US 20240187990A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2024/0187990 A1**

CHEN et al. (43) **Pub. Date: Jun. 6, 2024**

(54) **EXTENDED DISCONTINUOUS RECEPTION DIFFERENTIATION FOR NEW RADIO (NR)**

(71) Applicant: **Telefonaktiebolaget LM Ericsson (publ)**, Stockholm (SE)

(72) Inventors: **Qian CHEN**, Mölndal (SE); **Paul SCHLIWA-BERTLING**, Ljungsbro (SE); **Mohammed Yazid LYAZIDI**, London (GB); **Tuomas TIRRONEN**, Helsinki (FI); **Andreas HÖGLUND**, Solna (SE)

(73) Assignee: **Telefonaktiebolaget LM Ericsson (publ)**, Stockholm (SE)

(21) Appl. No.: **18/552,883**

(22) PCT Filed: **Mar. 31, 2022**

(86) PCT No.: **PCT/EP2022/058537**

§ 371 (c)(1),
(2) Date: **Sep. 27, 2023**

Related U.S. Application Data

(60) Provisional application No. 63/168,560, filed on Mar. 31, 2021.

Publication Classification

(51) **Int. Cl.**

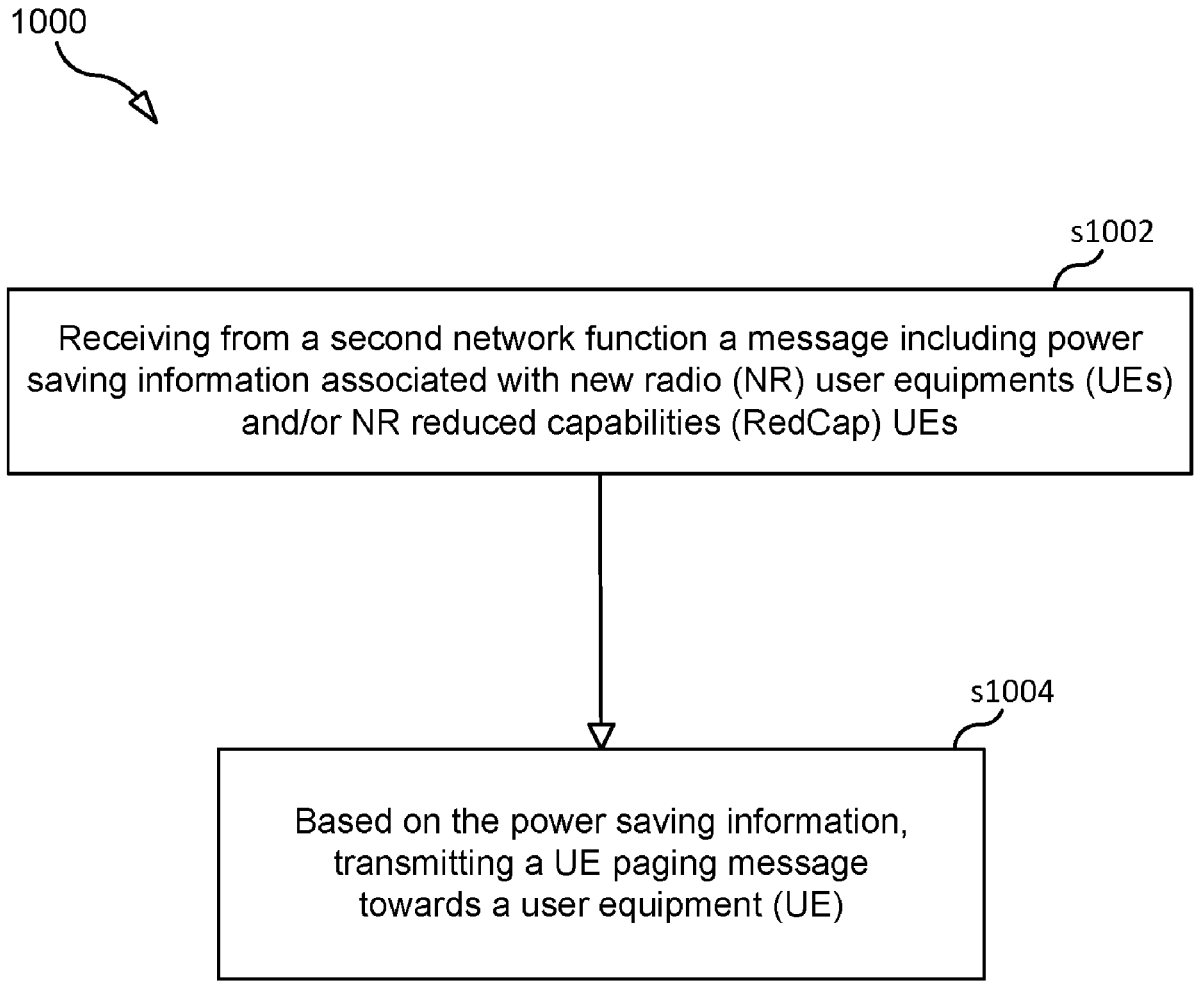
H04W 52/02	(2006.01)
H04W 68/02	(2006.01)
H04W 76/28	(2006.01)

(52) **U.S. Cl.**

CPC ***H04W 52/0235*** (2013.01); ***H04W 68/02*** (2013.01); ***H04W 76/28*** (2018.02)

(57) **ABSTRACT**

A method (**900**) performed by a first network function (**302**), the method comprising: transmitting (s**902**) toward a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, wherein the power saving information is used for transmitting a paging message towards a user equipment (UE) from the second network function.



