

MOBILITY IN A WIRELESS COMMUNICATION NETWORK

Field

- 5 [0001] The subject matter disclosed herein relates generally to the field of implementing mobility in a wireless communication network. This document defines a first network function, a method in a first network function, a second network function, and a method in a second network function.

10 **Introduction**

- [0002] A wireless communication device such as a UE may be able to connect to and communicate via both a 5th Generation System (5GS) and an Evolved Packet System (EPS). Such a UE can register to the 5GS and also attach to EPS via single registration or via dual registrations and can be capable of receiving UE policy sections in EPS as
15 well as in 5GS. In the case of single registration to 5GS, if the UE supports UE policy sections including the URSP in EPS, and handovers a PDU session from the 5GS to EPS, then the SM-PCF needs to establish the UE policy association with the UE-PCF, so as to assign the right policies to the PDU session after the handover. When the PDU sessions are handed-over from the 5GS to the EPS, it is not clear how the UE-PCF
20 should indicate to the AMF that the UE is able to handle the UE policy sections management list in the EPS.

Summary

- [0003] Disclosed herein are procedures for providing mobility in a wireless
25 communication network. Said procedures may be implemented by a first network function, a method in a first network function, a second network function, and a method in a second network function.
- [0004] There is presented herein a new interaction between the UE-PCF and the AMF for a handover of a PDU session from a 5GS to an EPS the N26 reference point is
30 implemented.
- [0005] Accordingly, there is provided a first network function comprising a processor and a memory coupled with the processor. The processor is configured to cause the first network function to send a request to a second network function, the request requesting a deletion of a first policy association, wherein the first policy association was established

for at least one PDU session, the at least one PDU session established by a wireless communication device in a first mobile communications technology and the at least one PDU session being transferred to a second mobile communications technology. The processor is further configured to cause the first network function to receive a processing response from the second network function, the processing response indicating that wireless communication device supports a second policy association, the second policy association for the second mobile communications technology.

[0006] There is further provided a method in a first network function, the method comprising sending a request to a second network function, the request requesting a deletion of a first policy association, wherein the first policy association was established for at least one PDU session, the at least one PDU session established by a wireless communication device in a first mobile communications technology and the at least one PDU session being transferred to a second mobile communications technology. The method further comprises receiving a processing response from the second network function, the processing response indicating that wireless communication device supports a second policy association, the second policy association for the second mobile communications technology.

[0007] There is further provided a second network function, comprising a processor and a memory coupled with the processor. The processor configured to cause the second network function to: receive from a first network function, deletion of a first policy association, a first policy association, wherein the first policy association was established for at least one PDU session, the at least one PDU session established by a wireless communication device in a first mobile communications technology and the at least one PDU session being transferred to a second mobile communications technology; and send a processing response to the first network function, the processing response indicating that wireless communication device supports a second policy association, the second policy association for the second mobile communications technology.

[0008] There is further provided a method in a second network function, the method comprising: receiving from a first network function, deletion of a first policy association, a first policy association, wherein the first policy association was established for at least one PDU session, the at least one PDU session established by a wireless communication device in a first mobile communications technology and the at least one PDU session being transferred to a second mobile communications technology; and sending a processing response to the first network function, the processing response indicating that

wireless communication device supports a second policy association, the second policy association for the second mobile communications technology.

Brief description of the drawings

5 [0009] In order to describe the manner in which advantages and features of the disclosure can be obtained, a description of the disclosure is rendered by reference to certain apparatus and methods which are illustrated in the appended drawings. Each of these drawings depict only certain aspects of the disclosure and are not therefore to be considered to be limiting of its scope. The drawings may have been simplified for clarity
10 and are not necessarily drawn to scale.

[0010] Methods and apparatus for providing mobility in a wireless communication network will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 depicts an embodiment of a wireless communication system for
15 providing mobility between wireless communication networks;

Figure 2 depicts a user equipment apparatus that may be used for implementing the methods described herein;

Figure 3 depicts further details of the network node that may be used for implementing the methods described herein;

20 Figure 4 illustrates a network architecture with a capability to transmit policy sections to a UE;

Figure 5 illustrates a process for the UE's mobility from 5GS to EPS when the N26 interface is supported by the AMF and the MME;

Figure 6 illustrates a method in a first network function; and

25 Figure 7 illustrates a method in a second network function.

Detailed description

[0011] As will be appreciated by one skilled in the art, aspects of this disclosure may be embodied as a system, apparatus, method, or program product. Accordingly,
30 arrangements described herein may be implemented in an entirely hardware form, an entirely software form (including firmware, resident software, micro-code, etc.) or a form combining software and hardware aspects.

[0012] For example, the disclosed methods and apparatus may be implemented as a hardware circuit comprising custom very-large-scale integration ("VLSI") circuits or gate

arrays, off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. The disclosed methods and apparatus may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices, or the like. As another example, the disclosed methods and apparatus may include one or more physical or logical blocks of executable code which may, for instance, be organized as an object, procedure, or function.

[0013] Furthermore, the methods and apparatus may take the form of a program product embodied in one or more computer readable storage devices storing machine readable code, computer readable code, and/or program code, referred hereafter as code.

The storage devices may be tangible, non-transitory, and/or non-transmission. The storage devices may not embody signals. In certain arrangements, the storage devices only employ signals for accessing code.

[0014] Any combination of one or more computer readable medium may be utilized. The computer readable medium may be a computer readable storage medium. The computer readable storage medium may be a storage device storing the code. The storage device may be, for example, but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, holographic, micromechanical, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing.

[0015] More specific examples (a non-exhaustive list) of the storage device would include the following: an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random-access memory ("RAM"), a read-only memory ("ROM"), an erasable programmable read-only memory ("EPROM" or Flash memory), a portable compact disc read-only memory ("CD-ROM"), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing. In the context of this document, a computer readable storage medium may be any tangible medium that can contain, or store, a program for use by or in connection with an instruction execution system, apparatus, or device.

[0016] Reference throughout this specification to an example of a particular method or apparatus, or similar language, means that a particular feature, structure, or characteristic described in connection with that example is included in at least one implementation of the method and apparatus described herein. Thus, reference to features of an example of a particular method or apparatus, or similar language, may, but do not necessarily, all refer to the same example, but mean "one or more but not all examples" unless expressly specified otherwise. The terms "including", "comprising", "having", and variations

thereof, mean “including but not limited to”, unless expressly specified otherwise. An enumerated listing of items does not imply that any or all of the items are mutually exclusive, unless expressly specified otherwise. The terms “a”, “an”, and “the” also refer to “one or more”, unless expressly specified otherwise.

