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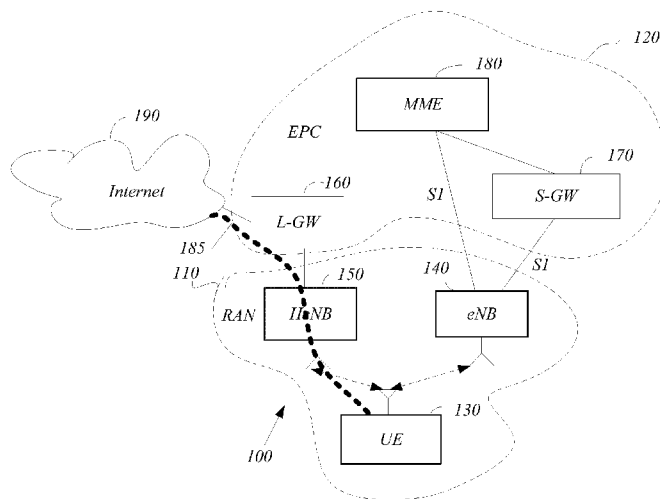


FIG. 1

(57) Abstract: Some demonstrative embodiments include devices, systems and/or methods to establish a connection to the Internet via a local gateway (L-GW) function for a LIPA or a SIPTO@LN. The establishment of the connection to the Internet may be performed, for example, by at least one of an E-RAB SETUP procedure, an INITIAL CONTEXT SETUP procedure, an INITIAL UE MESSAGE procedure or an UPLINK NAS TRANSPORT procedure.



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ESTABLISHMENT OF CONNECTION TO THE INTERNET IN CELLULAR NETWORK

CROSS REFERENCE

[001] This application claims the benefit of and priority from US Provisional Patent
5 Application No. 61/806,821 entitled “Advanced Wireless Communication Systems and
Techniques”, filed March 29, 2013, the entire disclosure of which is incorporated herein by
reference.

BACKGROUND

10 [002] In recent years, Internet usage and data services using the Internet from Smartphones
have dramatically increased and with that, traffic from the Smartphones increased. This abrupt
increase in the traffic has reduced the available bandwidth of mobile operator network. Traffic
offloading is a technology to veer traffic from U-plane directly to the Internet from long term
evolution (LTE) base stations (e.g., an evolved NodeB (eNB)). There are at least two traffic
15 offload technologies: local IP access (LIPA) and selected IP traffic offload (SIPTO).

[003] LIPA is used in LTE 3GPP Rel-10 as a function allowing the User Equipment (UE)
connected via a Home eNodeB (HeNB) to access other IP capable entities in the same
residential/enterprise IP network without the user plane traversing the mobile operator's core
network. The LIPA function is realized by collocating a Local Gateway (L-GW) function, which
20 is a subset of the PDN Gateway function, with the HeNB. The user plane traffic is forwarded
directly between the HeNB and its collocated L-GW function, without traversing the core
network. The LIPA function is specified in 3GPP TS 23.401.

[004] SIPTO is used in a 3GPP Rel-10 as a function allowing an operator to offload certain
types of traffic at a network node residing close to user equipment's (UE's) current location.
25 SIPTO is offloaded at a PDN Gateway function that resides in the mobile operator's core
network.

[005] Thus, there is a need to resolve the problem of available bandwidth in LTE networks by
using traffic offload technology.

BRIEF DESCRIPTION OF THE DRAWINGS

[006] For simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity of presentation. Furthermore, reference numerals may be repeated among the figures to indicate corresponding or analogous elements. The figures are listed below.

[007] Fig. 1 is a schematic block diagram illustration of a cellular system, in accordance with some demonstrative embodiments.

[008] Fig. 2 is a schematic flow-chart illustration of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) setup procedure, in accordance with some demonstrative embodiments.

[009] Fig. 3 is a schematic flow-chart illustration of an initial context setup procedure, in accordance with some demonstrative embodiments.

[0010] Fig. 4 is a schematic flow-chart illustration of an initial user equipment message procedure, in accordance with some demonstrative embodiments.

[0011] Fig. 5 is a schematic flow-chart illustration of an uplink Non Access Stratum (NAS) procedure, in accordance with some demonstrative embodiments.

[0012] Fig. 6 is a schematic block diagram illustration of a Mobility Management Entity (MME), in accordance with some demonstrative embodiments.

[0013] Fig. 7 is a schematic block diagram illustration of a base station in accordance with some demonstrative embodiments.

[0014] Fig. 8 is a schematic illustration of a product, in accordance with some demonstrative embodiments.

DETAILED DESCRIPTION

[0015] In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of some embodiments. However, it will be understood by persons of ordinary skill in the art that some embodiments may be practiced without these specific details. In other instances, well-known methods, procedures, components, units and/or circuits have not been described in detail so as not to obscure the discussion.

[0016] Discussions herein utilizing terms such as, for example, “processing”, “computing”, “calculating”, “determining”, “establishing”, “analyzing”, “checking”, or the like, may refer to operation(s) and/or process(es) of a computer, a computing platform, a computing system, or other electronic computing device, that manipulate and/or transform data represented as physical (e.g., electronic) quantities within the computer’s registers and/or memories into other data similarly represented as physical quantities within the computer’s registers and/or memories or other information storage medium that may store instructions to perform operations and/or processes.

[0017] The terms “plurality” and “a plurality”, as used herein, include, for example, “multiple” or “two or more”. For example, “a plurality of items” includes two or more items.

[0018] References to “one embodiment,” “an embodiment,” “demonstrative embodiment,” “various embodiments,” etc., indicate that the embodiment(s) so described may include a particular feature, structure, or characteristic, but not every embodiment necessarily includes the particular feature, structure, or characteristic. Further, repeated use of the phrase “in one embodiment” does not necessarily refer to the same embodiment, although it may.

[0019] As used herein, unless otherwise specified the use of the ordinal adjectives “first,” “second,” “third,” etc., to describe a common object, merely indicate that different instances of like objects are being referred to, and are not intended to imply that the objects so described must be in a given sequence, either temporally, spatially, in ranking, or in any other manner.

[0020] Some embodiments may be used in conjunction with various devices and systems, for example, a Personal Computer (PC), a desktop computer, a mobile computer, a laptop computer, a notebook computer, a tablet computer, an UltrabookTM computer, a Smartphone device, a server computer, a handheld computer, a handheld device, a Personal Digital Assistant (PDA)

device, a handheld PDA device, an on-board device, an off-board device, a hybrid device, a vehicular device, a non-vehicular device, a mobile or portable device, a consumer device, a non-mobile or non-portable device, a wireless communication station, a wireless communication device, a wireless Access Point (AP), a wired or wireless router, a wired or wireless modem, a video device, an audio device, an audio-video (A/V) device, a wired or wireless network, cellular network, a cellular node, a Multiple Input Multiple Output (MIMO) transceiver or device, a Single Input Multiple Output (SIMO) transceiver or device, a Multiple Input Single Output (MISO) transceiver or device, a device having one or more internal antennas and/or external antennas, Digital Video Broadcast (DVB) devices or systems, multi-standard radio devices or systems, a wired or wireless handheld device, e.g., a Smartphone, a Wireless Application Protocol (WAP) device, vending machines, sell terminals, and the like.

[0021] Some embodiments may be used in conjunction with devices and/or networks operating in accordance with existing Long Term Evolution (LTE) specifications, e.g., *3GPP TS 36.413: 3rd Generation Partnership Project; Technical Specification 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP) (Release 11) on Group Radio Access Network; Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP), 3GPP TS 36.401: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Architecture description*, and/or future versions and/or derivatives thereof, units and/or devices which are part of the above networks, and the like.

[0022] Some embodiments may be used in conjunction with one or more types of wireless communication signals and/or systems, for example, Radio Frequency (RF), Frequency-Division Multiplexing (FDM), Orthogonal FDM (OFDM), Single Carrier Frequency Division Multiple Access (SC-FDMA), Time-Division Multiplexing (TDM), Time-Division Multiple Access (TDMA), Extended TDMA (E-TDMA), General Packet Radio Service (GPRS), extended GPRS, Code-Division Multiple Access (CDMA), Wideband CDMA (WCDMA), CDMA 2000, single-carrier CDMA, multi-carrier CDMA, Multi-Carrier Modulation (MDM), Discrete Multi-Tone (DMT), Bluetooth®, Global Positioning System (GPS), Wireless Fidelity (Wi-Fi), Wi-Max, ZigBee™, Ultra-Wideband (UWB), Global System for Mobile communication (GSM), second

generation (2G), 2.5G, 3G, 3.5G, 4G, Long Term Evolution (LTE) cellular system, LTE advance cellular system, High-Speed Downlink Packet Access (HSDPA), High-Speed Uplink Packet Access (HSUPA), High-Speed Packet Access (HSPA), HSPA+, Single Carrier Radio Transmission Technology (1XRTT), Evolution-Data Optimized (EV-DO), Enhanced Data rates
5 for GSM Evolution (EDGE), and the like. Other embodiments may be used in various other devices, systems and/or networks.

[0023] The phrase “wireless device”, as used herein, includes, for example, a device capable of wireless communication, a communication device capable of wireless communication, a communication station capable of wireless communication, a portable or non-portable device
10 capable of wireless communication, or the like. In some demonstrative embodiments, a wireless device may be or may include a peripheral that is integrated with a computer, or a peripheral that is attached to a computer. In some demonstrative embodiments, the phrase “wireless device” may optionally include a wireless service.

[0024] The term “communicating” as used herein with respect to a wireless communication
15 signal includes transmitting the wireless communication signal and/or receiving the wireless communication signal. For example, a wireless communication unit, which is capable of communicating a wireless communication signal, may include a wireless transmitter to transmit the wireless communication signal to at least one other wireless communication unit, and/or a wireless communication receiver to receive the wireless communication signal from at least one
20 other wireless communication unit.

[0025] Some demonstrative embodiments are described herein with respect to a LTE cellular system. However, other embodiments may be implemented in any other suitable cellular network, e.g., a 3G cellular network, a 4G cellular network, a WiMax cellular network, and the like.

[0026] The term “antenna”, as used herein, may include any suitable configuration, structure
25 and/or arrangement of one or more antenna elements, components, units, assemblies and/or arrays. In some embodiments, the antenna may implement transmit and receive functionalities using separate transmit and receive antenna elements. In some embodiments, the antenna may implement transmit and receive functionalities using common and/or integrated transmit/receive

elements. The antenna may include, for example, a phased array antenna, a single element antenna, a dipole antenna, a set of switched beam antennas, and/or the like.