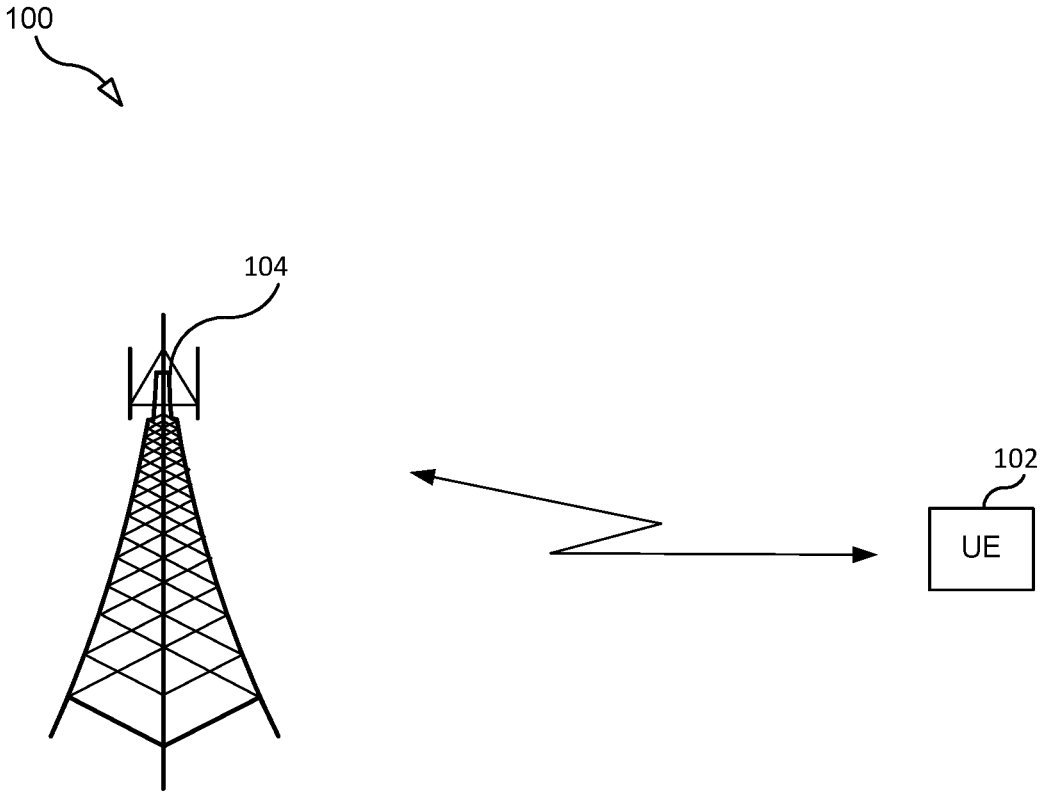


FIG. 1

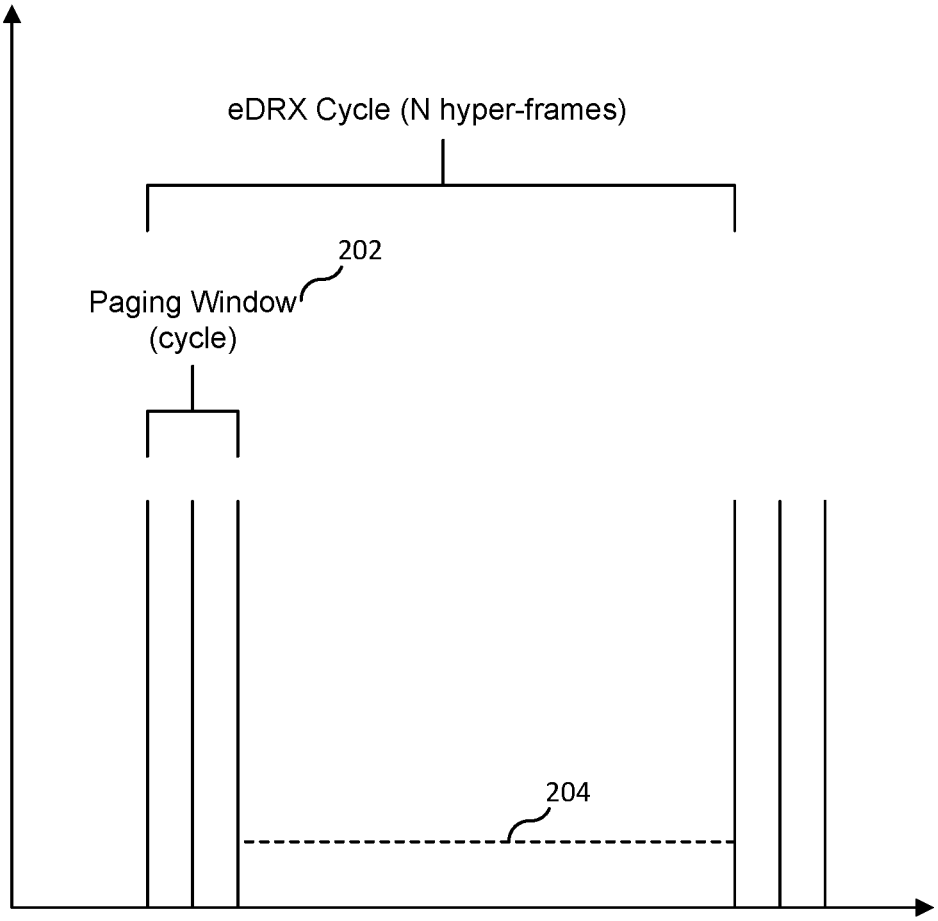


FIG. 2

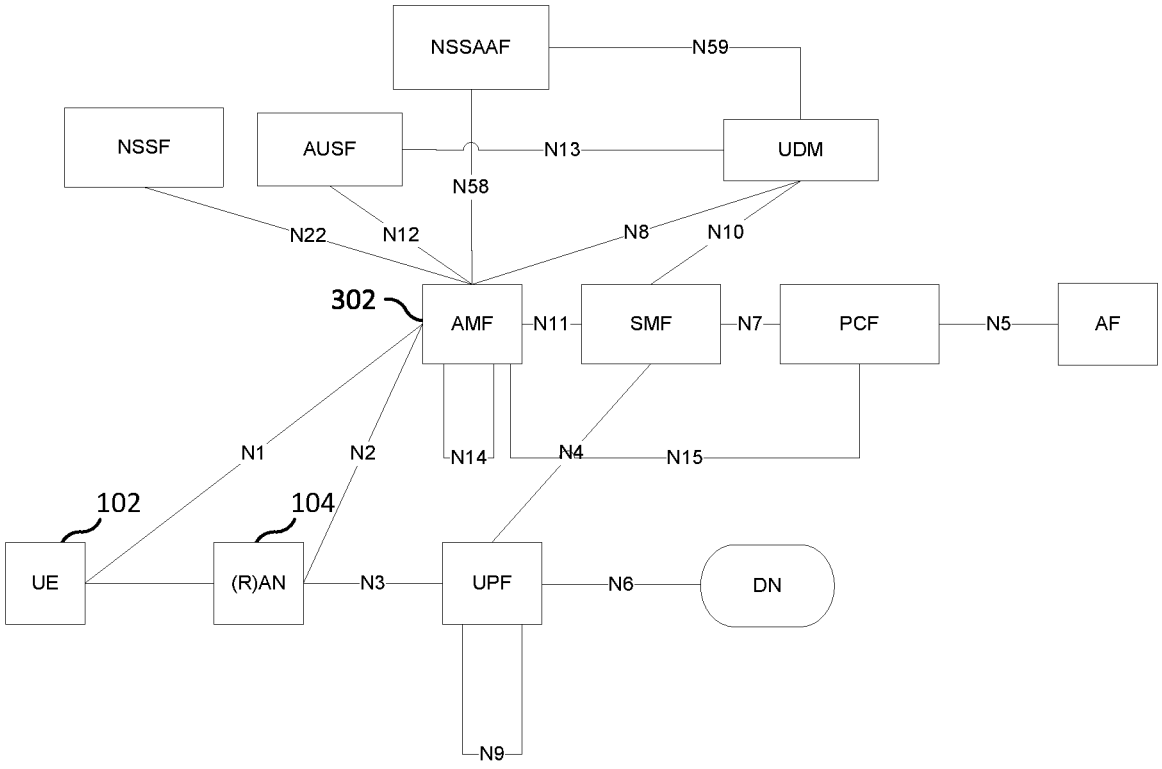

NSSAAF
N59
NSSF
AUSF
N13
UDM
N58
N22
N12
N8
N10
302
AMF
N11
SMF
N7
PCF
N5
AF
N1
N2
N14
N4
N15
102
104
UE
(R)AN
N3
UPF
N6
DN
N9