- 5 [0017] As used herein, a list with a conjunction of “and/or” includes any single item in the list or a combination of items in the list. For example, a list of A, B and/or C includes only A, only B, only C, a combination of A and B, a combination of B and C, a combination of A and C or a combination of A, B and C. As used herein, a list using the terminology “one or more of” includes any single item in the list or a combination of
10 items in the list. For example, one or more of A, B and C includes only A, only B, only C, a combination of A and B, a combination of B and C, a combination of A and C or a combination of A, B and C. As used herein, a list using the terminology “one of” includes one, and only one, of any single item in the list. For example, “one of A, B and C” includes only A, only B or only C and excludes combinations of A, B and C. As used
15 herein, “a member selected from the group consisting of A, B, and C” includes one and only one of A, B, or C, and excludes combinations of A, B, and C.” As used herein, “a member selected from the group consisting of A, B, and C and combinations thereof” includes only A, only B, only C, a combination of A and B, a combination of B and C, a combination of A and C or a combination of A, B and C.
- 20 [0018] Furthermore, the described features, structures, or characteristics described herein may be combined in any suitable manner. In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of
25 the disclosure. One skilled in the relevant art will recognize, however, that the disclosed methods and apparatus may be practiced without one or more of the specific details, or with other methods, components, materials, and so forth. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the disclosure.
- 30 [0019] Aspects of the disclosed method and apparatus are described below with reference to schematic flowchart diagrams and/or schematic block diagrams of methods, apparatuses, systems, and program products. It will be understood that each block of the schematic flowchart diagrams and/or schematic block diagrams, and combinations of blocks in the schematic flowchart diagrams and/or schematic block diagrams, can be

implemented by code. This code may be provided to a processor of a general-purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for
5 implementing the functions/acts specified in the schematic flowchart diagrams and/or schematic block diagrams.

[0020] The code may also be stored in a storage device that can direct a computer, other programmable data processing apparatus, or other devices to function in a particular manner, such that the instructions stored in the storage device produce an article of
10 manufacture including instructions which implement the function/act specified in the schematic flowchart diagrams and/or schematic block diagrams.

[0021] The code may also be loaded onto a computer, other programmable data processing apparatus, or other devices to cause a series of operational steps to be performed on the computer, other programmable apparatus, or other devices to produce
15 a computer implemented process such that the code which executes on the computer or other programmable apparatus provides processes for implementing the functions/acts specified in the schematic flowchart diagrams and/or schematic block diagram.

[0022] The schematic flowchart diagrams and/or schematic block diagrams in the Figures illustrate the architecture, functionality, and operation of possible
20 implementations of apparatuses, systems, methods, and program products. In this regard, each block in the schematic flowchart diagrams and/or schematic block diagrams may represent a module, segment, or portion of code, which includes one or more executable instructions of the code for implementing the specified logical function(s).

[0023] It should also be noted that, in some alternative implementations, the functions
25 noted in the block may occur out of the order noted in the Figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. Other steps and methods may be conceived that are equivalent in function, logic, or effect to one or more blocks, or portions thereof, of the illustrated
30 Figures.

[0024] The description of elements in each figure may refer to elements of proceeding Figures. Like numbers refer to like elements in all Figures.

[0025] Figure 1 depicts an embodiment of a wireless communication system 100 for providing mobility in a wireless communication network. In one embodiment, the

wireless communication system 100 includes remote units 102 and network units 104.

Even though a specific number of remote units 102 and network units 104 are depicted in Figure 1, one of skill in the art will recognize that any number of remote units 102 and network units 104 may be included in the wireless communication system 100. The

5 wireless communication system may comprise a wireless communication network and at least one wireless communication device. The wireless communication device is typically a 3GPP User Equipment (UE). The wireless communication network may comprise at least one network node. The network node may be a network unit.

[0026] In one embodiment, the remote units 102 may include computing devices, such as desktop computers, laptop computers, personal digital assistants (“PDAs”), tablet
10 computers, smart phones, smart televisions (e.g., televisions connected to the Internet), set-top boxes, game consoles, security systems (including security cameras), vehicle on-board computers, network devices (e.g., routers, switches, modems), aerial vehicles, drones, or the like. In some embodiments, the remote units 102 include wearable
15 devices, such as smart watches, fitness bands, optical head-mounted displays, or the like. Moreover, the remote units 102 may be referred to as subscriber units, mobiles, mobile stations, users, terminals, mobile terminals, fixed terminals, subscriber stations, UE, user terminals, a device, or by other terminology used in the art. The remote units 102 may communicate directly with one or more of the network units 104 via UL communication
20 signals. In certain embodiments, the remote units 102 may communicate directly with other remote units 102 via sidelink communication.

[0027] The network units 104 may be distributed over a geographic region. In certain embodiments, a network unit 104 may also be referred to as an access point, an access terminal, a base, a base station, a Node-B, an eNB, a gNB, a Home Node-B, a relay node,
25 a device, a core network, an aerial server, a radio access node, an AP, NR, a network entity, an Access and Mobility Management Function (“AMF”), a Unified Data Management Function (“UDM”), a Unified Data Repository (“UDR”), a UDM/UDR, a Policy Control Function (“PCF”), a Radio Access Network (“RAN”), an Network Slice Selection Function (“NSSF”), an operations, administration, and management (“OAM”),
30 a session management function (“SMF”), a user plane function (“UPF”), an application function, an authentication server function (“AUSF”), security anchor functionality (“SEAF”), trusted non-3GPP gateway function (“TNGF”), an application function, a service enabler architecture layer (“SEAL”) function, a vertical application enabler server, an edge enabler server, an edge configuration server, a mobile edge computing platform

function, a mobile edge computing application, an application data analytics enabler server, a SEAL data delivery server, a middleware entity, a network slice capability management server, or by any other terminology used in the art. The network units 104 are generally part of a radio access network that includes one or more controllers
5 communicably coupled to one or more corresponding network units 104. The radio access network is generally communicably coupled to one or more core networks, which may be coupled to other networks, like the Internet and public switched telephone networks, among other networks. These and other elements of radio access and core networks are not illustrated but are well known generally by those having ordinary skill in
10 the art.

[0028] In one implementation, the wireless communication system 100 is compliant with New Radio (NR) protocols standardized in 3GPP, wherein the network unit 104 transmits using an Orthogonal Frequency Division Multiplexing (“OFDM”) modulation scheme on the downlink (DL) and the remote units 102 transmit on the uplink (UL)
15 using a Single Carrier Frequency Division Multiple Access (“SC-FDMA”) scheme or an OFDM scheme. More generally, however, the wireless communication system 100 may implement some other open or proprietary communication protocol, for example, WiMAX, IEEE 802.11 variants, GSM, GPRS, UMTS, LTE variants, CDMA2000, Bluetooth®, ZigBee, Sigfox, LoraWAN among other protocols. The present disclosure
20 is not intended to be limited to the implementation of any particular wireless communication system architecture or protocol.

[0029] The network units 104 may serve a number of remote units 102 within a serving area, for example, a cell or a cell sector via a wireless communication link. The network units 104 transmit DL communication signals to serve the remote units 102 in the time,
25 frequency, and/or spatial domain.

[0030] Figure 2 depicts a user equipment apparatus 200 that may be used for implementing the methods described herein. The user equipment apparatus 200 is used to implement one or more of the solutions described herein. The user equipment apparatus 200 is in accordance with one or more of the user equipment apparatuses
30 described in embodiments herein. In particular, the user equipment apparatus 200 may comprise a wireless communication device, a remote unit 102, a UE 410, 411, or 510 as described herein. The user equipment apparatus 200 includes a processor 205, a memory 210, an input device 215, an output device 220, and a transceiver 225.