[0027] The term “cell”, as used herein, may include a combination of network resources, for example, downlink and optionally uplink resources. The resources may be controlled and/or allocated, for example, by a cellular node (“also referred to as a “base station”), or the like. The linking between a carrier frequency of the downlink resources and a carrier frequency of the uplink resources may be indicated in system information transmitted on the downlink resources.

[0028] The term S1, as used herein, may identify a logical interface between an eNB and an Evolved Packet Core (EPC), providing an interconnection point between the Evolved Universal Terrestrial Radio Access Network (E-UTRAN) and the EPC. It is also considered as a reference point.

[0029] The term E-UTRAN Radio Access Bearer (E-RAB), as used herein, may identify a concatenation of an S1 Bearer and the corresponding Data Radio Bearer. When an E-RAB exists, there is a one-to-one mapping between this E-RAB and an EPS bearer of the Non Access Stratum (NAS).

[0030] The term X2, as used herein, may identify a logical interface between two eNBs. Whilst logically representing a point-to-point link between eNBs, the physical realization need not be a point-to-point link.

[0031] Reference is now made to Fig. 1, which schematically illustrates a block diagram of a cellular system 100, in accordance with some demonstrative embodiments. For example, cellular system 100 may include a 4th generation cellular system such as, for example, a WiMAX cellular system, a long term evolution (LTE) or LTE advance cellular system for example, LTE advance may include releases 10, 11, 12 or above.

[0032] In some demonstrative embodiments, cellular system 100 may be 4th, 5th, 6th generation or higher generation cellular system. For example, cellular system 100 may include LTE, LTE advance, WiMAX or the like. According to one embodiment, cellular system 100 may include a radio access network (RAN) 110 and an EPC 120, if desired. For example, RAN 110 may include a user equipment (UE) 130, a base station 140 e.g., an eNB, and a base station 150 e.g., a

Home eNB (HeNB), if desired. EPC 120 may include a Local Gateway (L-GW) 160, a Serving Gateway (S-GW) 170 and a Mobility Management Entity (MME) 180.

[0033] In some demonstrative embodiments, for example, UE 130 may send a request to HeNB 150 and/or to eNB 140 to be connected to Internet 190. eNB 140 may send to MME 180 messages via S1 application protocol (S1AP) procedures. The message may include a request to establish the connection to the Internet 190 or to the local network. For example, MME 180 may establish connection to a local network via a L-GW function for a local IP access (LIPA), and to Internet 190 via a Selected IP traffic offload at a local network (SIPTO@LN), if desired.

[0034] According to one exemplary embodiment, after the establishment of the connection to the Internet 190, UE 130 may be connected to Internet 190 via HeNB 150 and/or eNB 140 and L-GW 160 as indicted by dotted line 185.

[0035] In some demonstrative embodiments, UE 130 may include, for example, a mobile computer, a laptop computer, a notebook computer, an UltrabookTM computer, a tablet computer, a mobile internet device, a handheld computer, a handheld device, a storage device, a PDA device, a handheld PDA device, an on-board device, an off-board device, a hybrid device (e.g., combining cellular phone functionalities with PDA device functionalities), a consumer device, a vehicular device, a non-vehicular device, a mobile or portable device, a mobile phone, a cellular telephone, a PCS device, a mobile or portable GPS device, a DVB device, a relatively small computing device, a non-desktop computer, a “Carry Small Live Large” (CSLL) device, an Ultra Mobile Device (UMD), an Ultra Mobile PC (UMPC), a Mobile Internet Device (MID), an “Origami” device or computing device, a video device, an audio device, an A/V device, a gaming device, a media player, a Smartphone, or the like.

[0036] According to some exemplary embodiments, MME 180 may be configured to establish a connection to the Internet 190 via a L-GW function for a LIPA or a SIPTO@LN. For example, MME 180 may be connected to eNB 140 via a S1 logical interface, if desired. The S1 logical interface may include S1AP procedures, and MME 180 may establish the connection to Internet 190 by at least one of an E-RAB SETUP procedure, and an INITIAL CONTEXT SETUP procedure, although it should be understood that embodiments are not limited to the above-described S1AP procedures.

[0037] According to some exemplary embodiments, the SIPTO function may allow for traffic offload even closer to the network edge. A node at which the offload is performed with SIPTO@LN is referred to as Local Gateway (L-GW), which is for example, a subset of the PDN Gateway function. The L-GW resides in the “local network”, the latter vaguely referring to an IP network that is accessible at the RAN level.

[0038] According to some embodiments, the SIPTO@LN may be implemented with a stand-alone L-GW, and/or with collocated L-GW. For example, L-GW function may be collocated with the HeNB, and the SIPTO@LN function may be invoked by the operator wishing to offload low-value traffic (e.g. Internet traffic), without notifying the user explicitly, although the scope of some embodiments is not limited to this example.

[0039] Reference is now made to Fig. 2, a schematic flow-chart illustration of an E-RAB setup procedure 200, in accordance with some demonstrative embodiments. According to some embodiments, the E-RAB setup procedure 200 may be configured, for example, in accordance with 3GPP technical specification (TS) *TS 36.413: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)*. The E-RAB Setup procedure 200 may be configured to assign resources on Uu and S1 for one or several E-RABs and to setup corresponding Data Radio Bearers for a given UE. The E-RAB Setup procedure may use UE-associated signaling.

[0040] According to some exemplary embodiments, an MME 220 may initiate the procedure by sending an E-RAB SETUP REQUEST message to an eNB 210. For example, an E-RAB SETUP REQUEST 230 message may include the information required by eNB 210 to build the E-RAB configuration including at least one E-RAB, and for each E-RAB to include an *E-RAB to be Setup Item* information element (IE).

[0041] Upon reception of the E-RAB SETUP REQUEST message 230, and if resources are available for the requested configuration, eNB 210 may execute the requested E-RAB configuration. For each E-RAB and based on the *E-RAB level quality of service (QoS) parameters* IE, eNB 210 may establish a Data Radio Bearer, and allocate the required resources on Uu. eNB 210 may pass the *NAS-PDU* IE and the value contained in the *E-RAB ID* IE received for the E-RAB for each established Data Radio Bearer to the UE. The eNB 210 may not send the

NAS PDUs associated to failed Data radio bearers to the UE. The eNB 210 may allocate the required resources on S1 for the E-RABs requested to be established.

[0042] According to some embodiments, MME 220 may send to eNB 210 an E-RAB setup request message 230, which may include a correlation ID information element (IE), wherein eNB 210 may be configured with L-GW function for LIPA operation or SIPTO@LN operation, and configured to use the information included in the correlation ID for LIPA operation or SIPTO@LN operation for a concerned E-RAB. For example, the correlation ID IE may inform eNB 210 which bearers may be routed to the L-GW. The correlation ID IE may identify the L-GW, if desired. eNB 210 may send an E-RAB SETUP RESPONSE message 240, which may include a result for an at least one requested E-RAB, although the scope of some embodiments is not limited in this respect.

[0043] According to embodiments, Table 1 below describes an exemplary content of E-RAB SETUP REQUEST message 230, if desired:

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
UE Aggregate Maximum Bit Rate	O		9.2.1.20		YES	reject
E-RAB to be Setup List		1			YES	reject
>E-RAB To Be Setup Item IEs		1 .. <maxno of E- RABs>			EACH	reject
>>E-RAB ID	M		9.2.1.2		-	
>>E-RAB	M		9.2.1.15	Includes	-	

Level QoS Parameters				necessary QoS parameters.		
>>Transport Layer Address	M		9.2.2.1		-	
>>GTP-TEID	M		9.2.2.2	EPC TEID.	-	
>>NAS-PDU	M		9.2.3.5		-	
>>Correlation ID	O		9.2.1.80		YES	ignore
>>LIPA-SIPTO Flag	O		9.2.1.90		YES	ignore

Range bound	Explanation
maxnoofE-RABs	Maximum no. of E-RAB allowed towards one UE, the maximum value is 256.

Table 1

[0044] For example, the LIPA-SIPTO Flag of the E-RAB setup request function may configure the eNB to establish the connection to the Internet via the L-GW function for LIPA or SIPTO@LN.

[0045] According to some embodiments, an E-RAB SETUP REQUEST function may include, for example the following:

```
-- *****
```

```
--
10 -- E-RAB Setup Request
--
```

```
-- *****
```

```
15 E-RABSetupRequest ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container  { {E-RABSetupRequestIEs} },
    ...
}
```

```
20 E-RABSetupRequestIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID          CRITICALITY reject  TYPE MME-UE-S1AP-ID
      PRESENCE mandatory }|
    { ID id-eNB-UE-S1AP-ID          CRITICALITY reject  TYPE ENB-UE-S1AP-ID
      PRESENCE mandatory }|
    { ID id-uEAggregateMaximumBitrate  CRITICALITY reject  TYPE UEAggregateMaximumBitrate
25 PRESENCE optional   }|
```

```

    { ID id-E-RABToBeSetupListBearerSReq CRITICALITY reject TYPE E-
RABToBeSetupListBearerSReq PRESENCE mandatory },

```

```

    ...
}

```

5 E-RABToBeSetupListBearerSReq ::= SEQUENCE (SIZE(1.. maxnoofE-RABs)) OF ProtocolIE-SingleContainer
 { {E-RABToBeSetupItemBearerSReqIEs} }

```

E-RABToBeSetupItemBearerSReqIEs S1AP-PROTOCOL-IES ::= {
    { ID id-E-RABToBeSetupItemBearerSReq CRITICALITY reject TYPE E-
RABToBeSetupItemBearerSReq PRESENCE mandatory },

```

```

    ...
}

```

15 E-RABToBeSetupItemBearerSReq ::= SEQUENCE {
 e-RAB-ID E-RAB-ID,
 e-RABLevelQoSParameters E-RABLevelQoSParameters,
 transportLayerAddress TransportLayerAddress,
 gTP-TEID GTP-TEID,
 nAS-PDU NAS-PDU,
 iE-Extensions ProtocolExtensionContainer { {E-RABToBeSetupItemBearerSReqExtIEs}
 } OPTIONAL,
 ...
 }

20
 25

```

E-RABToBeSetupItemBearerSReqExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    { ID id-Correlation-ID CRITICALITY ignore EXTENSION Correlation-ID PRESENCE
optional},
    { ID id-LIPA-SIPTO-Flag CRITICALITY ignore EXTENSION LIPA-SIPTO-Flag PRESENCE
optional},
    ...
}

```

30
 35 [0046] Reference is now made to Fig. 3 which is a schematic flow-chart illustration of an
 INITIAL CONTEXT SETUP procedure 300, in accordance with some demonstrative
 embodiments. According to some embodiments, the INITIAL CONTEXT SETUP procedure 300
 may be configured to establish the necessary overall initial UE Context including E-RAB
 context, a Security Key, a Handover Restriction List, an UE Radio capability, an UE Security
 Capabilities, and the like. The INITIAL CONTEXT SETUP procedure 300 may use E-associated
 40 signaling, if desired.