FIG. 3

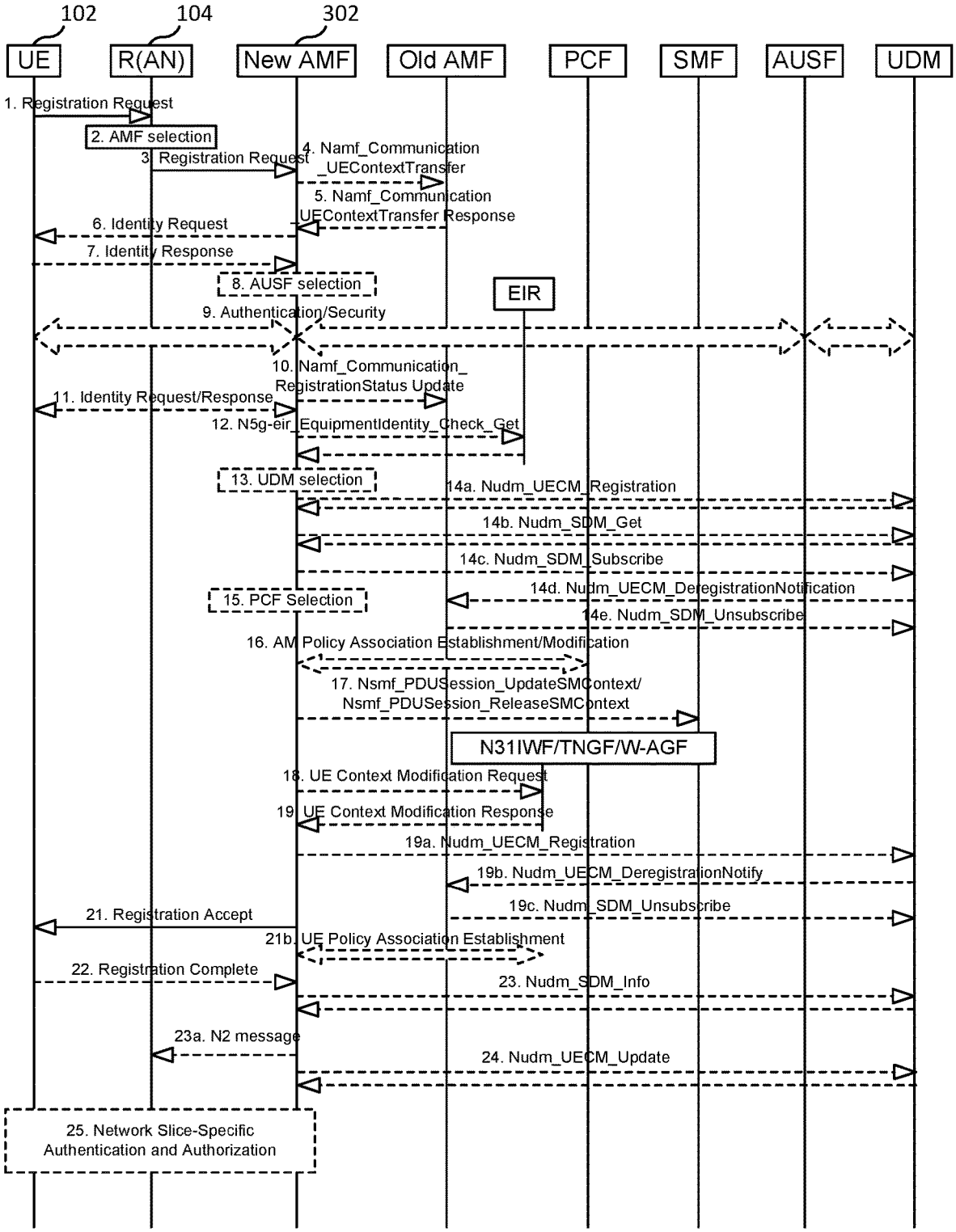

102
104
302
UE
R(AN)
New AMF
Old AMF
PCF
SMF
AUSF
UDM
EIR
1. Registration Request
2. AMF selection
3. Registration Request
4. Namf_Communication _UEContextTransfer
5. Namf_Communication UEContextTransfer Response
6. Identity Request
7. Identity Response
8. AUSF selection
9. Authentication/Security
10. Namf_Communication_ RegistrationStatus Update
11. Identity Request/Response
12. N5g-eir_EquipmentIdentity_Check_Get
13. UDM selection
14a. Nudm_UECM_Registration
14b. Nudm_SDM_Get
14c. Nudm_SDM_Subscribe
14d. Nudm_UECM_DeregistrationNotification
15. PCF Selection
14e. Nudm_SDM_Unsubscribe
16. AM Policy Association Establishment/Modification
17. Nsmf_PDUSession_UpdateSMContext/ Nsmf_PDUSession_ReleaseSMContext
N31IWF/TNGF/W-AGF
18. UE Context Modification Request
19. UE Context Modification Response
19a. Nudm_UECM_Registration
19b. Nudm_UECM_DeregistrationNotify
19c. Nudm_SDM_Unsubscribe
21. Registration Accept
21b. UE Policy Association Establishment
22. Registration Complete
23. Nudm_SDM_Info
23a. N2 message
24. Nudm_UECM_Update
25. Network Slice-Specific Authentication and Authorization