[0031] The input device 215 and the output device 220 may be combined into a single device, such as a touchscreen. In some implementations, the user equipment apparatus 200 does not include any input device 215 and/or output device 220. The user equipment apparatus 200 may include one or more of: the processor 205, the memory 210, and the transceiver 225, and may not include the input device 215 and/or the output device 220.

[0032] As depicted, the transceiver 225 includes at least one transmitter 230 and at least one receiver 235. The transceiver 225 may communicate with one or more cells (or wireless coverage areas) supported by one or more base units. The transceiver 225 may be operable on unlicensed spectrum. Moreover, the transceiver 225 may include multiple UE panels supporting one or more beams. Additionally, the transceiver 225 may support at least one network interface 240 and/or application interface 245. The application interface(s) 245 may support one or more APIs. The network interface(s) 240 may support 3GPP reference points, such as Uu, N1, PC5, etc. Other network interfaces 240 may be supported, as understood by one of ordinary skill in the art.

[0033] The processor 205 may include any known controller capable of executing computer-readable instructions and/or capable of performing logical operations. For example, the processor 205 may be a microcontroller, a microprocessor, a central processing unit ("CPU"), a graphics processing unit ("GPU"), an auxiliary processing unit, a field programmable gate array ("FPGA"), or similar programmable controller. The processor 205 may execute instructions stored in the memory 210 to perform the methods and routines described herein. The processor 205 is communicatively coupled to the memory 210, the input device 215, the output device 220, and the transceiver 225.

[0034] The processor 205 may control the user equipment apparatus 200 to implement the user equipment apparatus behaviors described herein. The processor 205 may include an application processor (also known as "main processor") which manages application-domain and operating system ("OS") functions and a baseband processor (also known as "baseband radio processor") which manages radio functions.

[0035] The memory 210 may be a computer readable storage medium. The memory 210 may include volatile computer storage media. For example, the memory 210 may include a RAM, including dynamic RAM ("DRAM"), synchronous dynamic RAM ("SDRAM"), and/or static RAM ("SRAM"). The memory 210 may include non-volatile computer storage media. For example, the memory 210 may include a hard disk drive, a flash

memory, or any other suitable non-volatile computer storage device. The memory 210 may include both volatile and non-volatile computer storage media.

[0036] The memory 210 may store data related to implement a traffic category field as described herein. The memory 210 may also store program code and related data, such as an operating system or other controller algorithms operating on the apparatus 200.

[0037] The input device 215 may include any known computer input device including a touch panel, a button, a keyboard, a stylus, a microphone, or the like. The input device 215 may be integrated with the output device 220, for example, as a touchscreen or similar touch-sensitive display. The input device 215 may include a touchscreen such that text may be input using a virtual keyboard displayed on the touchscreen and/or by handwriting on the touchscreen. The input device 215 may include two or more different devices, such as a keyboard and a touch panel.

[0038] The output device 220 may be designed to output visual, audible, and/or haptic signals. The output device 220 may include an electronically controllable display or display device capable of outputting visual data to a user. For example, the output device 220 may include, but is not limited to, a Liquid Crystal Display ("LCD"), a Light-Emitting Diode ("LED") display, an Organic LED ("OLED") display, a projector, or similar display device capable of outputting images, text, or the like to a user. As another, non-limiting, example, the output device 220 may include a wearable display separate from, but communicatively coupled to, the rest of the user equipment apparatus 200, such as a smart watch, smart glasses, a heads-up display, or the like. Further, the output device 220 may be a component of a smart phone, a personal digital assistant, a television, a table computer, a notebook (laptop) computer, a personal computer, a vehicle dashboard, or the like.

[0039] The output device 220 may include one or more speakers for producing sound. For example, the output device 220 may produce an audible alert or notification (e.g., a beep or chime). The output device 220 may include one or more haptic devices for producing vibrations, motion, or other haptic feedback. All, or portions, of the output device 220 may be integrated with the input device 215. For example, the input device 215 and output device 220 may form a touchscreen or similar touch-sensitive display. The output device 220 may be located near the input device 215.

[0040] The transceiver 225 communicates with one or more network functions of a mobile communication network via one or more access networks. The transceiver 225 operates under the control of the processor 205 to transmit messages, data, and other

signals and also to receive messages, data, and other signals. For example, the processor 205 may selectively activate the transceiver 225 (or portions thereof) at particular times in order to send and receive messages.

[0041] The transceiver 225 includes at least one transmitter 230 and at least one receiver

5 235. The one or more transmitters 230 may be used to provide uplink communication signals to a base unit of a wireless communication network. Similarly, the one or more receivers 235 may be used to receive downlink communication signals from the base unit. Although only one transmitter 230 and one receiver 235 are illustrated, the user equipment apparatus 200 may have any suitable number of transmitters 230 and receivers
10 235. Further, the transmitter(s) 230 and the receiver(s) 235 may be any suitable type of transmitters and receivers. The transceiver 225 may include a first transmitter/receiver pair used to communicate with a mobile communication network over licensed radio spectrum and a second transmitter/receiver pair used to communicate with a mobile communication network over unlicensed radio spectrum.

15 [0042] The first transmitter/receiver pair may be used to communicate with a mobile communication network over licensed radio spectrum and the second transmitter/receiver pair used to communicate with a mobile communication network over unlicensed radio spectrum may be combined into a single transceiver unit, for example a single chip performing functions for use with both licensed and unlicensed
20 radio spectrum. The first transmitter/receiver pair and the second transmitter/receiver pair may share one or more hardware components. For example, certain transceivers 225, transmitters 230, and receivers 235 may be implemented as physically separate components that access a shared hardware resource and/or software resource, such as for example, the network interface 240.

25 [0043] One or more transmitters 230 and/or one or more receivers 235 may be implemented and/or integrated into a single hardware component, such as a multi-transceiver chip, a system-on-a-chip, an Application-Specific Integrated Circuit ("ASIC"), or other type of hardware component. One or more transmitters 230 and/or one or more receivers 235 may be implemented and/or integrated into a multi-chip module.

30 Other components such as the network interface 240 or other hardware components/circuits may be integrated with any number of transmitters 230 and/or receivers 235 into a single chip. The transmitters 230 and receivers 235 may be logically configured as a transceiver 225 that uses one more common control signals or as

modular transmitters 230 and receivers 235 implemented in the same hardware chip or in a multi-chip module.

[0044] Figure 3 depicts further details of the network node 300 that may be used for implementing the methods described herein. The network node 300 may be one
5 implementation of an entity in the wireless communication network, e.g. in one or more of the wireless communication networks described herein. The network node 300 may comprise a first network function, a network unit 104, and/or an AMF 422, 522 as described herein. The network node 300 may comprise a second network function, a network unit 104, and/or a UE-PCF 431, 532 as described herein. The network node
10 300 includes a processor 305, a memory 310, an input device 315, an output device 320, and a transceiver 325.