[0047] For example, an MME 320 may send to an eNB 310, which is configured with L-GW
 function for LIPA operation or SIPTO@LN operation and further configured to use information
 included in the correlation ID for LIPA operation or SIPTO@LN operation for a concerned E-
 RAB, an INITIAL CONTEXT SETUP REQUEST message 330, which may include an “E-RAB
 45 to be Setup Item” IE that includes the correlation ID IE. For example, the correlation ID IE may
 inform the eNB which bearers should be routed to L-GW. In addition, the correlation ID IE may

identify the L-GW. MME 320 may receive an INITIAL CONTEXT SETUP RESPONSE message 340 from eNB 310.

[0048] According to some embodiments, Table 2 below describes an exemplary content of the INITIAL CONTEXT REQUEST message, if desired:

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
UE Aggregate Maximum Bit Rate	M		9.2.1.20		YES	reject
E-RAB to Be Setup List		1			YES	reject
>E-RAB to Be Setup Item IEs		1 .. <maxnoofE-RABs>			EACH	reject
>>E-RAB ID	M		9.2.1.2		-	
>>E-RAB Level QoS Parameters	M		9.2.1.15	Includes necessary QoS parameters.	-	
>>Transport Layer Address	M		9.2.2.1		-	
>>GTP-TEID	M		9.2.2.2		-	
>>NAS-PDU	O		9.2.3.5		-	
>>Correlation ID	O		9.2.1.80		YES	ignore
>>LIPA-SIPTO Flag	O		9.2.1.90		YES	ignore

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
UE Security Capabilities	M		9.2.1.40		YES	reject
Security Key	M		9.2.1.41	The KeNB is provided after the key-generation in the MME, see TS 33.401 [15].	YES	Reject
Trace Activation	O		9.2.1.4		YES	Ignore
Handover Restriction List	O		9.2.1.22		YES	Ignore
UE Radio Capability	O		9.2.1.27		YES	Ignore
Subscriber Profile ID for RAT/Frequency priority	O		9.2.1.39		YES	Ignore
CS Fallback Indicator	O		9.2.3.21		YES	Reject
SRVCC Operation Possible	O		9.2.1.58		YES	Ignore
CSG Membership Status	O		9.2.1.73		YES	Ignore
Registered LAI	O		9.2.3.1		YES	Ignore
GUMMEI	O		9.2.3.9	This IE indicates the MME serving the UE.	YES	Ignore
MME UE S1AP ID 2	O		9.2.3.3	This IE indicates the MME UE S1AP ID assigned by the MME.	YES	Ignore
Management Based MDT Allowed	O		9.2.1.83		YES	Ignore
Management Based MDT PLMN List	O		MDT PLMN List 9.2.1.89		YES	Ignore

Table 2

[0049] For example, the LIPA-SIPTO Flag of the E-RAB setup request function may configure the eNB to establish the connection to the Internet via the L-GW function for LIPA or SIPTO@LN.

- 5 [0050] According to some embodiments, the INITIAL CONTEXT SETUP REQUEST function may include, for example, the following:

```
-- *****
--
-- Initial Context Setup Request
--
-- *****
```

```
InitialContextSetupRequest ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container  { {InitialContextSetupRequestIEs} },
    ...
}
```

```

InitialContextSetupRequestIEs S1AP-PROTOCOL-IES ::= {
  { ID id-MME-UE-S1AP-ID          CRITICALITY reject  TYPE MME-UE-S1AP-ID
    PRESENCE mandatory}|
  { ID id-eNB-UE-S1AP-ID          CRITICALITY reject  TYPE ENB-UE-S1AP-ID
5    PRESENCE mandatory}|
  { ID id-uEAggregateMaximumBitrate CRITICALITY reject  TYPE UEAggregateMaximumBitrate
    PRESENCE mandatory}|
  { ID id-E-RABToBeSetupListCtxtSUReq CRITICALITY reject  TYPE E-RABToBeSetupListCtxtSUReq
10    PRESENCE mandatory}|
  { ID id-UESecurityCapabilities    CRITICALITY reject  TYPE UESecurityCapabilities
    PRESENCE mandatory}|
  { ID id-SecurityKey              CRITICALITY reject  TYPE SecurityKey
    PRESENCE mandatory}|
  { ID id-TraceActivation          CRITICALITY ignore  TYPE TraceActivation
15    PRESENCE optional}|
  { ID id-HandoverRestrictionList  CRITICALITY ignore  TYPE HandoverRestrictionList
    PRESENCE optional}|
  { ID id-UERadioCapability        CRITICALITY ignore  TYPE UERadioCapability
    PRESENCE optional}|
20  { ID id-SubscriberProfileIDforRFP CRITICALITY ignore  TYPE SubscriberProfileIDforRFP
    PRESENCE optional}|
  { ID id-CSFallbackIndicator      CRITICALITY reject  TYPE CSFallbackIndicator
    PRESENCE optional}|
  { ID id-SRVCCOperationPossible   CRITICALITY ignore  TYPE SRVCCOperationPossible
25    PRESENCE optional}|
  { ID id-CSGMembershipStatus      CRITICALITY ignore  TYPE CSGMembershipStatus
    PRESENCE optional}|
  { ID id-RegisteredLAI           CRITICALITY ignore  TYPE LAI
    PRESENCE optional}|
30  { ID id-GUMMEI-ID               CRITICALITY ignore  TYPE GUMMEI
    PRESENCE optional}|
  { ID id-MME-UE-S1AP-ID-2        CRITICALITY ignore  TYPE MME-UE-S1AP-ID
    PRESENCE optional}|
  { ID id-ManagementBasedMDTAllowed CRITICALITY ignore  TYPE ManagementBasedMDTAllowed
35    PRESENCE optional}|
  { ID id-ManagementBasedMDTPLMNList CRITICALITY ignore  TYPE MDTPLMNList
    PRESENCE optional},
  ...
40 }

E-RABToBeSetupListCtxtSUReq ::= SEQUENCE (SIZE(1.. maxnoofE-RABs)) OF ProtocolIE-SingleContainer {
45 {E-RABToBeSetupItemCtxtSUReqIEs} }

E-RABToBeSetupItemCtxtSUReqIEs S1AP-PROTOCOL-IES ::= {
  { ID id-E-RABToBeSetupItemCtxtSUReq CRITICALITY reject  TYPE E-RABToBeSetupItemCtxtSUReq
    PRESENCE mandatory },
50  ...
}

E-RABToBeSetupItemCtxtSUReq ::= SEQUENCE {
55  e-RAB-ID          E-RAB-ID,
  e-RABLevelQoSParameters E-RABLevelQoSParameters,
  transportLayerAddress  TransportLayerAddress,

```

gTP-TEID
 nAS-PDU
 iE-Extensions
 OPTIONAL,
 5 ...
 }

GTP-TEID,
 NAS-PDU OPTIONAL,
 ProtocolExtensionContainer { {E-RABToBeSetupItemCtxtSReqExtIEs} }

10 E-RABToBeSetupItemCtxtSReqExtIEs S1AP-PROTOCOL-EXTENSION ::= {
 { ID id-Correlation-ID CRITICALITY ignore EXTENSION Correlation-ID PRESENCE
 optional},
 { ID id-LIPA-SIPTO-Flag CRITICALITY ignore EXTENTION LIPA-SIPTO-Flag PRESENCE
 optional},
 ...
 15 }

[0051] Reference is now made to Fig. 4, which is a schematic flow-chart illustration of an INITIAL UE MESSAGE procedure 400, in accordance with some demonstrative embodiments. In some embodiments, an MME 420 may receive from an eNB 410, which may be configured with L-GW function for SIPTO@LN operation, an INITIAL UE MESSAGE message 430, which may include a L-GW transport layer address IE and local network ID IE. For example, the L-GW transport layer address IE and the local network ID IE may be configured to provide information to MME 420 about eNB 410 support of LIPA or SIPTO@LN and to learn the L-GW address or local network ID of eNB 410, if desired.

[0052] According to some embodiments, Table 3 below describes an exemplary content of the INITIAL UE MESSAGE message 430, if desired

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
eNB UE S1AP ID	M		9.2.3.4		YES	reject
NAS-PDU	M		9.2.3.5		YES	reject
TAI	M		9.2.3.16	Indicating the Tracking Area from which the UE has sent the NAS message.	YES	reject
E-UTRAN CGI	M		9.2.1.38	Indicating the E-UTRAN CGI from which the UE has sent the NAS message.	YES	ignore
RRC Establishment Cause	M		9.2.1.3a		YES	Ignore
S-TMSI	O		9.2.3.6		YES	reject
CSG Id	O		9.2.1.62		YES	reject
GUMMEI	O		9.2.3.9		YES	reject
Cell Access Mode	O		9.2.1.74		YES	reject

LIPA GW Transport Layer Address	O		Transport Layer Address 9.2.2.1	Indicating LIPA GW Transport Layer Address if the GW is collocated with eNB.	YES	ignore
Relay Node Indicator	O		9.2.1.79	Indicating a relay node.	YES	reject
GUMMEI Type	O		ENUMERATED (native, mapped, ...)		YES	reject
Tunnel Information for BBF	O		Tunnel Information 9.2.2.3	Indicating HeNB's Local IP Address assigned by the broadband access provider, UDP port Number.	YES	ignore
SIPTO L-GW Transport Layer Address	O		Transport Layer Address 9.2.2.1	Indicating SIPTO GW Transport Layer Address if the GW is collocated with eNB.	YES	ignore
Local Network ID	O			Indicating Local (H)eNB Network ID if L-GW is standalone	YES	ignore

Table 3

[0053] According to one demonstrative embodiment, the L-GW may be co-located with the eNB. According to this embodiment the INITIAL UE MESSAGE message may provide MME
5 420 with the SIPTO L-GW Transport layer address and/or SIPTO L-GW Transport layer address.

[0054] According to another demonstrative embodiment, the L-GW may be separate from the eNB. According to this embodiment, the INITIAL UE MESSAGE message may provide MME
10 420 with the local network ID of the HeNB and/or the eNB, although, the scope of the present embodiment is not limited to this example.