FIG. 4

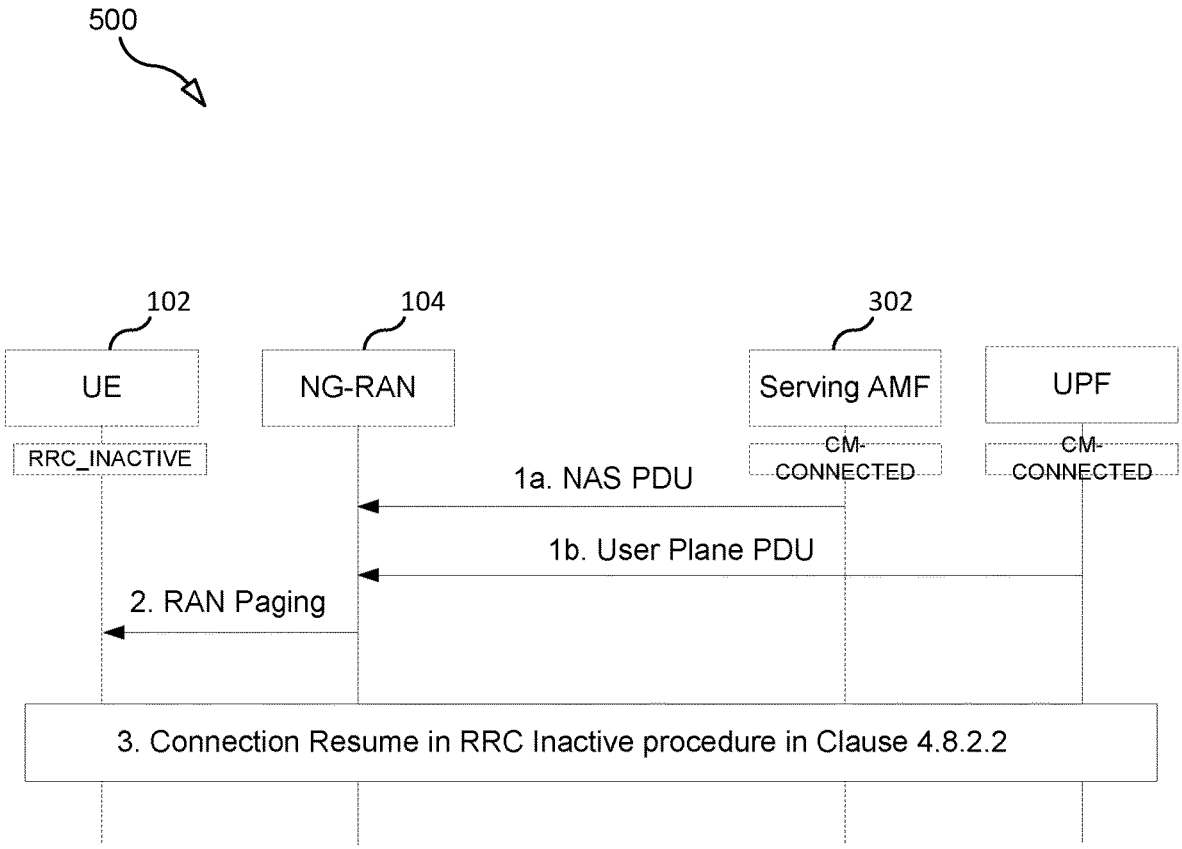

500
102
104
302
UE
NG-RAN
Serving AMF
UPF
RRC_INACTIVE
CM-CONNECTED
CM-CONNECTED
1a. NAS PDU
1b. User Plane PDU
2. RAN Paging
3. Connection Resume in RRC Inactive procedure in Clause 4.8.2.2

FIG. 5

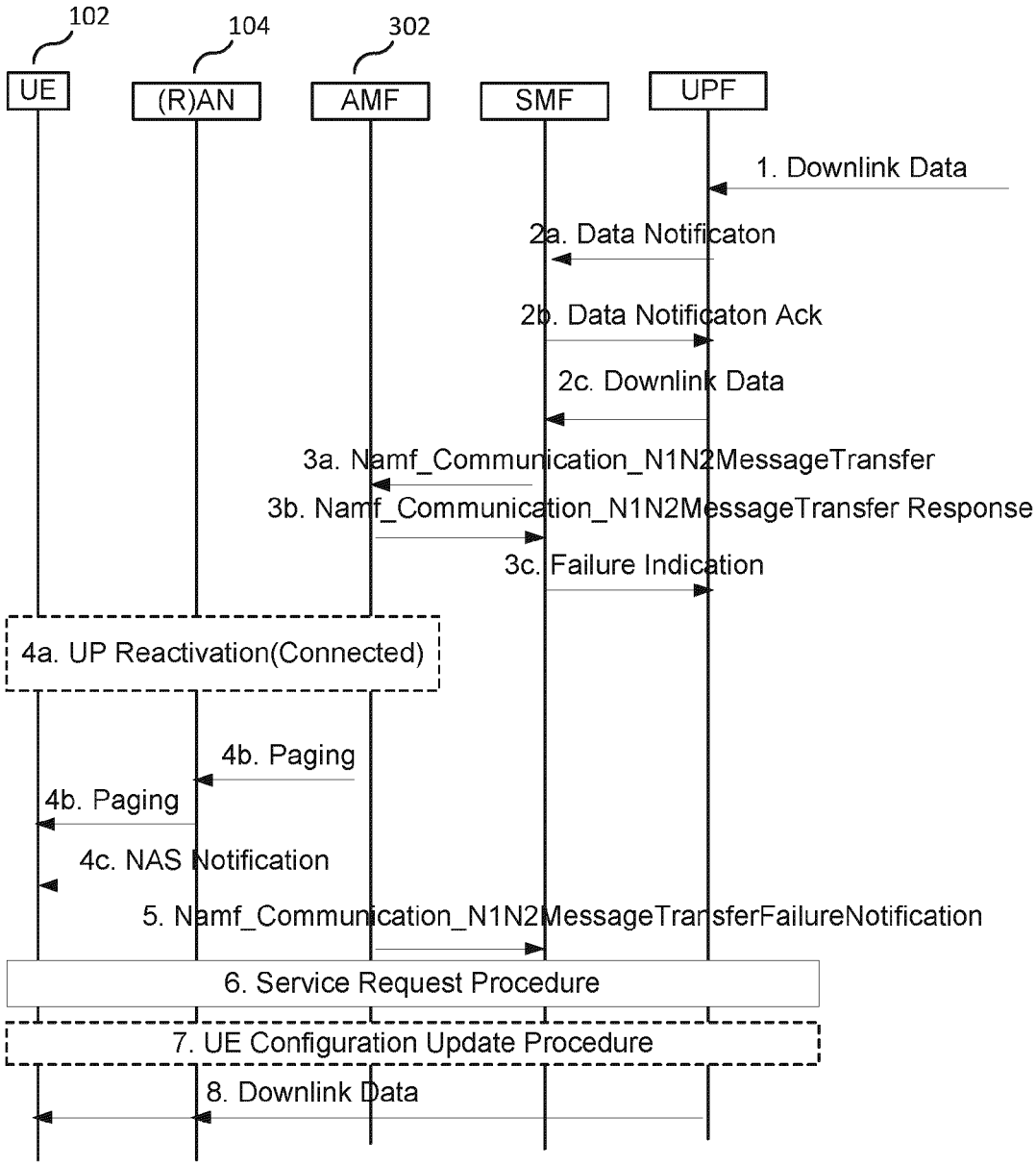

102
104
302
UE
(R)AN
AMF
SMF
UPF
1. Downlink Data
2a. Data Notificaton
2b. Data Notificaton Ack
2c. Downlink Data
3a. Namf_Communication_N1N2MessageTransfer
3b. Namf_Communication_N1N2MessageTransfer Response
3c. Failure Indication
4a. UP Reactivation(Connected)
4b. Paging
4b. Paging
4c. NAS Notification
5. Namf_Communication_N1N2MessageTransferFailureNotification
6. Service Request Procedure
7. UE Configuration Update Procedure
8. Downlink Data