[0045] The input device 315 and the output device 320 may be combined into a single device, such as a touchscreen. In some implementations, the network node 300 does not include any input device 315 and/or output device 320. The network node 300 may
15 include one or more of: the processor 305, the memory 310, and the transceiver 325, and may not include the input device 315 and/or the output device 320.

[0046] As depicted, the transceiver 325 includes at least one transmitter 330 and at least one receiver 335. Here, the transceiver 325 communicates with one or more remote units 200. Additionally, the transceiver 325 may support at least one network interface
20 340 and/or application interface 345. The application interface(s) 345 may support one or more APIs. The network interface(s) 340 may support 3GPP reference points, such as Uu, N1, N2 and N3. Other network interfaces 340 may be supported, as understood by one of ordinary skill in the art.

[0047] The processor 305 may include any known controller capable of executing
25 computer-readable instructions and/or capable of performing logical operations. For example, the processor 305 may be a microcontroller, a microprocessor, a CPU, a GPU, an auxiliary processing unit, a FPGA, or similar programmable controller. The processor 305 may execute instructions stored in the memory 310 to perform the methods and routines described herein. The processor 305 is communicatively coupled to the
30 memory 310, the input device 315, the output device 320, and the transceiver 325.

[0048] The memory 310 may be a computer readable storage medium. The memory 310 may include volatile computer storage media. For example, the memory 310 may include a RAM, including dynamic RAM ("DRAM"), synchronous dynamic RAM ("SDRAM"), and/or static RAM ("SRAM"). The memory 310 may include non-volatile computer

storage media. For example, the memory 310 may include a hard disk drive, a flash memory, or any other suitable non-volatile computer storage device. The memory 310 may include both volatile and non-volatile computer storage media.

[0049] The memory 310 may store data related to establishing a multipath unicast link and/or mobile operation. For example, the memory 310 may store parameters, configurations, resource assignments, policies, and the like, as described herein. The memory 310 may also store program code and related data, such as an operating system or other controller algorithms operating on the network node 300.

[0050] The input device 315 may include any known computer input device including a touch panel, a button, a keyboard, a stylus, a microphone, or the like. The input device 315 may be integrated with the output device 320, for example, as a touchscreen or similar touch-sensitive display. The input device 315 may include a touchscreen such that text may be input using a virtual keyboard displayed on the touchscreen and/or by handwriting on the touchscreen. The input device 315 may include two or more different devices, such as a keyboard and a touch panel.

[0051] The output device 320 may be designed to output visual, audible, and/or haptic signals. The output device 320 may include an electronically controllable display or display device capable of outputting visual data to a user. For example, the output device 320 may include, but is not limited to, an LCD display, an LED display, an OLED display, a projector, or similar display device capable of outputting images, text, or the like to a user. As another, non-limiting, example, the output device 320 may include a wearable display separate from, but communicatively coupled to, the rest of the network node 300, such as a smart watch, smart glasses, a heads-up display, or the like. Further, the output device 320 may be a component of a smart phone, a personal digital assistant, a television, a table computer, a notebook (laptop) computer, a personal computer, a vehicle dashboard, or the like.

[0052] The output device 320 may include one or more speakers for producing sound. For example, the output device 320 may produce an audible alert or notification (e.g., a beep or chime). The output device 320 may include one or more haptic devices for producing vibrations, motion, or other haptic feedback. All, or portions, of the output device 320 may be integrated with the input device 315. For example, the input device 315 and output device 320 may form a touchscreen or similar touch-sensitive display. The output device 320 may be located near the input device 315.

[0053] The transceiver 325 includes at least one transmitter 330 and at least one receiver 335. The one or more transmitters 330 may be used to communicate with the UE, as described herein. Similarly, the one or more receivers 335 may be used to communicate with network functions in the PLMN and/or RAN, as described herein. Although only one transmitter 330 and one receiver 335 are illustrated, the network node 300 may have any suitable number of transmitters 330 and receivers 335. Further, the transmitter(s) 330 and the receiver(s) 335 may be any suitable type of transmitters and receivers.

[0054] A wireless communication device such as a UE may be able to connect to and communicate via both a 5th Generation System (5GS) and an Evolved Packet System (EPS). Such a UE can register to the 5GS and also attach to EPS via single registration or via dual registrations and can be capable of receiving UE policy sections in EPS as well as in 5GS. In the case of single registration to 5GS, if the UE supports UE policy sections including the URSP in EPS, and handovers a PDU session from the 5GS to EPS, then the SM-PCF needs to establish the UE policy association with the UE-PCF, so as to assign the right policies to the PDU session after the handover. When the PDU sessions are handed-over from the 5GS to the EPS, it is not clear how the UE-PCF should indicate to the AMF that the UE is able to handle the UE policy sections management list in the EPS.

[0055] There is presented herein a new interaction between the UE-PCF and the AMF for a handover of a PDU session from a 5GS to an EPS the N26 reference point is implemented.

[0056] N26 is an inter-core network interface, for example between AMF and MME, and may be used to enable interworking between the 5G core and EPC. However, support of the N26 interface in the network is optional. Interworking procedures using N26 interface enable the exchange of MM and SM states between the source and target networks, and as such handover procedures may be supported through the N26 interface.

[0057] The N26 interface between AMF in 5GC and MME in EPC may be used to enable seamless session continuity for inter-system handover which may be of particular use for delivering voice services. Using N26 may result in reduced voice interruption time when, for example, performing a handover between 5G (VoNR) to 4G (VoLTE).

[0058] 3GPP TS 24.501 v18.1.0 titled “Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3; (Release 18)” describes at section D.2.2 a UE-initiated UE state

indication procedure, which is a procedure performed at the time of initial registration to the 5GS. Section D.2.2.1 of 3GPP TS 24.501 v18.1.0 states that the purpose of the UE-initiated UE state indication procedure is as follows.

The purpose of the UE-initiated UE state indication procedure is:

- 5 a) to deliver the UPSI(s) of the UE policy section(s) which are:
 - identified by a UPSI with the PLMN ID part indicating the HPLMN or the selected PLMN, and stored in the UE, if any; or
 - identified by a UPSI with the PLMN ID part indicating the PLMN ID part of the SNPN identity of the selected SNPN and associated with the NID of the selected SNPN, and stored in the UE, if any;
 - 10 b) to indicate whether UE supports ANDSP; and
 - c) to deliver the UE's one or more OS IDs;
- to the PCF.

[0059] Section D.2.2.2 of 3GPP TS 24.501 v18.1.0 describes UE-initiated UE state indication procedure initiation as follows.

In order to initiate the UE-initiated UE state indication procedure, the UE shall create a UE STATE INDICATION message. The UE:

- a) shall allocate a PTI value currently not used and set the PTI IE to the allocated PTI value;
- 20 b) if not operating in SNPN access operation mode, shall include the UPSI(s) of the UE policy section(s) which are identified by a UPSI with the PLMN ID part indicating the HPLMN or the selected PLMN available in the UE in the UPSI list IE;
- c) if operating in SNPN access operation mode, shall include UPSI(s) of the UE policy section(s) which are identified by a UPSI:
 - with the PLMN ID part indicating the MCC and MNC of the selected SNPN; and
 - 25 - associated with the NID of the selected SNPN;
- available in the UE in the UPSI list IE;
- d) shall specify whether the UE supports ANDSP in the UE policy classmark IE; and
- e) may include the UE's one or more OS IDs in the UE OS Id IE.