[0055] According to some embodiments, an example of an INITIAL UE MESSAGE function, may include, for example, the following:

```
-- *****
--
15 -- INITIAL UE MESSAGE
--
-- *****
```

```
InitialUEMessage ::= SEQUENCE {
    protocolIEs      ProtocolIE-Container  {{InitialUEMessage-IEs}},
    ...
}
```

```
InitialUEMessage-IEs S1AP-PROTOCOL-IES ::= {
```

```

    { ID id-eNB-UE-S1AP-ID          CRITICALITY reject  TYPE ENB-UE-S1AP-ID
  PRESENCE mandatory} |
    { ID id-NAS-PDU                  CRITICALITY reject  TYPE NAS-PDU
  PRESENCE mandatory} |
5   { ID id-TAI                      CRITICALITY reject  TYPE TAI
  PRESENCE mandatory} |
    { ID id-EUTRAN-CGI              CRITICALITY ignore  TYPE EUTRAN-CGI
  PRESENCE mandatory} |
10  { ID id-RRC-Establishment-Cause  CRITICALITY ignore  TYPE RRC-Establishment-Cause
  PRESENCE mandatory} |
    { ID id-S-TMSI                  CRITICALITY reject  TYPE S-TMSI
  PRESENCE optional} |
    { ID id-CSG-Id                  CRITICALITY reject  TYPE CSG-Id
  PRESENCE optional} |
15  { ID id-GUMMEI-ID               CRITICALITY reject  TYPE GUMMEI
  PRESENCE optional} |
    { ID id-CellAccessMode          CRITICALITY reject  TYPE CellAccessMode
  PRESENCE optional} |
    { ID id-LIPA-GW-TransportLayerAddressCRITICALITY ignore  TYPE TransportLayerAddress
20  PRESENCE optional} |
    { ID id-RelayNode-Indicator      CRITICALITY reject  TYPE RelayNode-Indicator
  PRESENCE optional} |
    { ID id-GUMMEIType              CRITICALITY reject  TYPE GUMMEIType
  PRESENCE optional} |
25  -- Extension for Release 11 to support BBAI --
    { ID id-Tunnel-Information-for-BBF CRITICALITY ignore  TYPE TunnelInformation
  PRESENCE optional} |
    { ID id-SIPTO-L-GW-TransportLayerAddress CRITICALITY ignore  TYPE TransportLayerAddress
  PRESENCE optional} |
30  { ID id-LocalNetworkID           CRITICALITY ignore  TYPE LocalNetworkID
  PRESENCE optional},
    ...
  }

```

35

[0056] Reference is now made to Fig. 5 which is a schematic flow-chart illustration of an UPLINK NON ACCESS STRATUM (NAS) TRANSPORT procedure 500, in accordance with some demonstrative embodiments. In some demonstrative embodiments, an MME 520 may receive from an eNB 510, which is configured with L-GW function for SIPTO@LN or LIPA

40 operation, an UPLINK NAS TRANSPORT 530 message, which may include a L-GW transport layer address IE local network ID IE. For example, L-GW transport layer address IE local network ID IE may include information about whether eNB 510 supports LIPA and/or SIPTO@LN, and the L-GW address and/or the local network ID of the eNB, if desired.

[0057] According to some embodiments, Table 4 below describes an exemplary content of the

45 UPLINK NAS TRANSPORT message 530, if desired:

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
NAS-PDU	M		9.2.3.5		YES	reject
E-UTRAN CGI	M		9.2.1.38		YES	ignore
TAI	M		9.2.3.16		YES	ignore
LIPA GW Transport Layer Address	O		Transport Layer Address 9.2.2.1	Indicating LIPA GW Transport Layer Address if the GW is collocated with eNB.	YES	ignore
SIPTO L-GW Transport Layer Address	O		Transport Layer Address 9.2.2.1	Indicating SIPTO GW Transport Layer Address if the GW is collocated with eNB.	YES	ignore
Local Network ID	O			Indicating Local (H)eNB Network ID if L-GW is standalone	YES	ignore

Table 4

[0058] According to one demonstrative embodiment, the L-GW may be co-located with the eNB. According to this embodiment, the UPLINK NAS TRANSPORT message may provide MME 420 with the SIPTO L-GW Transport layer address and/or SIPTO L-GW Transport layer address.

[0059] According to another demonstrative embodiment, the L-GW may be separate from the eNB. According to this embodiment, the UPLINK NAS TRANSPORT message may provide MME 420 with the local network ID of the HeNB and/or the eNB, although, the scope of the present embodiment is not limited to this example.

[0060] According to some embodiments, an UPLINK NAS TRANSPORT function may include the following:

```
-- *****
```

```
--
```

```
-- UPLINK NAS TRANSPORT
```

```
--
```

```
-- *****
```

```
UplinkNASTransport ::= SEQUENCE {
    protocolIEs      ProtocolIE-Container  {{UplinkNASTransport-IEs}},
    ...
}
```

```
UplinkNASTransport-IEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID          CRITICALITY reject  TYPE MME-UE-S1AP-ID
    PRESENCE mandatory} |
```

```

5      { ID id-eNB-UE-S1AP-ID          CRITICALITY reject  TYPE ENB-UE-S1AP-ID
      PRESENCE mandatory} |
      { ID id-NAS-PDU                  CRITICALITY reject  TYPE NAS-PDU
      PRESENCE mandatory} |
10     { ID id-EUTRAN-CGI              CRITICALITY ignore  TYPE EUTRAN-CGI
      PRESENCE mandatory} |
      { ID id-TAI                      CRITICALITY ignore  TYPE TAI
      PRESENCE mandatory} |
      { ID id-GW-TransportLayerAddress CRITICALITY ignore  TYPE TransportLayerAddress
10     PRESENCE optional}|
      { ID id-SIPTO-L-GW-TransportLayerAddress CRITICALITY ignore  TYPE TransportLayerAddress
      PRESENCE optional} |
      { ID id-LocalNetworkID           CRITICALITY ignore  TYPE LocalNetworkID
15     PRESENCE optional},
      ...
  }
```

[0061] Reference is now made to Fig. 6, which is a schematic block diagram illustration of a MME 600, in accordance with some demonstrative embodiments.

[0062] In some demonstrative embodiments, MME 600 may include a memory 610, a processor circuitry 620 and a L-GW function 630.

[0063] For example, memory 610 may be a FLASH memory, SSD, a hard drive, a mass storage device or the like. In some embodiments, for example, memory 610 may store instructions and data, which may be used by processor circuitry 620. Memory 610 may store an UPLINK NAS TRANSPORT procedure 612, an E-RAB SETUP procedure 614, an INITIAL CONTEXT SETUP procedure 616 and/or an INITIAL UE MESSAGE procedure 618.

[0064] In operation and according to some embodiments, processor circuitry 620 may be configured to establish the connection to the Internet or local network via a local gateway (L-GW) function 630 for a LIPA and/or a SIPTO@LN. MME 600 may use one or more S1 procedures to establish the connection to the Internet. For example, MME 600 may use one or more of an E-RAB SETUP procedure 614, and an INITIAL CONTEXT SETUP procedure 616, to establish a connection of an UE to the Internet, if desired.

[0065] For example, when using E-RAB SETUP procedure 614, processor circuitry 620 may send to an eNB an E-RAB SETUP REQUEST message, which may include a correlation ID information element (IE), wherein the eNB is configured with L-GW function for LIPA operation or SIPTO@LN operation and configured to use information included in the correlation ID for LIPA operation or SIPTO@LN operation for a concerned E-RAB. For example, the eNB may use this information to understand which bearers may be routed to the L-GW. Processor

circuitry 620 may be configured to receive an E-RAB SETUP RESPONSE message from the eNB, which may include a result for an at least one requested E-RAB, although the scope of some embodiments is not limited in this respect.

[0066] In a further example, when using INITIAL CONTEXT SETUP REQUEST procedure 616, processor circuitry 620 may send to eNB an INITIAL CONTEXT SETUP REQUEST message that includes a correlation ID IE, wherein the eNB is configured with L-GW function for LIPA operation or SIPTO@LN operation and configured to use information included in the correlation ID for LIPA operation or SIPTO@LN operation for a concerned E-RAB. For example, the eNB may use this information to understand which bearers may be routed to the L-GW. Processor circuitry 620 may be configured to receive an INITIAL CONTEXT SETUP RESPONSE message from the eNB E-RAB.

[0067] When operating with some embodiments and employing INITIAL UE MESSAGE procedure 618, processor circuitry 620 may receive from the eNB an INITIAL UE MESSAGE message that includes a GW transport layer address IE, wherein the eNB is configured with L-GW function for SIPTO@LN operation. Furthermore, when employing UPLINK NAS TRANSPORT procedure, processor circuitry 620 may receive from the eNB an UPLINK NAS TRANSPORT message that include a GW transport layer address IE, wherein the eNB is configured with L-GW function for SIPTO@LN operation, although some embodiments are not limited to this example.

[0068] For example, the MME may use the information to support eNB that supports LIPA and/or SIPTO@LN, and may use the L-GW address and/or a local network ID, which may be provided by the GW transport layer address IE, if desired.

[0069] Reference is made to Fig. 7, which is a schematic block diagram illustration of a base station 700, in accordance with some demonstrative embodiments. In some demonstrative embodiments, base station 700 may include an eNB, a HeNodeB, or the like. Base station 700, for example eNB, may include a memory 710, a processor circuitry 720, a L-GW function 730, at least one transmitter (TX) 740, at least one receiver (RX) 750, and an at least one antenna 760.

[0070] For example, base station 700 may be implemented as part of an LTE cellular system and may include an eNodeB, a Home eNodeB, a femto cell, a pico cell, a cellular node, or the like. It should be understood that only some of the base station functionalities and blocks are

present. Processor circuitry 720 may include a communication processor to control the downlink-uplink traffic and a software and/or hardware modules to establish a connection of a UE to the internet or local network via a L-GW using SIPTO@LN procedures, if desired.

[0071] In some demonstrative embodiments, the at least one antenna 760 may include any type of antennas suitable for transmitting and/or receiving wireless communication signals, blocks, frames, transmission streams, packets, messages and/or data. For example, the at least one antenna 760 may include any suitable configuration, structure and/or arrangement of one or more antenna elements, components, units, assemblies and/or arrays. For example, antennas 760 may include an antenna array, an antenna tower, a phased array antenna, a dipole antenna, a single element antenna, a set of switched beam antennas, and/or the like.