FIG. 6

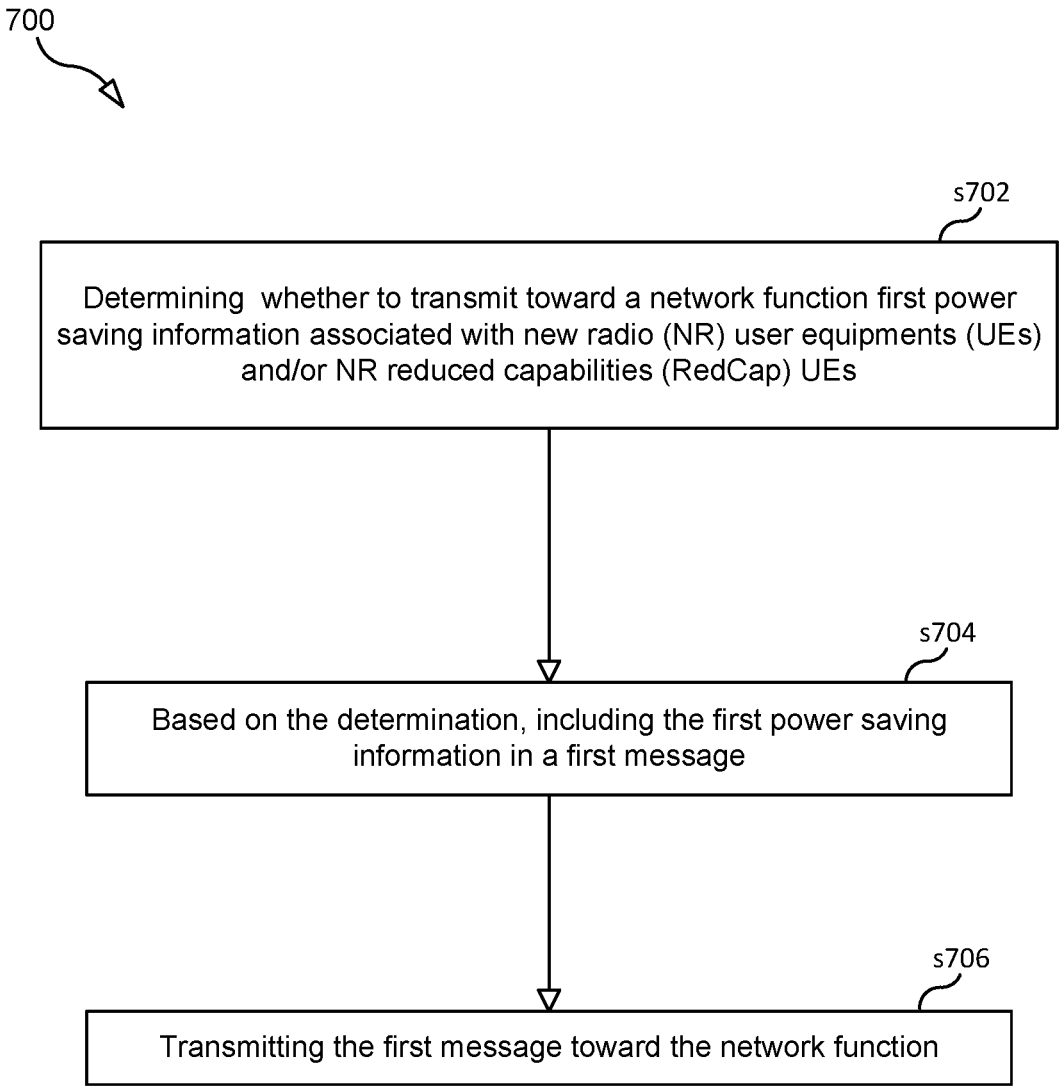

700
s702
Determining whether to transmit toward a network function first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs
s704
Based on the determination, including the first power saving information in a first message
s706
Transmitting the first message toward the network function

FIG. 7

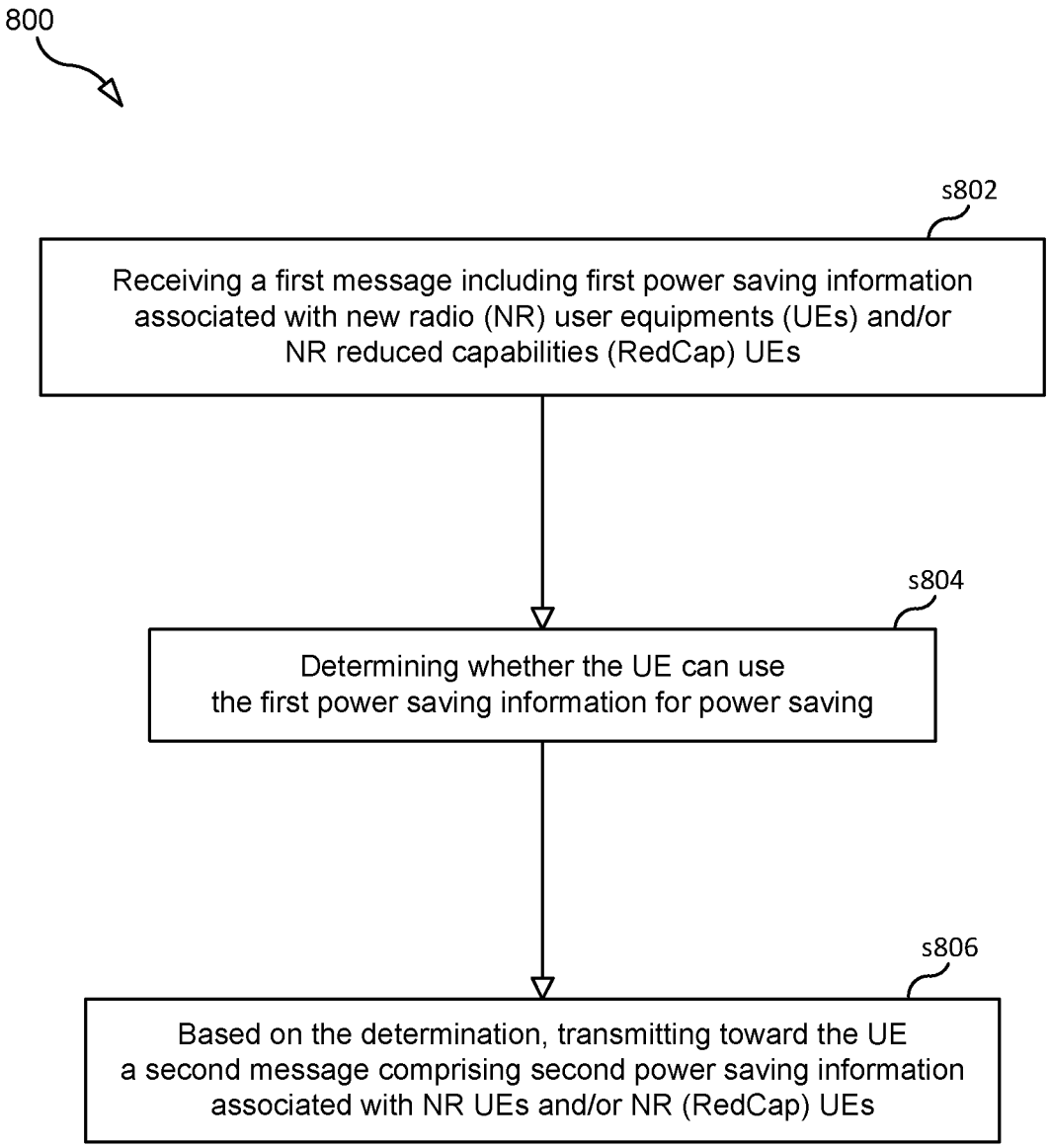

800
s802
Receiving a first message including first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs
s804
Determining whether the UE can use the first power saving information for power saving
s806
Based on the determination, transmitting toward the UE a second message comprising second power saving information associated with NR UEs and/or NR (RedCap) UEs