30 The UE shall send the UE STATE INDICATION message (see example in figure D.2.2.2.1). The UE shall transport the created UE STATE INDICATION message using the registration procedure (see subclause 5.5.1).

[0060] Section D.2.2.3 of 3GPP TS 24.501 v18.1.0 describes the UE-initiated UE state indication procedure accepted by the network. This explains that upon receipt of the UE STATE INDICATION message, the PCF shall operate as described in 3GPP TS 23.502 v18.1.0 titled "Procedures for the 5G System (5GS)" and 3GPP TS 29.525 v18.1.0 titled "5G System; UE Policy Control Service; Stage 3".

[0061] A 3GPP working item for enhanced UE policy (eUEPO) allows the UE to receive UE policy sections when the UE registers to an EPS network. Figure 4 illustrates the network architecture 400 with the capability to transmit policy sections to the UE.

[0062] The network architecture 400 comprises a UE 410 that communicates via an E-UTRAN 412 and a Mobility Management Entity (MME) 424. The network architecture 400 further comprises a UE 411 that communicates with a Next Generation Radio Access Network (NG-RAN) 413 and an Access and Mobility Management function (AMF) 422. MME 424 and E-UTRAN 412 communicates with a Serving Gateway (SGW) 426, which in turn communicates with Session Management function (SMF) + Packet Data Network Gateway-Control (PGW-C) 428 and User plane function (UPF) + Packet Data Network Gateway-User (PGW-U) 427. AMF 422 and NG-RAN 413 also communicate with SMF + PGW-C 428 and User plane function (UPF) + Packet Data Network Gateway-User (PGW-U) 427. The network architecture 400 further comprises a Session Management Policy Control Function (SM-PCF) 430, a Home Subscriber Server (HSS) + Unified Data Management (UDM) 436 and a User Equipment Policy Control Function (UE-PCF) 431. The interfaces between the various network functions are also shown in Figure 4.

[0063] The UEs 410, 411 may each comprise a wireless communication device, a remote unit 102, a user equipment apparatus 200, and/or a UE 510 as described herein. The AMF 422 may comprise a first network function, a network unit 104, network node 300, and/or an AMF 522 as described herein. The UE-PCF 431 may comprise a second network function, a network unit 104, network node 300, and/or a UE-PCF 532 as described herein.

[0064] The UE 410, at the time of attach to the EPS (here, E-UTRAN 412), requests establishment of a PDN connectivity. Further, by using an extended protocol configuration options (ePCO), the UE 410 transmits the UE STATE INDICATION message to the SMF+PGW-C 428 which will later be forwarded to SM-PCF 430 to establish a UE policy associations with UE-PCF 431 in order to provide the UE policy sections.

[0065] The SM-PCF 430 does not support N15 reference point while the UE-PCF 431 does not support N7 reference point. In this arrangement, for URSP delivery from UE-PCF 431 in 5GC to the UE 410 in EPS, the UE Policy Association establishment between SM-PCF 430 and UE-PCF 431 is provided. The URSP can be transparently delivered to the UE 410 via SM-PCF 430, SMF+PGW-C 428, SGW 426, and MME 424.

As depicted in Figure 4, an interface (Nx) needs to be specified between SM-PCF 430 and UE-PCF 431 for establishing a UE Policy Association. The N15 interface can be reused as Nx. When the UE 410 sends an Attach Request in EPS (e.g. Initial Attach procedure, 5GS to EPS Mobility procedure without N26), the UE 410 sends UE Policy Container including list of PSIs and URSP delivery over EPS Indication in PCO to UE-PCF 431. When the UE policy has been updated in the UE-PCF 431 while the UE 410 is in EPS, the UE-PCF 431 sends the UE Policy Container to SMF+PGW-C 428. The SMF+PGW-C 428 sends PCO including UE Policy Container to the UE 410. Further, when the UE 411 sends a Registration Request in 5GS, UE Policy Container including list of PSIs and URSP delivery over EPS Indication to UE-PCF 431. In 5GS to EPS Handover/Idle mode mobility using N26, the UE Policy Association established in 5GS can be maintained in EPS.

[0066] Figure 5 illustrates a process 500 for the UE's mobility from 5GS to EPS when the N26 interface is supported by the AMF and the MME. The process 500 is performed by a UE 510, 1 gNB and/or an eNB 520, an AMF 522, an MME 524, an SGW 526, an SMF + PGW-C 528, and SM-PCF 530, and a UE-PCF 532.

[0067] The UE 510 may comprise a wireless communication device, a remote unit 102, a user equipment apparatus 200, and/or a UE 410, 411 as described herein. The AMF 522 may comprise a first network function, a network unit 104, network node 300, and/or an AMF 422 as described herein. The UE-PCF 532 may comprise a second network function, a network unit 104, network node 300, and/or a UE-PCF 431 as described herein.

[0068] Assumed pre-conditions for the process 500 are:

- The UE is initially registered in 5GS with a PDU session and the UE is operating in single registration mode.
- The UE has already included a UE state indication message when registering to 5GS and include a capability to support URSP provisioning in EPS.
- The capability to support URSP provisioning in EPS is stored in the UDR for the UE.
- The N26 interface is supported.

[0069] The process 500 begins at 571, this step comprises steps 1 to 18 as shown in, and described with reference to, Figure 4.11.1.2.1-1 of 3GPP TS 23.502 v18.1.0 titled "Procedures for the 5G System (5GS)". By the time of the tracking area update, it is assumed that the PDU session has been transferred to the EPS with the EPS bearer

being established for both UL and DL. The AMF 522 has released the PDU SM context.

[0070] At 572, the AMF 522 uses the Npcf_UEPolicyControl_Delete service operation as described in 3GPP TS 29.525 v18.1.0 titled “5G System; UE Policy Control Service; Stage 3” to delete the UE policy association. The Npcf_UEPolicyControl_Delete message may include a UE Policy Association Identity (UePolAssoId).

[0071] At 573, the UE-PCF 532 evaluates whether the UE 510 is capable of the UE policy section management list in the EPS. The UE-PCF 532 may respond with “102 Processing” 573a, the response comprising an indication of the UE capability in respect of the UE policy section management list in the EPS. Alternatively, the UE-PCF 532 may reject the Npcf_UEPolicyControl_Delete service operation by responding with “400 Bad Request” 573b, the response comprising an indication of the UE capability of the UE policy section management list in the EPS. The “400 Bad Request” message is an example of a “4XX reject” message, the UE-PCF 532 may respond with any such “4XX reject” message. A new information element may be added to the data structure supported by the DELETE response body as described in table 5.3.3.3.2 of 3GPP TS 29.525 v18.1.0 titled “5G System; UE Policy Control Service; Stage 3”, and reproduced as table 1 below. Note that this table references table 5.2.7.1-1 of 3GPP TS 29.500 v18.1.0 “5G System; Technical Realization of Service Based Architecture; Stage 3”.