[0072] In some demonstrative embodiments, the at least one transmitter 740 may transmit signals via a downlink modulated according to OFDM modulation scheme, and the at least one receiver 750 may receive signals from an uplink modulated according to SC-FDMA modulation scheme. According to some exemplary embodiments, the at least one transmitter 740 and the at least one receiver 750 may be controlled by a multiple input multiple output (MIMO) module and may be configured to generate a beamforming, if desired.

[0073] For example, memory 710 may be a FLASH memory, SSD, a hard drive, a mass storage device or the like. In some embodiments, for example, memory 710 may store instructions and data, which may be used by processor circuitry 720. Memory 710 may store an UPLINK NAS TRANSPORT procedure 712, an E-RAB SETUP procedure 714, an INITIAL CONTEXT SETUP procedure 716, and/or an INITIAL UE MESSAGE procedure 718.

[0074] In operation and according to some embodiments, processor circuitry 720 may be configured to establish the connection to the Internet or local network via a L-GW function for LIPA or SIPTO@LN, wherein connection establishment to the Internet or local network involves at least one INITIAL UE MESSAGE procedure 718 or UPLINK NAS TRANSPORT procedure 712, if desired.

[0075] According to one example embodiment, base station 700 may include an eNB and receiver 750 may be configured to receive an E-RAB SETUP REQUEST message that includes a correlation ID information element (IE). The eNB may be configured with L-GW function 730

for LIPA operation and/or SIPTO@LN operation. In addition, the eNB may be configured to use information included in the correlation ID for LIPA operation and/or SIPTO@LN operation for a concerned E-RAB. Transmitter 740 may be configured to transmit an E-RAB SETUP RESPONSE message, which includes a result for an at least one requested E-RAB, although it should be understood that the scope some embodiments is not limited to this example.

[0076] According to another example embodiment, receiver 750 may be configured to receive an INITIAL CONTEXT SETUP REQUEST message, which includes a correlation ID IE. The eNB may be configured with L-GW function 730 for LIPA operation and/or SIPTO@LN operation. Furthermore, the eNB may be configured to use the information included in the correlation ID for LIPA operation and/or SIPTO@LN operation. Transmitter 740 may be configured to transmit an INITIAL CONTEXT SETUP RESPONSE message, although it should be understood that the scope of some embodiments is not limited to this example.

[0077] According to some embodiments, transmitter 740 may be configured to transmit an INITIAL UE MESSAGE message, which includes a GW transport layer address IE. In addition, transmitter 740 may be configured to transmit an UPLINK NAS TRANSPORT message, which includes a L-GW transport layer address IE, although it should be understood that the scope of some embodiments is not limited to these examples.

[0078] Reference is made to Fig. 8, which schematically illustrates a product of manufacture 800, in accordance with some demonstrative embodiments. Product 800 may include a non-transitory machine-readable storage medium 810 to store logic 820, which may be used, for example, to perform at least part of the functionality of base station 700 (Fig. 7) and/or MME 600 (Fig. 6), and/or to perform one or more operations of the S1 procedures such as, for example E-RAB SETUP procedure 200 (Fig. 2), INITIAL CONTEXT SETUP procedure 300 (Fig. 3), INITIAL UE MESSAGE procedure 400 (Fig. 4) and/or UPLINK NAS TRANSPORT procedure 500 (Fig. 5). The phrase “non-transitory machine-readable medium” is directed to include all computer-readable media, with the sole exception being a transitory propagating signal.

[0079] In some demonstrative embodiments, product 800 and/or machine-readable storage medium 810 may include one or more types of computer-readable storage media capable of storing data, including volatile memory, non-volatile memory, removable or non-removable memory, erasable or non-erasable memory, writeable or re-writeable memory, and the like. For

example, machine-readable storage medium 810 may include, RAM, DRAM, Double-Data-Rate DRAM (DDR-DRAM), SDRAM, static RAM (SRAM), ROM, programmable ROM (PROM), erasable programmable ROM (EPROM), electrically erasable programmable ROM (EEPROM), Compact Disk ROM (CD-ROM), Compact Disk Recordable (CD-R), Compact Disk Rewriteable (CD-RW), flash memory (e.g., NOR or NAND flash memory), content addressable memory (CAM), polymer memory, phase-change memory, ferroelectric memory, silicon-oxide-nitride-oxide-silicon (SONOS) memory, a disk, a floppy disk, a hard drive, an optical disk, a magnetic disk, a card, a magnetic card, an optical card, a tape, a cassette, and the like. The computer-readable storage media may include any suitable media involved with downloading or transferring a computer program from a remote computer to a requesting computer carried by data signals embodied in a carrier wave or other propagation medium through a communication link, e.g., a modem, radio or network connection.

[0080] In some demonstrative embodiments, logic 820 may include instructions, data, and/or code, which, if executed by a machine, may cause the machine to perform a method, process and/or operations as described herein. The machine may include, for example, any suitable processing platform, computing platform, computing device, processing device, computing system, processing system, computer, processor, or the like, and may be implemented using any suitable combination of hardware, software, firmware, and the like.

[0081] In some demonstrative embodiments, logic 820 may include, or may be implemented as, software, a software module, an application, a program, a subroutine, instructions, an instruction set, computing code, words, values, symbols, and the like. The instructions may include any suitable type of code, such as source code, compiled code, interpreted code, executable code, static code, dynamic code, and the like. The instructions may be implemented according to a predefined computer language, manner or syntax, for instructing a processor to perform a certain function. The instructions may be implemented using any suitable high-level, low-level, object-oriented, visual, compiled and/or interpreted programming language, such as C, C++, Java, BASIC, Matlab, Pascal, Visual BASIC, assembly language, machine code, and the like.

EXAMPLES

[0082] The following examples pertain to further embodiments.

[0083] Example 1 includes a method of communication to Internet operated by a mobility management entity (MME), the method comprising configuring an evolved Node-B(eNB) to establish connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local network (SIPTO@LN), wherein establishing the connection to the Internet includes performing at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) setup procedure, an initial context setup procedure, an initial user equipment (UE) message procedure or an uplink Non Access Stratum (NAS) transport procedure.

[0084] Example 2 includes the subject matter of Example 1, and optionally, wherein the E-RAB setup procedure comprises sending to the eNB an E-RAB setup request message including a correlation ID information element (IE), wherein information included in the correlation ID is configured to enable the eNB to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and receiving an E-RAB setup response message from the eNB, the E-RAB setup response message including a result for an at least one requested E-RAB.

[0085] Example 3 includes the subject matter of Example 1, and optionally, wherein the initial context setup procedure comprises sending to the eNB an initial context setup request message including a correlation ID IE, wherein information included in the correlation ID is configured to enable the eNB to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and receiving an initial context setup response message from the eNB.

[0086] Example 4 includes the subject matter of Example 1, and optionally, wherein the initial UE message procedure comprises receiving from the eNB an INITIAL UE MESSAGE message including a GW transport layer address IE, and establishing the connection to the Internet via a L-GW function for SIPTO@LN.

[0087] Example 5 includes the subject matter of Example 1, and optionally, wherein the uplink NAS transport procedure comprises receiving from the eNB an UPLINK NAS TRANSPORT message including a GW transport layer address IE, and establishing the connection to the Internet via a L-GW function for SIPTO@LN.

[0088] Example 6 includes an evolved Node-B(eNB) configured to establish communication to the Internet, the eNB comprising a processor circuitry configured to establish the connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP

traffic offload at a local network (SIPTO@LN), the processor circuitry to establish the connection to the Internet by at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) setup procedure, an initial context setup procedure, an initial user equipment (UE) message procedure or an uplink Non Access Stratum (NAS) transport procedure.

[0089] Example 7 includes the subject matter of Example 6, and optionally, comprising a receiver to receive an E-RAB SETUP REQUEST message including a correlation ID information element (IE), wherein the eNB is configured with a L_GW function for LIPA operation or SIPTO@LN operation, and the eNB is configured to use information included in the correlation ID for LIPA operation or SIPTO@LN operation for a concerned E-RAB; and a transmitter to transmit an E-RAB SETUP RESPONSE including a result for an at least one requested E-RAB.

[0090] Example 8 includes the subject matter of Example 6, and optionally, comprising a receiver to receive an INITIAL CONTEXT SETUP REQUEST message including a correlation ID IE, wherein the eNB is configured with a L_GW function for LIPA operation or SIPTO@LN operation, and configured to use information included in the correlation ID for LIPA operation or SIPTO@LN operation for a concerned E-RAB; and a transmitter to transmit an INITIAL CONTEXT SETUP RESPONSE message from the eNB.

[0091] Example 9 includes the subject matter of Example 6, and optionally, comprising a transmitter to transmit an INITIAL UE MESSAGE message including a GW transport layer address IE, wherein the eNB is configured with a L_GW function for SIPTO@LN operation.

[0092] Example 10 includes the subject matter of Example 6, and optionally, comprising a transmitter to transmit an UPLINK NAS TRANSPORT message including a GW transport layer address IE, wherein the eNB is configured with a L_GW function for SIPTO@LN operation.

[0093] Example 11 includes a cellular system comprising an evolved Node-B (eNB) operably coupled to an antenna array and configured to establish communication to Internet, the eNB comprising a processor configured to establish the connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local network (SIPTO@LN), the processor to establish the connection to the Internet by at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-

RAB) setup procedure, an initial context setup procedure, an initial user equipment (UE) message procedure or an uplink Non Access Stratum (NAS) transport procedure.

[0094] Example 12 includes the subject matter of Example 11, and optionally, wherein the eNB comprises a receiver to receive an E-RAB SETUP REQUEST message including a correlation ID information element (IE), wherein the eNB is configured with a L_GW function for LIPA operation or SIPTO@LN operation, and the eNB is configured to use information included in the correlation ID for LIPA operation or SIPTO@LN operation for a concerned E-RAB; and a transmitter to transmit an E-RAB SETUP RESPONSE including a result for an at least one requested E-RAB.

[0095] Example 13 includes the subject matter of Example 11, and optionally, wherein the eNB comprises a receiver to receive an INITIAL CONTEXT SETUP REQUEST message including a correlation ID IE, wherein the eNB is configured with a L_GW function for LIPA operation or SIPTO@LN operation, and wherein the eNB is configured to use information included in the correlation ID for LIPA operation or SIPTO@LN operation for a concerned E-RAB; and a transmitter to transmit an INITIAL CONTEXT SETUP RESPONSE message from the eNB.

[0096] Example 14 includes the subject matter of Example 13, and optionally, wherein the processor is configured to terminate the initial context setup procedure.

[0097] Example 15 includes the subject matter of Example 11, and optionally, wherein the eNB comprises a transmitter to transmit an INITIAL UE MESSAGE message including a GW transport layer address IE, wherein the eNB is configured with a L_GW function for SIPTO@LN operation.