FIG. 8

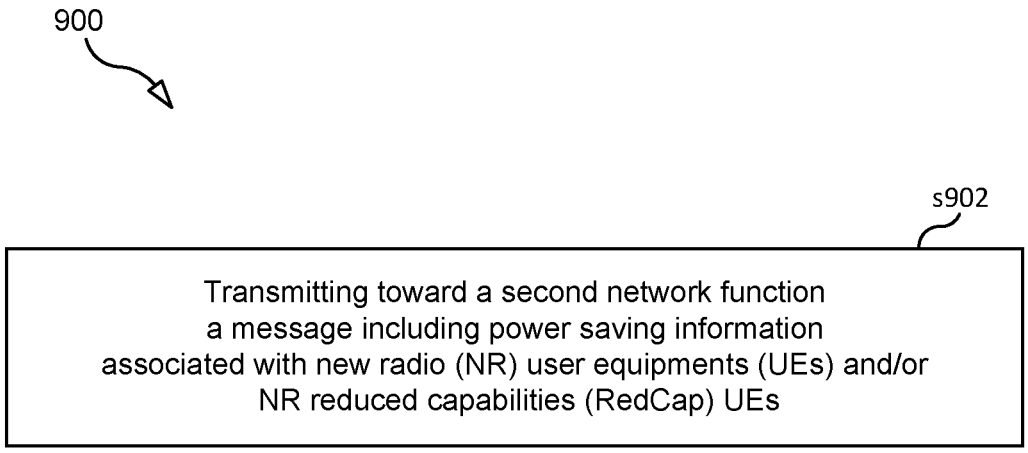

900
s902
Transmitting toward a second network function
a message including power saving information
associated with new radio (NR) user equipments (UEs) and/or
NR reduced capabilities (RedCap) UEs

FIG. 9

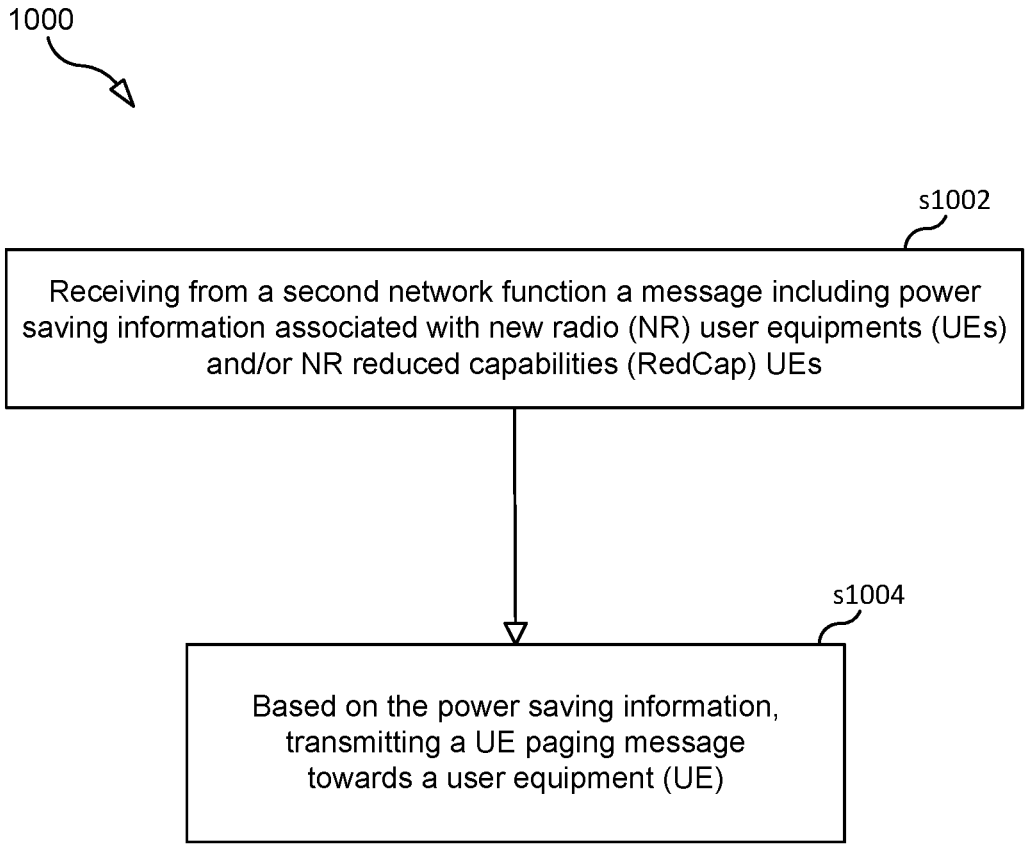

1000
s1002
Receiving from a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs
s1004
Based on the power saving information, transmitting a UE paging message towards a user equipment (UE)

FIG. 10

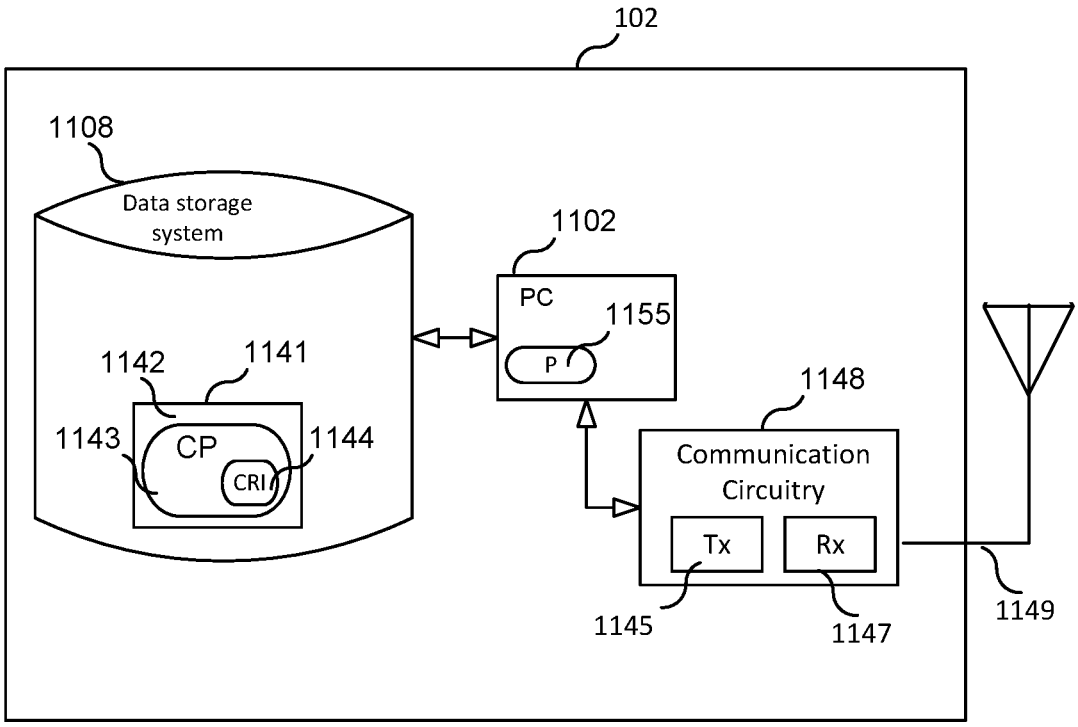

102
1108
Data storage system
1102
PC
1155
P
1142
1141
1143
CP
1144
CRI
1148
Communication Circuitry
Tx
Rx
1145
1147
1149