Data type	P	Cardinality	Response codes	Description
ProcessingResponse	O	0..1	102 Processing	The response includes a cause for the reason of processing.
n/a			204 No Content	The policy association was successfully deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual UE policy deletion. The response shall include a Location header field containing an alternative URI of the resource located in an alternative PCF (service) instance. Applicable if the feature "ES3XX" is supported.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual UE policy deletion. The response shall include a Location header field containing an alternative URI of the resource located in an alternative PCF (service) instance. Applicable if the feature "ES3XX" is supported.
ProcessingResponse	O	0..1	400 Bad Request	The response includes a cause for the reason of rejection.
NOTE: The mandatory HTTP error status codes for the DELETE method listed in table 5.2.7.1-1 of 3GPP TS 29.500 also apply.				

Table 1: Data structures supported by a DELETE Response Body

[0072] A new data type “ProcessingResponse” is thus defined herein as shown in table 2 below.

Attribute name	Data type	P	Cardinality	Description
cause	string	C	0..1	A machine-readable cause string, specific to this occurrence of the processing. If the processing is initiated by a UE-PCF towards an AMF which has requested for the deletion of a UE policy association at the time of one or more PDU sessions are transferring from 5GS to 4GS but the UE supports the UE policy sections management list in the EPS, this IE shall be present and set to "The UE supports the UE policy sections management list in the EPS".

Table 2: Definition of type ProcessingResponse

- 5
- [0073] At 574, the AMF 522 sends UE-PCF ID, UE Policy Association ID and the reason for the request within the Nsmf_PDUSession_UpdateSMContext request to the SMF+PGW-C 528. This may require additional attributes for the SmContextUpdateData type over those defined in 3GPP TS 29.502 v18.1.0 titled “Procedures for the 5G System (5GS)”. By way of example, the
- 10
- Nsmf_PDUSession_UpdateSMContext request may comprise a UE-PCF ID, and a UE policy association ID.
- [0074] At 575, the SM+PGW-C passes the info to the SM-PCF 530. This may be performed by sending a Npcf_SMPolicyControl_Update Request message to the SM-PCF 530. The Npcf_SMPolicyControl_Update Request message may include the UE-
- 15
- PCF ID and the UE policy association ID.
- [0075] At 576, the SM-PCF 530, based on the information provided by the SMF+PGW-C 528 may determine whether the UE 510 supports URSP delivery in EPC by checking UE context policy control subscription information in a UDR (not illustrated) and based on that decides to establish a UE policy association towards the UE-PCF 532.
- 20
- [0076] At 577, the UE policy association is still kept due to either step 573a or step 573b, where the UE-PCF 532 indicates to the AMF 522 that the deletion of the UE policy association is processing or rejected, respectively, due to the reason that the UE supports the UE policy section management list in the EPS.
- [0077] At 578, the SM-PCF 530 uses the UE policy association ID received from the
- 25
- SMF+PGW-C 528 and finds the UE-PCF 532 by using UE-PCF ID to establish the UE policy association with the selected UE-PCF 532. The SM-PCF 530 includes the policy container received from the SMF+PGW-C 528.

[0078] At 579, the UE policy association between the SM-PCF 530 and UE-PCF 532 is established and regular procedure is now followed to determine the UE policy sections.

[0079] At 580, the UE-PCF 532 sends Npcf_UEPolicyControl_Create.

[0080] At 581, the UE-PCF 532 eliminates the original UE policy association which was
5 created when the UE 510 was registered to the 5GS.

[0081] At 582, where the UE-PCF 532 responded to the AMF 522 in step 573a) with “102 Processing”, the UE-PCF 532 sends “204 No Contents” to confirm the deletion of the original UE policy association which was established at the time of 5GS registration.

[0082] At 583, the SMF+PGW-C 528 receives the new UE policy association and
10 updates the UE policy association it stored for the UE 510 accordingly.

[0083] In an alternative to 582 and 583, and where the UE-PCF 532 responded to the AMF 522 in step 573b with a “400 Bad Request” message, at 584 the SMF+PGW-C 528 sends an Nsmf_PDUSession_UpdateSMContext response to AMF 522, so the AMF 522 notices that the new UE Policy association is established per SM-PCF's request. (Step
15 584 is not needed if the UE-PCF 532 responded with “102 Processing” as at 573a.

[0084] At 585, the AMF 522 de-registers the UE 510 from the 5GS and deletes the UE policy association which was created at the time for the UE 510 registration to the 5GS.

[0085] At 586, the SM-PCF 530 and UE-PCF 532 may transmit the UE policy section management list as described in 3GPP TS 24.501 v18.1.0 titled “Non-Access-Stratum
20 (NAS) protocol for 5G System (5GS); Stage 3”.

[0086] Accordingly, there is provided a first network function comprising a processor and a memory coupled with the processor. The processor is configured to cause the first network function to send a request to a second network function, the request requesting a deletion of a first policy association, wherein the first policy association was established
25 for at least one PDU session, the at least one PDU session established by a wireless communication device in a first mobile communications technology and the at least one PDU session being transferred to a second mobile communications technology. The processor is further configured to cause the first network function to receive a processing response from the second network function, the processing response
30 indicating that wireless communication device supports a second policy association, the second policy association for the second mobile communications technology.

[0087] The first network function may be an AMF. The second network function may be a UE-PCF. The first mobile communications technology may be 5GS. The second mobile communications technology may be EPS.

[0088] The processing response may include a cause. The cause may define a reason for the processing response.

[0089] The processing response may comprise an indication that the requested deletion of a first policy association is being processed. The processing response may include a
5 cause for the reason of processing.

[0090] The processing response may comprise an indication that the requested deletion of a first policy association is rejected. The processing response may include a cause for the reason of rejection.

[0091] The processor may be further arranged to provide to a fourth network function,
10 the identity of the second network function and the identity of the at least one PDU session. The fourth network function may comprise an SMF+ PGW-C. The first network function may be an AMF.

[0092] Figure 6 illustrates a method 600 in a first network function, the method 600 comprising sending 610 a request to a second network function, the request requesting a
15 deletion of a first policy association, wherein the first policy association was established for at least one PDU session, the at least one PDU session established by a wireless communication device in a first mobile communications technology and the at least one PDU session being transferred to a second mobile communications technology. The method 600 further comprises receiving 620 a processing response from the second
20 network function, the processing response indicating that wireless communication device supports a second policy association, the second policy association for the second mobile communications technology.

[0093] In certain embodiments, the method 600 may be performed by a processor executing program code, for example, a microcontroller, a microprocessor, a CPU, a
25 GPU, an auxiliary processing unit, a FPGA, or the like.

[0094] The first network function may be an AMF. The second network function may be a UE-PCF. The first mobile communications technology may be 5GS. The second mobile communications technology may be EPS.

[0095] The processing response may include a cause. The cause may define a reason for
30 the processing response.