[0098] Example 16 includes the subject matter of Example 11, and optionally, wherein the eNB comprises a transmitter to transmit an UPLINK NAS TRANSPORT message including a GW transport layer address IE, wherein the eNB is configured with a L_GW function for SIPTO@LN operation.

[0099] Example 17 includes a mobility management entity (MME) configured to enable an establishment of communication to the Internet, the MME comprising a processor circuitry configured to enable the establishment of the connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local network

(SIPTO@LN), wherein the processor circuitry is to enable the establishment of the connection to the Internet by at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) setup procedure, an initial context setup procedure, an initial user equipment (UE) message procedure or an uplink Non Access Stratum (NAS) transport procedure.

[00100] Example 18 includes the subject matter of Example 17, and optionally, wherein the processor circuitry is configured to send to an evolved Node-B(eNB) an E-RAB SETUP REQUEST message including a correlation ID information element (IE), wherein information included in the correlation ID is configured to enable the eNB to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and to receive an E-RAB SETUP RESPONSE message from the eNB, the E-RAB SETUP RESPONSE message including a result for an at least one requested E-RAB.

[00101] Example 19 includes the subject matter of Example 17, and optionally, wherein the processor circuitry is configured to send to an evolved Node-B(eNB) an INITIAL CONTEXT SETUP request message including a correlation ID IE, wherein information included in the correlation ID is configured to enable the eNB to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and receive an INITIAL CONTEXT setup response message from the eNB.

[00102] Example 20 includes the subject matter of Example 17, and optionally, wherein the processor circuitry is configured to receive from an evolved Node-B(eNB) an INITIAL UE MESSAGE message including a GW transport layer address IE; and establish the connection to the Internet via a L-GW function for SIPTO@LN.

[00103] Example 21 includes the subject matter of Example 17, and optionally, wherein the processor circuitry is configured to receive from an evolved Node-B(eNB) an UPLINK NAS TRANSPORT message including a GW transport layer address IE; and establish the connection to the Internet via a L-GW function for SIPTO@LN.

[00104] Example 22 includes a product including a non-transitory storage medium having stored thereon instructions that, when executed by a machine, result in establishing a connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local network (SIPTO@LN), wherein establishing a connection to the Internet

includes performing at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) setup procedure, an initial context setup procedure, an initial user equipment (UE) message procedure or an uplink Non Access Stratum (NAS) transport procedure.

5 [00105] Example 23 includes the subject matter of Example 22, and optionally, wherein instructions of the E-RAB SETUP procedure, when executed result in reception of an E-RAB SETUP REQUEST message including a correlation ID information element (IE), wherein information included in the correlation ID is configured to enable an Evolved Node B (eNB) to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and transmitting
10 an E-RAB SETUP RESPONSE including a result for an at least one requested E-RAB.

[00106] Example 24 includes the subject matter of Example 22, and optionally, wherein instructions of the INITIAL CONTEXT SETUP procedure, when executed result in receiving an INITIAL CONTEXT SETUP REQUEST message including a correlation ID IE, wherein information included in the correlation ID is configured to enable an Evolved Node B (eNB) to
15 perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and transmitting an INITIAL CONTEXT SETUP RESPONSE message from the eNB, the INITIAL CONTEXT SETUP RESPONSE message including a result for an at least one requested E-RAB.

[00107] Example 25 includes the subject matter of Example 22, and optionally, wherein instructions of the INITIAL UE MESSAGE procedure, when executed result in transmitting an
20 INITIAL UE MESSAGE message including a GW transport layer address IE; and establishing the connection to the Internet via a L-GW function for SIPTO@LN.

[00108] Example 26 includes the subject matter of Example 22, and optionally, wherein instructions of the UPLINK NAS TRANSPORT procedure, when executed result in transmitting
25 an UPLINK NAS TRANSPORT message including a GW transport layer address IE; and establishing the connection to the Internet via a L-GW function for SIPTO@LN.

[00109] Example 27 includes a product including a non-transitory storage medium having stored thereon instructions that, when executed by a machine, result in at a mobility management entity (MME), configuring an evolved Node-B(eNB) to establish connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local
30 network (SIPTO@LN), wherein establishing the connection to the Internet includes performing

at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) setup procedure, an initial context setup procedure, an initial user equipment (UE) message procedure or an uplink Non Access Stratum (NAS) transport procedure.

5 [00110] Example 28 includes the subject matter of Example 27, and optionally, wherein the instructions result in sending from the MME to the eNB an E-RAB setup request message including a correlation ID information element (IE), wherein information included in the correlation ID is configured to enable the eNB to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and receiving an E-RAB setup response message from the
10 eNB, the E-RAB setup response message including a result for an at least one requested E-RAB.

[00111] Example 29 includes the subject matter of Example 27, and optionally, wherein the instructions result in sending to the eNB an initial context setup request message including a correlation ID IE, wherein information included in the correlation ID is configured to enable the eNB to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and
15 receiving an initial context setup response message from the eNB.

[00112] Example 30 includes the subject matter of Example 27, and optionally, wherein the instructions result in receiving from the eNB- an INITIAL UE MESSAGE message including a GW transport layer address IE, and establishing the connection to the Internet via a L-GW function for SIPTO@LN.

20 [00113] Example 31 includes the subject matter of Example 27, and optionally, wherein the instructions result in receiving from the eNB an UPLINK NAS TRANSPORT message including a GW transport layer address IE, and establishing the connection to the Internet via a L-GW function for SIPTO@LN.

[00114] Example 32 includes an apparatus comprising means for configuring an evolved Node-
25 B(eNB) to establish connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local network (SIPTO@LN), wherein establishing the connection to the Internet includes performing at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) setup procedure, an initial context setup procedure, an initial user equipment (UE) message procedure
30 or an uplink Non Access Stratum (NAS) transport procedure.

[00115] Example 33 includes the subject matter of Example 32, and optionally, comprising means for sending from the MME to the eNB an E-RAB setup request message including a correlation ID information element (IE), wherein information included in the correlation ID is configured to enable the eNB to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and means for receiving an E-RAB setup response message from the eNB, the E-RAB setup response message including a result for an at least one requested E-RAB.

[00116] Example 34 includes the subject matter of Example 32, and optionally, comprising means for sending to the eNB an initial context setup request message including a correlation ID IE, wherein information included in the correlation ID is configured to enable the eNB to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and means for receiving an initial context setup response message from the eNB.

[00117] Example 35 includes the subject matter of Example 32, and optionally, comprising means for receiving from the eNB- an INITIAL UE MESSAGE message including a GW transport layer address IE, and establishing the connection to the Internet via a L-GW function for SIPTO@LN.

[00118] Example 36 includes the subject matter of Example 32, and optionally, comprising means for receiving from the eNB an UPLINK NAS TRANSPORT message including a GW transport layer address IE, and establishing the connection to the Internet via a L-GW function for SIPTO@LN.

[00119] Example 37 includes a method of establishing communication to the Internet, the method comprising at an Evolved node B (eNB), establishing a connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local network (SIPTO@LN), wherein establishing a connection to the Internet includes performing at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) setup procedure, an initial context setup procedure, an initial user equipment (UE) message procedure or an uplink Non Access Stratum (NAS) transport procedure.

[00120] Example 38 includes the subject matter of Example 37, and optionally, wherein the E-RAB SETUP procedure includes receiving an E-RAB SETUP REQUEST message including a correlation ID information element (IE), wherein information included in the correlation ID is

configured to enable an Evolved Node B (eNB) to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and transmitting an E-RAB SETUP RESPONSE including a result for an at least one requested E-RAB.

[00121] Example 39 includes the subject matter of Example 37, and optionally, wherein the
5 INITIAL CONTEXT SETUP procedure includes receiving an INITIAL CONTEXT SETUP REQUEST message including a correlation ID IE, wherein information included in the correlation ID is configured to enable an Evolved Node B (eNB) to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and transmitting an INITIAL CONTEXT SETUP RESPONSE message from the eNB, the INITIAL CONTEXT SETUP RESPONSE
10 message including a result for an at least one requested E-RAB.

[00122] Example 40 includes the subject matter of Example 37, and optionally, wherein the INITIAL UE MESSAGE procedure includes transmitting an INITIAL UE MESSAGE message including a GW transport layer address IE; and establishing the connection to the Internet via a L-GW function for SIPTO@LN.

15 [00123] Example 41 includes the subject matter of Example 37, and optionally, wherein the UPLINK NAS TRANSPORT procedure includes transmitting an UPLINK NAS TRANSPORT message including a GW transport layer address IE; and establishing the connection to the Internet via a L-GW function for SIPTO@LN.

[00124] Example 42 includes an apparatus comprising means for establishing a connection to
20 the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local network (SIPTO@LN), wherein establishing a connection to the Internet includes performing at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) setup procedure, an initial context setup procedure, an initial user equipment (UE) message procedure or an uplink Non Access Stratum (NAS)
25 transport procedure.

[00125] Example 43 includes the subject matter of Example 42, and optionally, comprising means for receiving an E-RAB SETUP REQUEST message including a correlation ID information element (IE), wherein information included in the correlation ID is configured to enable an Evolved Node B (eNB) to perform the LIPA operation or SIPTO@LN operation for a

concerned E-RAB; and means for transmitting an E-RAB SETUP RESPONSE including a result for an at least one requested E-RAB.

[00126] Example 44 includes the subject matter of Example 42, and optionally, comprising means for receiving an INITIAL CONTEXT SETUP REQUEST message including a correlation ID IE, wherein information included in the correlation ID is configured to enable an Evolved Node B (eNB) to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and means for transmitting an INITIAL CONTEXT SETUP RESPONSE message from the eNB, the INITIAL CONTEXT SETUP RESPONSE message including a result for an at least one requested E-RAB.

[00127] Example 45 includes the subject matter of Example 42, and optionally, comprising means for transmitting an INITIAL UE MESSAGE message including a GW transport layer address IE; and means for establishing the connection to the Internet via a L-GW function for SIPTO@LN.

[00128] Example 46 includes the subject matter of Example 42, and optionally, comprising means for transmitting an UPLINK NAS TRANSPORT message including a GW transport layer address IE; and means for establishing the connection to the Internet via a L-GW function for SIPTO@LN.

[00129] Functions, operations, components and/or features described herein with reference to one or more embodiments, may be combined with, or may be utilized in combination with, one or more other functions, operations, components and/or features described herein with reference to one or more other embodiments, or vice versa.

