preferably by conveying a BS ACK_ORDER message to the BS. In response to being informed that mobile station **102** has successfully acquired the traffic channels allocated at BS **114**, BS **114** informs MSC **120** that the handoff is complete, preferably by conveying a HANDOFF COMPLETE message to the MSC. In addition, BS **114** completes **728** the establishment of a bearer path for mobile station **102** in legacy network **110** by registering the mobile station with PDSN **124** and setting up a new tunnel to the PDSN. Preferably, BS **114** registers the mobile station and sets up a new tunnel by conveying an A11 REGISTRATION REQUEST message to the PDSN. In response to receiving the Al 1 REGISTRATION REQUEST, PDSN **124** allocates a connection to BS **114** and informs the BS of the allocated connection, preferably by conveying an A11 REGISTRATION REPLY to the BS. The establishment of communication session between PDSN **124** and mobile station **102** via BS **114** is then completed **734** in accordance with well-known techniques.

[**0086**] At some point in time after mobile station **102** has successfully acquired the traffic channels allocated at BS **114**, and preferably after BS **114** further completes **728** the establishment of a bearer path for mobile station **102** in legacy network **110**, BS **134** releases **730**, **732** the resources allocated to mobile station **102** in legacy network **110**. For example, as described above in greater detail, the release **730** of the resources allocated by BS **134** to mobile station **102** may be timer-based or may be based upon an exchange of messages, pursuant to well known HRPD resource release protocols, between BS **134** and the mobile station after the mobile station has successfully acquired the traffic channels allocated at BS **134**.

[**0087**] BS **134** and PDSN **124** further arrange **732** for the release of resources allocated to mobile station **102** between the BS and PDSN in accordance with well known HRPD resource release protocols. For example, in response to receiving an A11 REGISTRATION REQUEST, PDSN **124** may instruct BS **134** to request an update of registration information concerning mobile station **102**, for example, by conveying a REGISTRATION UPDATE message to the BS that further identifies mobile station **102**. In response to receiving the REGISTRATION UPDATE message, BS **134** may request updated registration information from PDSN **124** for mobile station **102**, for example, by conveying a REGISTRATION REQUEST message to PDSN **124**. In response to receiving the request for updated registration information for mobile station **102**, PDSN **124** may inform BS **134** of the successful handoff of the mobile station to BS **114**, for example, by conveying a REGISTRATION REPLY message to BS **134**. If BS **134** has not yet released the resources allocated by BS **114** to mobile station **102**, BS **114** may now release such resources.

[**0088**] Thus communication system **100** further provides for a handoff of hybrid mobile station **102** from HRPD network **130** to legacy, or non-HRPD, network **110** by encapsulating a legacy network message in an HRPD network message or by use of a redirection message. In one embodiment of the present invention, HRPD network **130** receives a handoff trigger and, in response to receiving the handoff trigger, requests an allocation of legacy network RF resources from legacy network **110**. In response to the receiving the request, legacy network **110** allocates RF resources to mobile station **102** and informs HRPD network **130** of the allocated RF resources via a legacy network message. HRPD network **130** then informs mobile station **102** of the allocated legacy network RF resources by encapsulating the legacy network message in an HRPD network message. Based on the allocated HRPD RF resources, mobile station **102** then establishes a traffic channel with legacy network **110**. Subsequent to the establishment of the traffic channel, HRPD network **130** releases HRPD network RF resources associated with the mobile station. The release may be timer-based or may be based on a message received by HRPD network **130** from legacy base station **114** or from PDSN **124**. In another embodiment of the present invention, the handoff may be controlled by MSC **120** and inform mobile station **102** of the allocated legacy network RF resources by use of a redirection message.

[**0089**] While the present invention has been particularly shown and described with reference to particular embodiments thereof, it will be understood by those skilled in the art that various changes may be made and equivalents substituted for elements thereof without departing from the scope of the invention as set forth in the claims below. Furthermore, one of ordinary skill in the art realizes that the components and operations of the transmitting communication device and receiving communication device detailed herein are not intended to be exhaustive but are merely provided to enhance an understanding and appreciation for the inventive principles and advantages of the present invention, rather than to limit in any manner the invention. Accordingly, the specification and figures are to be regarded in an illustrative rather then a restrictive sense, and all such changes and substitutions are intended to be included within the scope of the present invention.