[0096] The processing response may comprise an indication that the requested deletion of a first policy association is being processed. The processing response may include a cause for the reason of processing.

[0097] The processing response may comprise an indication that the requested deletion of a first policy association is rejected. The processing response may include a cause for the reason of rejection.

[0098] The method may further comprise providing to a fourth network function the identity of the second network function and the identity of the at least one PDU session. The fourth network function may comprise an SMF+ PGW-C.

[0099] The first network function may be an AMF.

[0100] There is further provided a second network function, comprising a processor and a memory coupled with the processor. The processor configured to cause the second network function to: receive from a first network function, deletion of a first policy association, a first policy association, wherein the first policy association was established for at least one PDU session, the at least one PDU session established by a wireless communication device in a first mobile communications technology and the at least one PDU session being transferred to a second mobile communications technology; and send a processing response to the first network function, the processing response indicating that wireless communication device supports a second policy association, the second policy association for the second mobile communications technology.

[0101] The first network function may be an AMF. The second network function may be a UE-PCF. The first mobile communications technology may be 5GS. The second mobile communications technology may be EPS.

[0102] The processing response may include a cause. The cause may define a reason for the processing response.

[0103] The processing response may comprise an indication that the requested deletion of a first policy association is being processed. The processing response may include a cause for the reason of processing.

[0104] The processing response may comprise an indication that the requested deletion of a first policy association is rejected. The processing response may include a cause for the reason of rejection.

[0105] The processor may be further arranged to cause the second network function to: receive from a third network function a request to establish the second policy association; and establish the second policy association. The third network function may be an SM-PCF. The third network function may be arranged to transmit the policy section management list to the device.

[0106] The processor may be further arranged to cause the second network function to: delete the first policy association; and notify the first network function that the first policy association is deleted.

[0107] The second first network function may be a UE-PCF.

5 [0108] Figure 7 illustrates a method 700 in a second network function, the method 700 comprising: receiving 710 from a first network function, deletion of a first policy association, a first policy association, wherein the first policy association was established for at least one PDU session, the at least one PDU session established by a wireless communication device in a first mobile communications technology and the at least one
10 PDU session being transferred to a second mobile communications technology; and sending 720 a processing response to the first network function, the processing response indicating that wireless communication device supports a second policy association, the second policy association for the second mobile communications technology.

[0109] In certain embodiments, the method 700 may be performed by a processor
15 executing program code, for example, a microcontroller, a microprocessor, a CPU, a GPU, an auxiliary processing unit, a FPGA, or the like.

[0110] The first network function may be an AMF. The second network function may be a UE-PCF. The first mobile communications technology may be 5GS. The second mobile communications technology may be EPS.

20 [0111] The processing response may include a cause. The cause may define a reason for the processing response.

[0112] The processing response may comprise an indication that the requested deletion of a first policy association is being processed. The processing response may include a cause for the reason of processing.

25 [0113] The processing response may comprise an indication that the requested deletion of a first policy association is rejected. The processing response may include a cause for the reason of rejection.

[0114] The method may further comprise receiving from a third network function a request to establish the second policy association; and establishing the second policy
30 association. The third network function may be an SM-PCF. The third network function may be arranged to transmit the policy section management list to the device.

[0115] The method may further comprise deleting the first policy association, and notifying the first network function that the first policy association is deleted. The second network function may be a UE-PCF.

[0116] At the time of handover from the 5GS to the EPS, if there is any PDU session to be transferred from the 5GS to the EPS, and the UE supports the UE policy sections management list, the UE-PCF transmits a “102 processing” message when the AMF request for the deletion of the UE policy association of the transferred PDU sessions.

- 5 The “102 processing” message comprises a machine-readable message indicating that the UE supports UE policy sections management list in the EPS. The UE-PCF may further send a “204 no contents” message once the UE policy association is modified for the EPS.

[0117] At the time of handover from the 5GS to the EPS, if there is any PDU session to be transferred from the 5GS to the EPS, and if the UE supports the UE policy sections management list in EPS, a new UE policy association needs to be established and the old one (which was established at the time of 5GS registration) needs to be removed.

[0118] After the transfer of the PDU session to the EPS from the 5GS, the AMF requests that the UE-PCF deletes the old UE policy association, established at the time of 5GS registration. The UE-PCF realizes that the UE is capable of having UE policy association in the EPS and therefore processes the request after establishment of the new UE policy association in EPS. A new cause is also exchanged between the UE-PCF and the AMF.

[0119] As described herein, upon receiving a request from the AMF to remove the UE policy association created at the time of 5GS registration, the UE-PCF realizes that the UE is capable of handling UE policy association in the EPS, therefore the UE-PCF:

- responds with a “102 Processing” message with a cause that the UE is capable of handling UE policy association in the EPS;
- that triggers that AMF provides the SMF+PGW-C the information about the identity of the UE-PCF and the identity of the UE policy association;
- the information is passed along to the SM-PCF which request the UE-PCF to establish the UE policy association for the UE in the EPS; and
- then the UE-PCF removes the old UE policy association and transmits a “204 No Contents” message towards the AMF.

30 [0120] In an alternative arrangement, the first UE-PCF response listed above is instead a “400 Bad Request” message with the same cause, and which indicates that the UE is capable of handling UE policy association in the EPS. As such, the SMF+PWG-C will then notify the AMF about the removal of the old UE policy association.

[0121] Accordingly, there is provided a method comprising: requesting by a first network entity to a second network entity, deletion of a first policy association, the first policy association was established for one or more PDU sessions, established by a device in a first mobile communications technology but transferred to a second mobile communications technology; responding by the second entity to the first network entity by a processing response, the processing response comprising that the device supports a second policy association, the second policy association is for the second mobile communications technology; providing by the first network entity to a fourth network entity, identity of the second network entity and identities of one or more PDU sessions; requesting by the third network entity to the second network entity to established the second policy association; establishing by the second network entity, the second policy association; and deleting the first policy association and notifying the first network entity by the second network entity.

[0122] The third network entity may transmit the policy section management list to the device.

[0123] The first network entity may be an AMF. The second network entity may be a UE-PCF. The third network entity may be an SM-PCF. The first mobile communications technology may be 5GS. The second mobile communications technology may be EPS.

[0124] It should be noted that the above-mentioned methods and apparatus illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative arrangements without departing from the scope of the appended claims. The word “comprising” does not exclude the presence of elements or steps other than those listed in a claim, “a” or “an” does not exclude a plurality, and a single processor or other unit may fulfil the functions of several units recited in the claims. Any reference signs in the claims shall not be construed so as to limit their scope.

[0125] Further, while examples have been given in the context of particular communication standards, these examples are not intended to be the limit of the communication standards to which the disclosed method and apparatus may be applied.

For example, while specific examples have been given in the context of 3GPP, the principles disclosed herein can also be applied to another wireless communication system, and indeed any communication system which uses routing rules.

[0126] The method may also be embodied in a set of instructions, stored on a computer

readable medium, which when loaded into a computer processor, Digital Signal Processor (DSP) or similar, causes the processor to carry out the hereinbefore described methods.