[00130] While certain features have been illustrated and described herein, many modifications, substitutions, changes, and equivalents may occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

CLAIMS

What is claimed is:

1. A method of communication to Internet operated by a mobility management entity (MME), the method comprising:

configuring an evolved Node-B(eNB) to establish connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local network (SIPTO@LN), wherein establishing the connection to the Internet includes performing at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) SETUP procedure, an INITIAL CONTEXT SETUP procedure, an INITIAL USER EQUIPMENT (UE) MESSAGE procedure or an UPLINK NON ACCESS STRATUM (NAS) TRANSPORT procedure.

2. The method of claim 1, wherein the E-RAB SETUP procedure comprises:

sending to the eNB an E-RAB SETUP REQUEST message including a correlation ID information element (IE), wherein information included in the correlation ID is configured to enable the eNB to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and

receiving an E-RAB SETUP RESPONSE message from the eNB, the E-RAB SETUP RESPONSE message including a result for an at least one requested E-RAB.

3. The method of claim 1, wherein the INITIAL CONTEXT SETUP procedure comprises:

sending to the eNB an INITIAL CONTEXT SETUP REQUEST message including a correlation ID IE, wherein information included in the correlation ID is configured to enable the eNB to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and

receiving an INITIAL CONTEXT SETUP RESPONSE message from the eNB.

4. The method of claim 1, wherein the INITIAL UE MESSAGE procedure comprises:
receiving from the eNB an INITIAL UE MESSAGE message including a GW transport layer address IE, and establishing the connection to the Internet via a L-GW function for SIPTO@LN.

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5. The method of claim 1, wherein the UPLINK NAS TRANSPORT procedure comprises:

receiving from the eNB an UPLINK NAS TRANSPORT message including a GW transport layer address IE, and establishing the connection to the Internet via a L-GW function for SIPTO@LN.

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6. An evolved Node-B(eNB) configured to establish communication to the Internet, the eNB comprising:

a processor circuitry configured to establish the connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local network (SIPTO@LN), said processor circuitry to establish the connection to the Internet by at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) SETUP procedure, an INITIAL CONTEXT SETUP procedure, an INITIAL USER EQUIPMENT (UE) MESSAGE procedure or an UPLINK NON ACCESS STRATUM (NAS) TRANSPORT procedure.

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7. The eNB of claim 6 comprising:

a receiver to receive an E-RAB SETUP REQUEST message including a correlation ID information element (IE), wherein the eNB is configured with a L_GW function for LIPA operation or SIPTO@LN operation, and the eNB is configured to use information included in the correlation ID for LIPA operation or SIPTO@LN operation for a concerned E-RAB; and

25

a transmitter to transmit an E-RAB SETUP RESPONSE including a result for an at least one requested E-RAB.

8. The eNB of claim 6 comprising:

a receiver to receive an INITIAL CONTEXT SETUP REQUEST message including a correlation ID IE, wherein the eNB is configured with a L_GW function for LIPA operation or SIPTO@LN operation, and configured to use information included in the correlation ID for LIPA operation or SIPTO@LN operation for a concerned E-RAB; and

a transmitter to transmit an INITIAL CONTEXT SETUP RESPONSE message from the eNB.

9. The eNB of claim 6 comprising:

a transmitter to transmit an INITIAL UE MESSAGE message including a GW transport layer address IE, wherein the eNB is configured with a L_GW function for SIPTO@LN operation.

10. The eNB of claim 6 comprising:

a transmitter to transmit an UPLINK NAS TRANSPORT message including a GW transport layer address IE, wherein the eNB is configured with a L_GW function for SIPTO@LN operation.

11. A cellular system comprising:

an evolved Node-B (eNB) operably coupled to an antenna array and configured to establish communication to Internet, the eNB comprising a processor configured to establish the connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local network (SIPTO@LN), said processor to establish the connection to the Internet by at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-

RAB) SETUP procedure, an INITIAL CONTEXT SETUP procedure, an INITIAL USER EQUIPMENT (UE) MESSAGE procedure or an UPLINK NON ACCESS STRATUM (NAS) TRANSPORT procedure.

- 5 12. The cellular system of claim 11, wherein the eNB comprises:
- a receiver to receive an E-RAB SETUP REQUEST message including a correlation ID information element (IE), wherein the eNB is configured with a L_GW function for LIPA operation or SIPTO@LN operation, and the eNB is configured to use information included in the correlation ID for LIPA operation or SIPTO@LN operation
10 for a concerned E-RAB; and
- a transmitter to transmit an E-RAB SETUP RESPONSE including a result for an at least one requested E-RAB.
13. The cellular system of claim 11, wherein the eNB comprises:
- 15 a receiver to receive an INITIAL CONTEXT SETUP REQUEST message including a correlation ID IE, wherein the eNB is configured with a L_GW function for LIPA operation or SIPTO@LN operation, and wherein the eNB is configured to use information included in the correlation ID for LIPA operation or SIPTO@LN operation for a concerned E-RAB; and
- 20 a transmitter to transmit an INITIAL CONTEXT SETUP RESPONSE message from the eNB.
14. The cellular system of claim 11, wherein the eNB comprises:
- a transmitter to transmit an INITIAL UE MESSAGE message including a GW transport layer address IE, wherein the eNB is configured with a L_GW function for SIPTO@LN operation.
25
15. The cellular system of claim 11, wherein the eNB comprises:

a transmitter to transmit an UPLINK NAS TRANSPORT message including a GW transport layer address IE, wherein the eNB is configured with a L_GW function for SIPTO@LN operation.

- 5 16. A mobility management entity (MME) configured to enable an establishment of communication to the Internet, the MME comprising:

10 a processor circuitry configured to enable the establishment of the connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local network (SIPTO@LN), wherein the processor circuitry is to enable the establishment of the connection to the Internet by at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) SETUP procedure, an INITIAL CONTEXT SETUP procedure, an INITIAL USER EQUIPMENT (UE) MESSAGE procedure or an UPLINK NON ACCESS STRATUM (NAS) TRANSPORT procedure.

- 15 17. The MME of claim 16, wherein the processor circuitry is configured to:

20 send to an evolved Node-B(eNB) an E-RAB SETUP REQUEST message including a correlation ID information element (IE), wherein information included in the correlation ID is configured to enable the eNB to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and

 to receive an E-RAB SETUP RESPONSE message from the eNB, the E-RAB SETUP RESPONSE message including a result for an at least one requested E-RAB.

- 25 18. The MME of claim 16, wherein the processor circuitry is configured to:

 send to an evolved Node-B(eNB) an INITIAL CONTEXT SETUP REQUEST message including a correlation ID IE, wherein information included in the correlation ID is configured to enable the eNB to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and

 receive an INITIAL CONTEXT SETUP RESPONSE message from the eNB.

19. The MME of claim 16, wherein the processor circuitry is configured to:
- receive from an evolved Node-B(eNB) an INITIAL UE MESSAGE message including a GW transport layer address IE; and
 - establish the connection to the Internet via a L-GW function for SIPTO@LN.

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20. The MME of claim 16, wherein the processor circuitry is configured to:
- receive from an evolved Node-B(eNB) an UPLINK NAS TRANSPORT message including a GW transport layer address IE; and
 - establish the connection to the Internet via a L-GW function for SIPTO@LN.

10

21. A product including a non-transitory storage medium having stored thereon instructions that, when executed by a machine, result in:
- establishing a connection to the Internet via a local gateway (L-GW) function for a local IP access (LIPA) or a Selected IP traffic offload at a local network (SIPTO@LN), wherein establishing a connection to the Internet includes performing at least one of an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Radio Access Bearer (E-RAB) SETUP procedure, an initial context setup procedure, an INITIAL USER EQUIPMENT (UE) MESSAGE procedure or an UPLINK NON ACCESS STRATUM (NAS) TRANSPORT procedure.

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22. The product of claim 21, wherein instructions of the E-RAB SETUP procedure, when executed result in:
- reception of an E-RAB SETUP REQUEST message including a correlation ID information element (IE), wherein information included in the correlation ID is configured to enable an Evolved Node B (eNB) to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and
 - transmitting an E-RAB SETUP RESPONSE including a result for an at least one requested E-RAB.

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23. The product of claim 21, wherein instructions of the INITIAL CONTEXT SETUP procedure, when executed result in:

receiving an INITIAL CONTEXT SETUP REQUEST message including a correlation ID IE, wherein information included in the correlation ID is configured to enable an Evolved Node B (eNB) to perform the LIPA operation or SIPTO@LN operation for a concerned E-RAB; and

transmitting an INITIAL CONTEXT SETUP RESPONSE message from the eNB, the INITIAL CONTEXT SETUP RESPONSE message including a result for an at least one requested E-RAB.

24. The product of claim 21, wherein instructions of the INITIAL UE MESSAGE procedure, when executed result in:

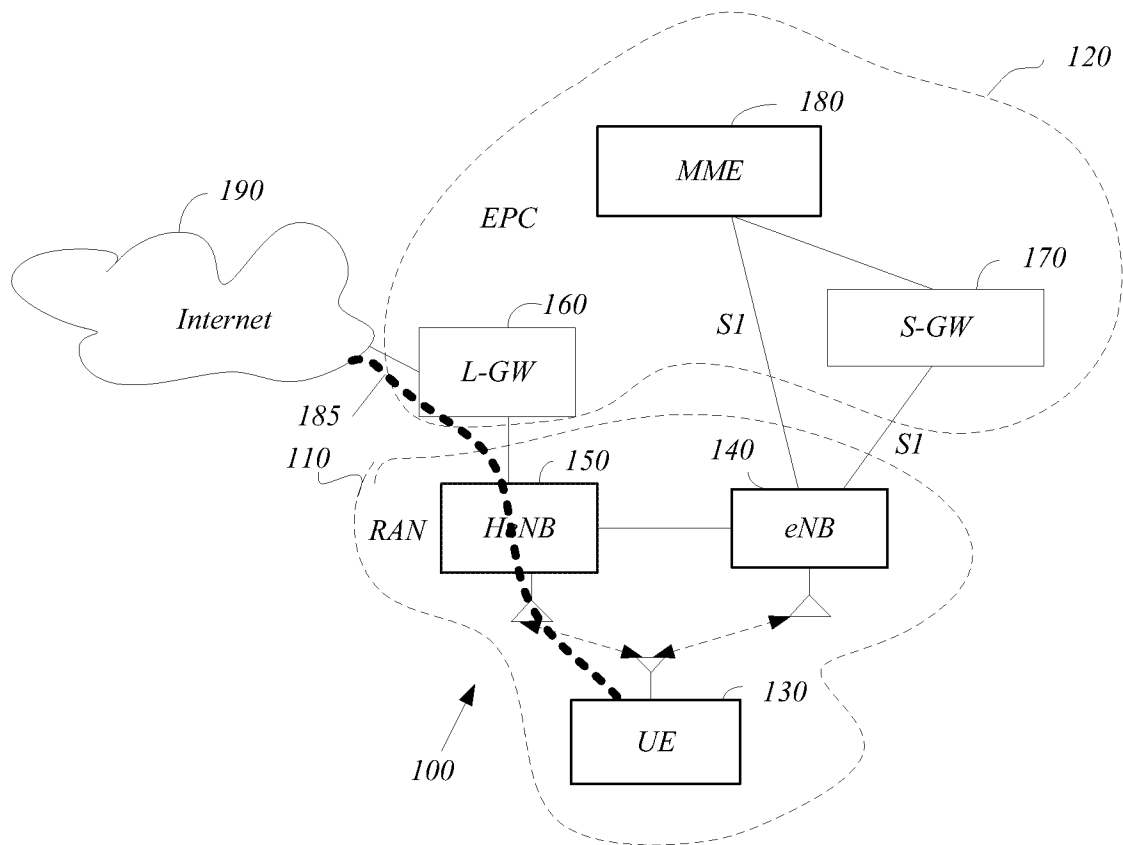
transmitting an INITIAL UE MESSAGE message including a GW transport layer address IE; and