[**0090**] Benefits, other advantages, and solutions to problems have been described above with regard to specific

embodiments. However, the benefits, advantages, solutions to problems, and any element(s) that may cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as a critical, required, or essential feature or element of any or all the claims. As used herein, the terms "comprises,""comprising," or any variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. Furthermore, unless otherwise indicated herein, the use of relational terms, if any, such as first and second, top and bottom, and the like are used solely to distinguish one entity or action from another entity or action without necessarily requiring or implying any actual such relationship or order between such entities or actions.

**1**. A method for a handoff of a hybrid mobile station from a network implementing a non-high rate packet data (non-HRPD) communication technology to a network implementing a high rate packet data (HRPD) communication technology, the method comprising:

conveying forward link bearer traffic to, and receiving reverse link bearer traffic from, the mobile station via radio frequency (RF) resources associated with the non-HRPD network;

receiving, by the non-HRPD network, a handoff trigger;

in response to receiving the handoff trigger, requesting, by the non-HRPD network of the HRPD network, an allocation of HRPD network resources;

in response to the request, receiving by the non-HIRPD network from the HRPD network, an allocation of HRPD network resources;

informing the mobile station, by the non-HRPD network, of the allocated HRPD network resources;

establishing, by the HRPD network, a tic channel with the mobile station based on the allocated HRPD network resources; and

subsequent to the establishment by the HRPD network of a traffic channel with the mobile station, releasing, by the non-HRPD network, the RF resources of the non-HRPD network.

**2**. The method of claim 1, wherein requesting comprises conveying a redirection message to the high rate packet data network.

**3**. The method of claim 1, wherein receiving an allocation of high rate packet data (HRPD) network resources comprises receiving an HRPD network message informing of an allocation of HRPD network resources and wherein informing the mobile station of the allocated HRPD network resources comprises:

encapsulating the HRPD network message informing of an allocation of HRPD network resources in a non-high rate packet data (non-HRPD) network message; and

conveying to the mobile station the non-HRPD network message that encapsulates the HRPD network message.

**4**. The method of claim 1, wherein receiving an allocation of high rate packet data HRPD) network resources comprises receiving an HRPD network message informing of an allocation of HRPD network resources and wherein informing the mobile station of the allocated HRPD network resources comprises conveying the HRPD network message to the mobile station via a channel of the non-HRPD network dedicated to HRPD messaging.

**5**. The method of claim 1, wherein releasing comprises:

when informing the mobile station of the allocated high rate packet data (HRPD) network resources, starting a timer by the non-HRPD network; and

upon expiration of the timer, releasing the non-HRPD radio frequency resources by the non-HRPD network.

**6**. The method of claim 1, wherein releasing comprises:

receiving, by the non-high rate packet data (non-HRPD) network from the high rate packet data network, a message informing of a successful handoff; and

in response to being informed of the successful handoff, releasing the non-HRPD radio frequency resources by the non-HRPD network.

**7**. The method of claim 1, wherein releasing comprises:

receiving, by the non-high rate packet data (non-HRPD) network from a Packet Data Serving Node, a message informing of a successful handoff; and

in response to being informed of the successful handoff, releasing the non-HRPD radio frequency resources by the non-HRPD network.

**8-17**. (canceled)

**18**. A method for a handoff of a hybrid mobile station from a network implementing a high rate packet data (HRPD) communication technology to a network implementing a non-high rate packet data (non-HRPD) communication technology, the method comprising;

conveying forward link bearer traffic to, and receiving reverse link bearer traffic from, the mobile station via radio frequency (RF) resources associated with the HRPD network;

receiving, by the HRPD network, a handoff trigger;

in response to receiving the handoff trigger, requesting, by the HRPD network of the non-HRPD network, an allocation of non-HRPD network resources;

in response to the request, receiving, by the HRPD network from the non-HRPD network, an allocation of non-HRPD network resources;

informing the mobile stion, by the HRPD network, of the allocated non-HRPD network resources;

establishing, by the non-HRPD network, a traffic channel with the mobile station based on the allocated non-HRPD network resources; and

subsequent to the establishment by the non-HRPD network of a traffic channel with the mobile station releasing, by the HRPD network, the RF resources of the HRPD network.