[0127] The described methods and apparatus may be practiced in other specific forms.

- 5 The described methods and apparatus are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.
- 10 [0128] The following abbreviations are relevant in the field addressed by this document: 5GCN, 5G Core Network; 5GS, 5G System; AMF, Access and Mobility Management Function; ANDSP, Access Network Discovery and Selection Policy; API, Application Programming Interface; APN, Access Point Name; BRID, Broadcast Remote Identification; BVLOS, Beyond Visual Line of Sight; C2, Command and Control; CAA,
- 15 Civil Aviation Administration; DCN, Dedicated Core Network; DNN, Data Network Name; DNS, Domain Name System; ePDG, evolved Packet Data Gateway; ePCO, Extended Protocol Configuration Options; EPS, Evolved Packet System; ER-NSSAI, Extended rejected NSSAI ; E-UTRA, Evolved Universal Terrestrial Radio Access; FQDN, Fully Qualified Domain Name; GUMMEI, Globally Unique Mobility
- 20 Management Entity Identifier; GUTI, Globally Unique Temporary Identity; HPLMN, Home PLMN; HSS, Home Subscriber Server; IE, Information Element; IMSI, International Mobile Subscriber Identity; IP, Internet Protocol; LADN, Local Area Data Network; LCS, LoCation Services ; MCC, Mobile Country Code; MNC, Mobile Network Code; N3AN, Non-3GPP Access Network; N3IWF, Non-3GPP InterWorking
- 25 Function; NEF, Network Exposure Function; NID, Network Identifier; OS, Operating System; OS Id, Operating System Identity; OS App Id, Operating System Application Identity; PCF, Policy Control Function; PCO, Protocol Configuration Options; PDN, Packet Data Network; PDN GW, PDN Gateway; PDU, Protocol Data Unit; PGW, PDN GW; PLMN, Public Land Mobile Network; PLMN ID, Public Land Mobile
- 30 Network identity; PTI, Procedure Transaction Identity; MCC, Mobile Country Code; MME, Mobility Management Entity; MNC, Mobile Network Code; NF, Network Function; NID, Network Identifier; NRID, Networked Remote Identification; NSAC, Network Slice Admission Control; NSSF, Network Slice Selection Function; PTI, Procedure Transaction Identity; P-TMSI, Packet Temporary Mobile Subscriber Identity;

- RAI, Routing Area Identity; RID, Remote Identification; SWG, Serving Gateway; SMF, Session and Mobility Management Function; SM-PCO, Session Management PCO; SNPN, Standalone Non-Public Network; S-NSSAI, Single Network Slice Selection Assistance Information; SSC, Session and Service Continuity; SSID, Service Set Identifier; SUCI, Subscription Concealed Identifier; SUPI, Subscription Permanent Identifier; TA, Tracking Area; TAI, Tracking Area Identity; TAU, Tracking Area Update; TEID, Tunnel Endpoint Identifier; TNAN, Trusted Non-3GPP-Access-Network; TNAP, Trusted Non-3GPP Access Network; TNGF, Trusted Non-3GPP Gateway Function; TPAAE, Third Party Authorized Entity; UAS, Uncrewed Aerial System; UAS
- 5 NF, Uncrewed Aerial System Network Function; UAV, Uncrewed Aerial Vehicle; UAV-C, Uncrewed Aerial Vehicle Controller; UDM, Unified Data Management; UDR, Unified Data Repository; UE, User Equipment; UPDS, UE policy delivery service; UPSC, UE Policy Section Code; UPSI, UE Policy Section Identifier; URSP, UE Route Selection Policy; USIM, Universal Subscriber Identity Module; USS, UAS Service Supplier; UTM,
- 10 Uncrewed Aerial System Traffic Management; UUAA, USS UAV Authorization/Authentication; UUID, Universal Unique Identifier; and WLANSPP, Wireless Location Area Network Selection Policy.

Claims

1. A first network function comprising:
a processor; and
5 a memory coupled with the processor, the processor configured to cause the first network function to:
send a request to a second network function, the request requesting a deletion of a first policy association, wherein the first policy association was established for at least one PDU session, the at least one PDU session established by a wireless communication
10 device in a first mobile communications technology and the at least one PDU session being transferred to a second mobile communications technology;
receive a processing response from the second network function, the processing response indicating that wireless communication device supports a second policy association, the second policy association for the second mobile communications
15 technology.
2. The first network function of claim 1, wherein the processing response includes a cause.
- 20 3. The first network function of claim 1 or 2, wherein the processing response comprises an indication that the requested deletion of a first policy association is being processed.
4. The first network function of claim 1 or 2, wherein the processing response
25 comprises an indication that the requested deletion of a first policy association is rejected.
5. The first network function of any of claims 1 to 4, wherein the processor is further arranged to provide to a fourth network function, the identity of the second network function and the identity of the at least one PDU session.
30
6. The first network function of any of claims 1 to 5, wherein the first network function is an AMF.
7. A method in a first network function comprising:

5 sending a request to a second network function, the request requesting a deletion of a first policy association, wherein the first policy association was established for at least one PDU session, the at least one PDU session established by a wireless communication device in a first mobile communications technology and the at least one PDU session being transferred to a second mobile communications technology;

10 receiving a processing response from the second network function, the processing response indicating that wireless communication device supports a second policy association, the second policy association for the second mobile communications technology.

8. The method of claim 7, wherein the processing response includes a cause.

9. The method of claim 7 or 8, wherein the processing response comprises an indication that the requested deletion of a first policy association is being processed.

15 10. The method of claim 7 or 8, wherein the processing response comprises an indication that the requested deletion of a first policy association is rejected.

20 11. The method of any of claims 7 to 10, further comprising providing to a fourth network function, the identity of the second network function and the identity of the at least one PDU session.

25 12. The method of any of claims 7 to 11, wherein the first network function is an AMF.

13. A second network function, comprising:
a processor; and
a memory coupled with the processor, the processor configured to cause the second network function to:
30 receive from a first network function, deletion of a first policy association, a first policy association, wherein the first policy association was established for at least one PDU session, the at least one PDU session established by a wireless communication device in a first mobile communications technology and the at least one PDU session being transferred to a second mobile communications technology; and

send a processing response to the first network function, the processing response indicating that wireless communication device supports a second policy association, the second policy association for the second mobile communications technology.

5 14. The second network function of claim 13, wherein the processing response includes a cause.

15 15. The second network function of claim 13 or 14, wherein the processing response comprises an indication that the requested deletion of a first policy association is being
10 processed.

16. The second network function of claim 13 or 14, wherein the processing response comprises an indication that the requested deletion of a first policy association is rejected.

15 17. The second network function of any of claims 13 to 16, wherein the processor is further arranged to cause the second network function to:
 receive from a third network function a request to establish the second policy association; and
 establish the second policy association.

20 18. The second network function of any of claims 13 to 17, wherein the processor is further arranged to cause the second network function to:
 delete the first policy association; and
 notify the first network function that the first policy association is deleted.

25 19. The second network function of any of claims 13 to 18, wherein second first network function is a UE-PCF.