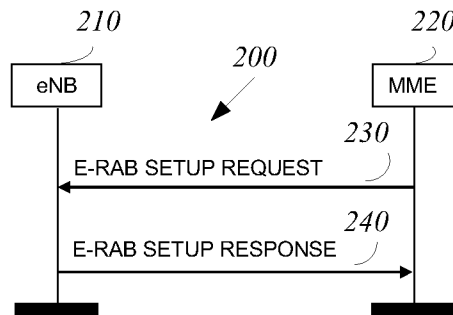
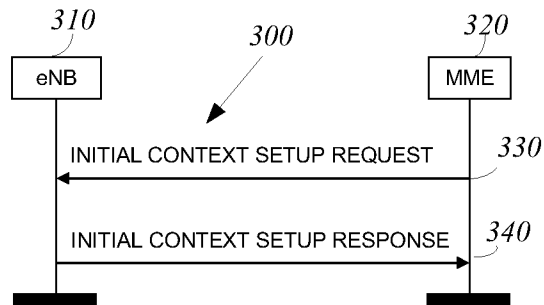
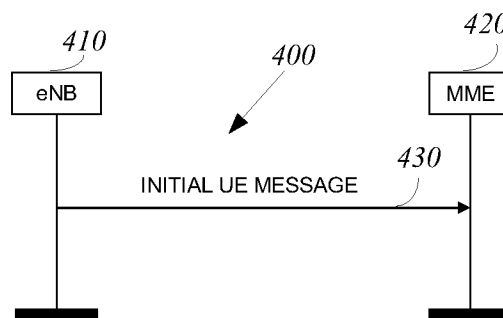
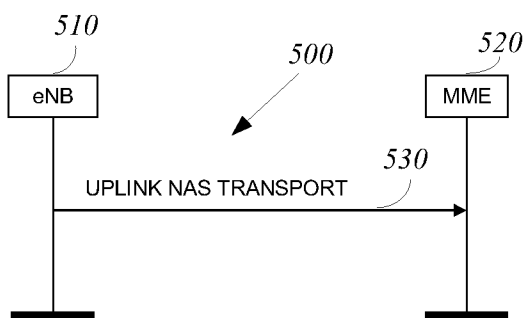
establishing the connection to the Internet via a L-GW function for SIPTO@LN.

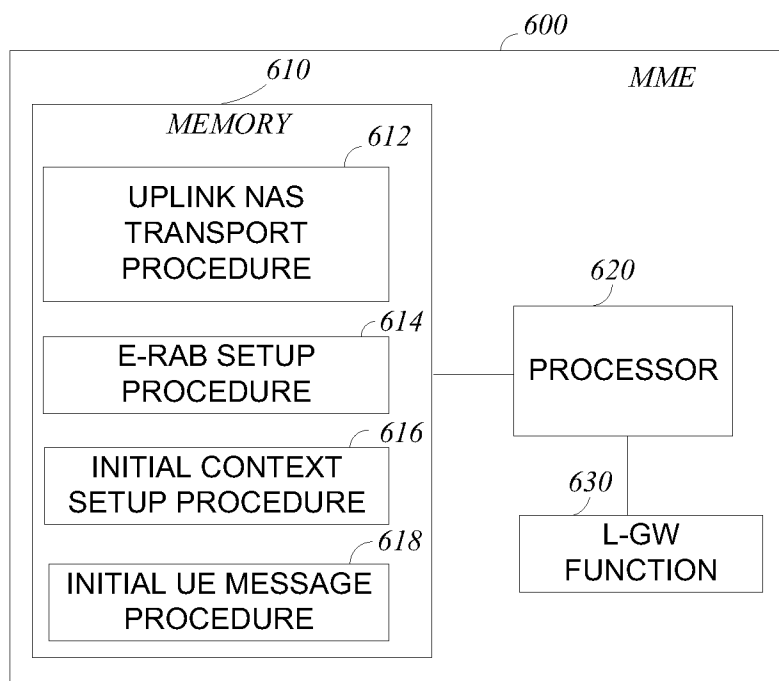
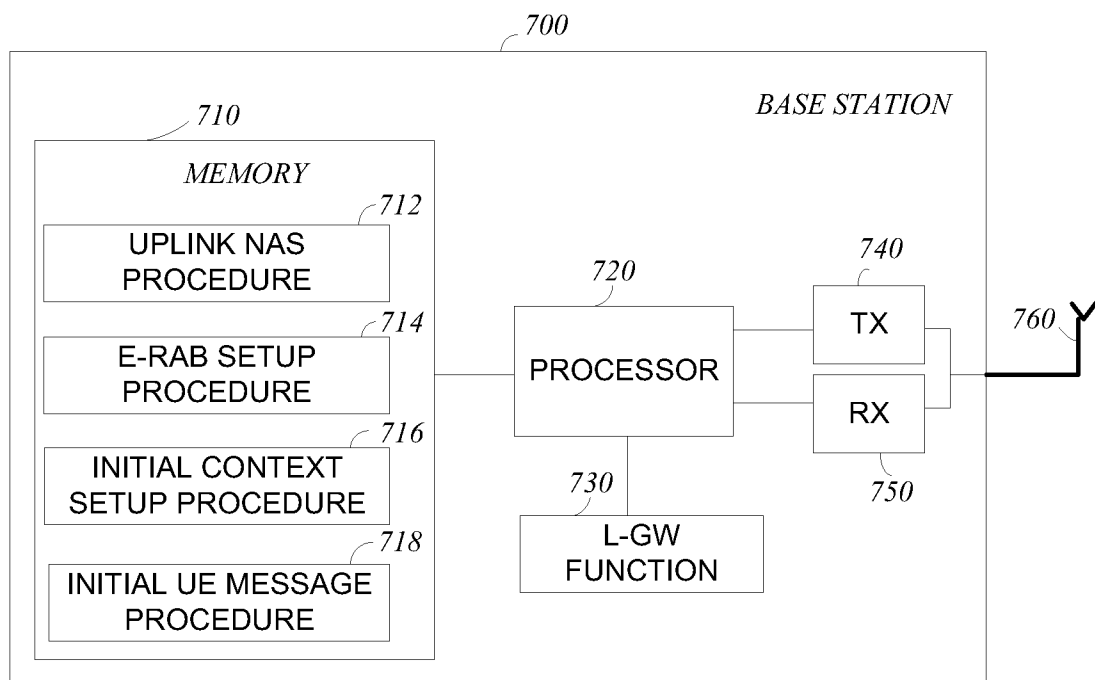
25. The product of claim 21, wherein instructions of the UPLINK NAS TRANSPORT procedure, when executed result in:

transmitting an UPLINK NAS TRANSPORT message including a GW transport layer address IE; and

establishing the connection to the Internet via a L-GW function for SIPTO@LN.

**FIG. 1**

**FIG. 2****FIG. 3****FIG. 4****FIG. 5**

**FIG. 6****FIG. 7**

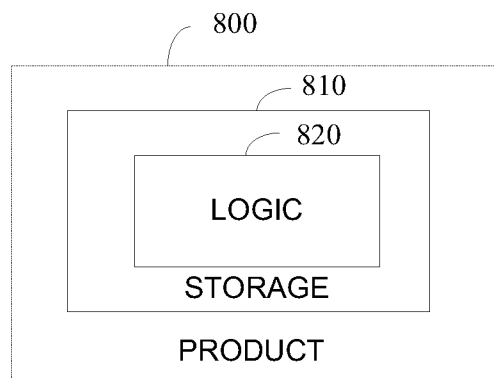


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/077793**A. CLASSIFICATION OF SUBJECT MATTER****H04W 8/02(2009.01)i, H04W 76/02(2009.01)i**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W 8/02; H04W 28/02; H04W 8/26; H04W 60/04; H04W 4/00; H04W 72/04; H04W 36/00; H04W 76/02

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords:MME, eNB, UE, LIPA (local IP address), SIPTO (Selected IP traffic offload), L-GW (local gateway)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2012-177023 A1 (LG ELECTRONICS INC.) 27 December 2012 See paragraphs [0012]-[0013], [0016], [0020]-[0029], [0042]-[0051], [0058]-[0059], [0061]-[0072]; and figures 1-5.	1-25
A	US 2011-0103310 A1 (SASO STOJANOVSKI et al.) 05 May 2011 See paragraphs [0014], [0020]-[0029], [0035]-[0040], [0046]-[0050], [0071]-[0084]; and figures 1-6, 9-10.	1-25
A	WO 2012-128355 A1 (NTT DOCOMO, INC.) 27 September 2012 See paragraphs [0002]-[0013], [0015]-[0018], [0030]-[0053], [0073]-[0081]; and figures 2-5.	1-25
A	US 2012-0300750 A1 (CHEN HO CHIN et al.) 29 November 2012 See paragraphs [0013]-[0028], [0048]-[0065], [0091]-[0102]; and figures 2-6.	1-25
A	US 2013-0077575 A1 (SRIDHAR VADLAMUDI) 28 March 2013 See paragraphs [0002]-[0006], [0013]-[0018], [0022]-[0037]; and figure 1.	1-25



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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

"&" document member of the same patent family

Date of the actual completion of the international search

25 April 2014 (25.04.2014)

Date of mailing of the international search report

28 April 2014 (28.04.2014)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2013/077793

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