**19**. The method of claim 18, wherein receiving an allocation of non-high rate packet data (non-HRPD) network resources comprises receiving a non-HRPD network message informing of an allocation of non-HRPD network resources and wherein informing the mobile station of the allocated non-HRPD network resources comprises:

encapsulatig the non-HRPD network message informing of an allocation of HRPD network resources in a high rate packet data (HRPD) network message; and

conveying to the mobile station the HRPD network message that encapsulates the non-HRPD network message.

**20**. The method of claim 18, wherein receiving an allocation of non-high rate packet data (non-HRPD) network resources comprises receiving, by the high rate packet data (HRPD) network from the non-HRPD network, a handoff direction message informing of an allocation of non-HRPD network resources and wherein informing the mobile station, by the HRPD network, of the allocated non-HRPD network resources comprises routing the received handoff direction message to the mobile station.

**21**. The method of claim 18, wherein releasing comprises:

when informing the mobile station of the allocated non-high rate packet data (non-HRPD) network resources, starting a timer by the HRPD network; and

upon expiration of the timer, releasing the HRPD radio frequency resources by the HRPD network.

**22**. The method of claim 18, wherein releasing comprises:

receiving, by the high rate packet data (HRPD) network from the non-high rate packet data network, a message informing of a successful handoff; and

in response to being informed of the successful handoff, releasing the HRPD radio frequency resources by the HRPD network.

**23**. The method of claim 18, wherein releasing comprises:

receiving, by the high rate packet data (HRPD) network from a Packet Data Serving Node, a message informing of a successful handoff; and

in response to being informed of the successful handoff, releasing the HRPD radio frequency resources by the HRPD network **24-27**. (canceled)

**28**. A system for a handoff of a hybrid mobile station from a network implementing a non-high rate packet data (non-HRPD) communication technology to a network implementing a high rate packet data (HRPD) communication technology, the system comprising:

a non-HRPD base station configured to convey forward link bearer traffic to and receives reverse link bearer traffic form the mobile station via non-HRPD network radio frequency (RF) resources, receive a handoff trigger; in response to receiving the handoff trigger, request an allocation of HRPD network resources, in response to the request, receive an allocation of HRPD network resources, inform the mobile station of the allocated HRPD network resources, and release the non-HRPD network RF resources subsequent to an establishment of a traffic channel with the mobile station by an HRPD base station; and

an RPD base station in communication with the non-HRPD base station and that is configured to receive the request for allocation of HRPD network resources, in response to receiving the request, convey an allocation of HRPD network resources, and establish a traffic channel with the mobile station based on the allocated HRPD network resources.

**29**. The system of claim 28, wherein the non-high rate packet data (non-HRPD) base station is further configured to request an allocation of high rate packet data (HRPD) network resources by conveying a redirection message to the HRPD base station.

**30**. The system of claim 28, wherein the non-high rate packet data (non-HRPD) base station receives an allocation of high rate packet data (HRPD) network resources by receiving an HRPD network message informing of an allocation of HRPD network resources and wherein the non-HRPD base station is further configured to inform the mobile station of the allocated HRPD network resources by encapsulating the HRPD network message informing of an allocation of HRPD network resources in a non- HRPD network message and conveying to the mobile station the non-HRPD network message that encapsulates the HRPD network message.

**31**. The system of claim 28, wherein the non-high rate packet data (non-HRPD) base station receives an allocation of high rate packet data (HRPD) network resources by recieving an HRPD network message informing of an allocation of HRPD network resources and wherein the non-HRPD base station is further configured to inform the mobile station of the allocated HRPD network resources by conveying the HRPD network message to the mobile station via a channel of the non-HRPD network dedicated to HRPD messaging.