FIG. 11

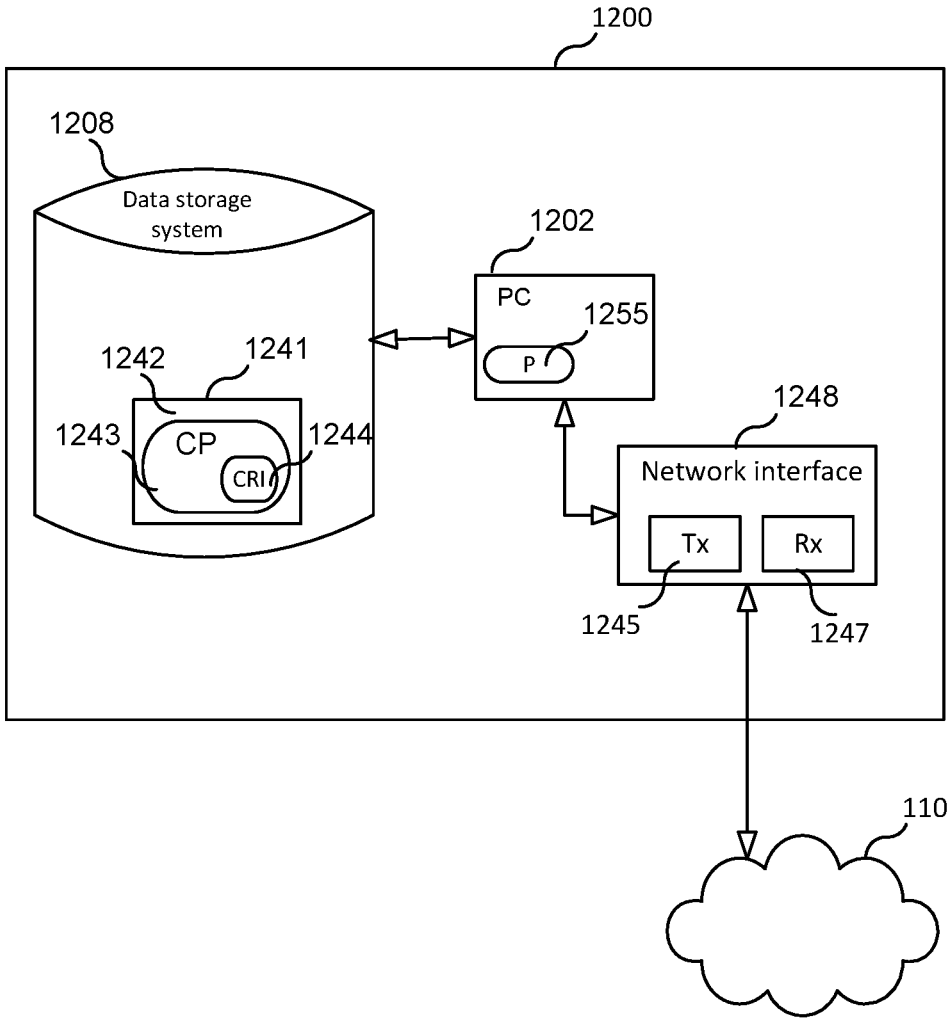

1200
1208
Data storage system
1202
PC
1255
P
1242
1241
1243
CP
1244
CRI
1248
Network interface
Tx
Rx
1245
1247
110

FIG. 12

EXTENDED DISCONTINUOUS RECEPTION DIFFERENTIATION FOR NEW RADIO (NR)

TECHNICAL FIELD

[0001] This disclosure relates to extended Discontinuous Reception (eDRX) differentiation for New Radio (NR).

BACKGROUND

[0002] FIG. **1** shows a simplified wireless system **100**. As shown in FIG. **1**, the wireless system **100** comprises a user equipment (UE) **102** and a base station (BS) **104** (NG-RAN node). The UE **102** is capable of transmitting and/or receiving data to/from the BS **104**. The UE **102** may be a mobile phone, a laptop, a tablet, an Internet of Things (IoT) device, or any computing device that is capable of wirelessly connected to the BS **104**.

[0003] To reduce power consumption of the UE **102** that is configured to wirelessly communicate with the BS **104**, the UE **102** may operate in an extended Discontinuous Reception (eDRX) mode. FIG. **2** illustrates an eDRX mode **200**. As shown in FIG. **2**, in the eDRX mode **200**, the UE **102** operates on an eDRX cycle **200**. The eDRX cycle **200** may comprise a paging time window (PTW) **202** and a sleeping time interval **204**. During the PTW **202**, the UE **102** is configured to be capable of receiving paging message(s) from the BS **104**. On the other hand, during the sleeping time interval **204**, the UE **102** is configured to be not capable of receiving paging message(s) from the BS **104**. The UE **102** is not capable of receiving paging message(s) from the BS **104** during the sleeping time interval **204** because the UE **102** sleeps during the sleeping time interval **204**.

SUMMARY

[0004] The eDRX mode may be used for 5G New Radio (NR) and 5G Reduced Capability (RedCap) NR. More specifically, the UEs capable of performing wireless communication using 5GNR and/or 5G RedCap NR may adapt the eDRX mode to reduce their power consumption. The UEs capable of performing wireless communication using 5G NR will be referred as NR UEs and the UEs capable of performing wireless communication using 5G Red Cap NR will be referred as Red Cap NR UEs.

[0005] In the 3rd Generation Partnership Project (3GPP) Technical Specification (TS) 38.875 v1.10, the eDRX mode for Red Cap NR UEs is specified. The disclosure of the TS is incorporated by reference in its entirety in this disclosure.

[0006] In the aforementioned TS, power saving of UEs operating on the eDRX in Radio Resource Control (RRC) inactive state (RRC_INACTIVE) and/or RRC idle state (RRC-IDLE) is discussed. The discussion includes analysis of UE power saving, possible upper and lower bounds for eDRX cycles, and possible mechanisms for eDRX for RedCap UEs disclosed in clauses 8.3.1-8.3.4. For example, the upper bound for DRX cycles and shorter eDRX values than 5.12 seconds, i.e., 2.56 seconds, have been studied and options are discussed in clause 8.3.3. In another example, solutions for PTW and eDRX cycle configuration and which node should configure the eDRX cycle for RRC_INACTIVE have been studied and solutions are captured in clause 8.3.4.

[0007] In the TS, based on the study of UE power saving on the eDRX, the followings are recommended from RAN2 perspective, where feasibility is to be confirmed with SA2 and/or CT1:

[0008] (i) The applicable parts of eDRX mechanisms for LTE, including use of H-SFN, PH and PTW, are expected to be re-used for RedCap UEs.

[0009] (ii) It is recommended that for eDRX cycles below and equal to 10.24 seconds, PTW and paging hyperframe (PH) are not used and that common design for handling eDRX cycle equal to 10.24 seconds in RRC_IDLE and RRC_INACTIVE is specified; and

[0010] (iii) It is recommended eDRX cycles in RRC_IDLE are extended up to 10485.76 seconds unless RAN4 indicates such eDRX value requires UE to perform Radio Resource Management (RRM) on serving cell outside PTW.

[0011] (iv) It is recommended eDRX cycles in RRC_INACTIVE are extended>10.24 seconds.

[0012] Certain challenges presently exist. When Access and Mobility and Management Function (AMF) allocates Registration Area (RA) which includes multiple Tracking Areas (TAs), the RA may include TA(s) covering NR cell(s) as well as TA(s) covering E-UTRA cells.