**32**. The system of claim 28, wherein the non-high rate packet data (non-HRPD) base station is further configured to, when informing the mobile station of the allocated high rate packet data (HRPD) network resources, start a timer and to release the non-HRPD radio frequency resources upon expiration of the timer.

**33**. The system of claim 28, wherein the high rate packet data (HRPD) base station is further configured to, in response to establishing a traffic channel with the mobile station, convey a message informing of a successful handoff and wherein the non- high rate packet data (non-HRPD) base station is further configured to receive the message informing of a successful handoff and, in response to receiving the message informing of the successful handoff, release the non-HRPD radio frequency resources.

**34**. The system of claim 28, further comprising a Packet Data Serving Node (PDSN) in communication with each of the non-high rate packet data (non-HRPD) base station and the high rate packet data (HRPD) base station, wherein the HRPD base station is further configured to, in response to establishing a traffic channel with the mobile station, inform the PDSN of a successful handoff, wherein the PDSN is configured to, in response to being informed by the HRPD base station of the successful handoff, inform the non-HRPD base station of the successful handoff, and wherein the non-HRPD base station is further configured to, in response to being informed by the PDSN of the successful handoff, release the non-HRPD radio frequency resources.

**35-44**. (canceled)

**45**. A system for a handoff of a hybrid mobile station from a network implementing a high rate packet data (HRPD) communication technology to a network implementing a non-high rate packet data (non-HRPD) communication technology, the system comprising: an HRPD base station that is configured to convey forward link bearer traffic to, and receive reverse link bearer traffic from, the mobile station via radio frequency (RF) resources associated with the

HRPD network, receive a handoff trigger, in response to receiving the handoff trigger, request an allocation of non-HRPD network resources, in response to the request, receive an allocation of non-HRPD network resources, and inform the mobile station of the allocated non-HRPD network resources, and subsequent to an establishment of a traffic channel of the non-HRPD network with the mobile station, release the RF resources of the HRPD network; and

a non-HRPD base station in communication with the HRPD base station and that is configured to receive a request from the HRPD base station for an allocation of non-HRPD network resources, in response to receiving the request, convey an allocation of non-HRPD network resources to the HRPD base station, and establish a traffic channel with the mobile station based on the allocated HRPD network resources.

**46**. The system of claim 45, wherein the high rate packet data (HRPD) base station is configured to receive an allocation of non-high rate packet data (non-HRPD) network resources by receiving a non-HRPD network message informing of an allocation of non-HRPD network resources and wherein the HRPD base station is further configured to inform the mobile station of the allocated non-HRPD network resources by encapsulating the non-HRPD network message informing of an allocation of HRPD network resources in a high rate packet data (HRPD) network message and conveying to the mobile station the HRPD network message that encapsulates the non-HRPD network message.

**47**. The system of claim 45, wherein the non-high rate packet data (non-HRPD) base station is configured to inform of an allocation of non-HRPD network resources by conveying a handoff direction message informing of the allocation of non-HRPD network resources and wherein the high rate packet data (HRPD) base station is configured to inform the mobile station of the allocated non-HRPD network resources by routing the received handoff direction message to the mobile station.

**48**. The system of claim 45, wherein the high rate packet data (HRPD) base station is configured to release the HRPD radio frequency (RF) resources by, when informing the mobile station of the allocated non-high rate packet data (non-HRPD) network resources, starting a timer and releasing the HRPD RF resources when the timer expires.

**49**. The system of claim 45, wherein the high rate packet data (HRPD) base station is configured to release the HRPD radio frequency (RF) resources by receiving, from the non-high rate packet data network, a message informing of a successful handoff and, in response to being informed of the successful handoff, releasing the HRPD radio frequency resources.

**50**. The system of claim 45, wherein the high rate packet data (HRPD) base station is configured to release the HRPD radio frequency (RF) resources by receiving, from a Packet Data Serving Node, a message informing of a successful handoff and, in response to being informed of the successful handoff, releasing the HRPD radio frequency resources.

**51-54**. (canceled)

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