[0013] However, there may be a scenario where the eDRX operation for NR cell(s) and the eDRX operation for WB-E-UTRA may not work well together in the same RA. Furthermore, there may be a need to apply different eDRX parameters to normal NR cell(s) and Red Cap NR cell(s).

[0014] Accordingly, in one embodiment of this disclosure, separate eDRX parameters are provided for normal NR UE(s), Red Cap NR UE(s), UEs using the Wideband part of Evolved Universal Mobile Telecommunications System (WB-E-UTRA) for wireless communication, and UEs using the Narrowband part of E-UTRA (NB-E-UTRA).

[0015] More specifically, in some embodiments, different eDRX parameters for NR UEs and Red Cap NR UEs may be used at both N1 interface (using Non-Access Stratum (NAS) message(s)) and N2 interface (using New Generation Application Protocol (NGAP) messages). This allows supporting heterogeneous eDRX modes/operations in the same RA and the RAN Notification Area covering different cells, thereby still achieving significant power saving.

[0016] Also, in some embodiments, if the eDRX parameters for the normal NR UE(s) and the Red Cap NR UE(s) are the same, then common eDRX parameters may be shared between the normal NR UE(s) and the Red Cap NR UE(s).

[0017] Accordingly, in one aspect, there is provided a method performed by a user equipment (UE). The method comprises determining whether to transmit toward a network function first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, based on the determination, including the first power saving information in a first message, and transmitting the first message toward the network function.

[0018] In another aspect, there is provided a method performed by a network function. The method comprises receiving a first message including first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs. The first message was transmitted by a user equipment (UE). The method further comprises determining whether the UE can use the first power saving information for power saving and

based on the determination, transmitting toward the UE a second message comprising second power saving information associated with NR UEs and/or NR (RedCap) UEs.

[0019] In another aspect, there is provided a method performed by a first network function. The method comprises transmitting toward a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs. The power saving information is used for transmitting a paging message towards a user equipment (UE) from the second network function.

[0020] In another aspect, there is provided a method performed by a first network function. The method comprises receiving from a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, and based on the power saving information, transmitting a UE paging message towards a user equipment (UE).

[0021] In another aspect, there is provided a computer program comprising instructions which when executed by processing circuitry of a UE, causes the UE to perform the above discussed method.

[0022] In another aspect, there is provided a computer program comprising instructions which when executed by processing circuitry of a network function, causes the network function to perform the above discussed methods.

[0023] In another aspect, there is provided a UE. The UE comprises processing circuitry; and a memory, the memory containing instructions executable by the processing circuitry, whereby the UE is configured to perform any one of the above discussed method.

[0024] In another aspect, there is provided a network function. The network function comprises processing circuitry and a memory. The memory contains instructions executable by the processing circuitry and the network function is configured to perform the above discussed methods.

[0025] In another aspect, there is provided a UE. The UE is configured to determine whether to transmit toward a network function first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, based on the determination, include the first power saving information in a first message, and transmit the first message toward the network function.

[0026] In another aspect, there is provided a network function. The network function is configured to receive a first message including first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs. The first message was transmitted by a user equipment (UE). The network function is further configured to determine whether the UE can use the first power saving information for power saving, and based on the determination, transmit toward the UE a second message comprising second power saving information associated with NR UEs and/or NR (RedCap) UEs.

[0027] In another aspect, there is provided a first network function. The first network function is configured to transmit toward a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs. The power saving information is used for transmitting a paging message towards a user equipment (UE) from the second network function.

[0028] In another aspect, there is provided a first network function. The first network function is configured to receive from a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, and based on the power saving information, transmit a UE paging message towards a user equipment (UE).

[0029] An advantage of the embodiments is that a UE and a network can support the Registration Area (RA) and/or the RAN-based Notification Area (RNA) that covers different cells (e.g., normal NR cell(s) and Red Cap NR cell(s), and WB-UTRA cell(s)) applying different eDRX parameters. More specifically, by allowing to provide different eDRX parameter values for NR, NR Red Cap, and WB-LTE, the RA (used by the AMF as the paging area when the AMF triggers the paging for UEs in CM-IDLE mode) and the RAN (used by the gNB as the paging area when the gNB triggers the paging for UEs in RRC Inactivate state) can be formulated with mixed TAIs/cells of different radio types (WB-LTE, NR), except NB (Narrow Band). In those embodiments, no NAS mobility procedure is needed when switching between these different cells.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] The accompanying drawings, which are incorporated herein and form part of the specification, illustrate various embodiments.

[0031] FIG. **1** shows a simplified wireless system.

[0032] FIG. **2** illustrates an eDRX mode.

[0033] FIG. **3** is an expanded system architecture of the wireless system.

[0034] FIG. **4** shows UE registration process.

[0035] FIG. **5** shows a paging process according to an embodiment.

[0036] FIG. **6** shows a paging process according to an embodiment.

[0037] FIG. **7** shows a process showing according to an embodiment.

[0038] FIG. **8** shows a process showing according to an embodiment.

[0039] FIG. **9** shows a process showing according to an embodiment.

[0040] FIG. **10** shows a process showing according to an embodiment.

[0041] FIG. **11** shows a UE according to one embodiment.

[0042] FIG. **12** shows a network function according to one embodiment.

DETAILED DESCRIPTION

[0043] eDRX Information/Parameters for NR and/or NR Red Cap in Registration Request/Accept Message

[0044] FIG. **3** shows an expanded system architecture **300** of the wireless system **100**. The system architecture **300** may be a non-roaming 5G system architecture in reference point representation. The system architecture **300** may comprise the UE **102** and the BS (radio access network (RAN) node) **104**.

[0045] FIG. **4** shows a registration process **400** of the UE **102**. The process **400** may begin with the UE **102** transmitting a Registration Request message **402** toward new AMF **302** via the BS **104**. The Registration Request message **402**

is for registering the UE **102** to the new AMF **302**. The paragraph below lists various information elements (IEs) that can be included in the Registration Request message **402**.

[0046] UE to (R)AN: AN message (AN parameters, Registration Request (Registration type, SUCI or 5G-GUTI or PEI, [last visited TAI (if available)], Security parameters, [Requested NSSAI], [Mapping Of Requested NSSAI], [Default Configured NSSAI Indication], [UE Radio Capability Update], [UE MM Core Network Capability], [PDU Session status], [List Of PDU Sessions To Be Activated], [Follow-on request], [MICO mode preference], [Requested Active Time], [Requested DRX parameters for E-UTRA and NR], [Requested DRX parameters for NB-IoT], [extended idle mode DRX parameters], [extended idle mode DRX parameters for NR], [extended idle mode DRX parameters for RedCap], [LADN DNN(s) or Indicator Of Requesting LADN Information], [NAS message container], [Support for restriction of use of Enhanced Coverage], [Preferred Network Behavior], [UE paging probability information], [UE Policy Container (the list of PSIs, indication of UE support for ANDSP and the operating system identifier)] and [UE Radio Capability ID], PEI)).

[0047] Table 1 shows the content of the Registration Request message **402** according to one embodiment. As shown in the Table 1, the Registration Request message **402** may comprise one or more requested eDRX parameters for NR and one or more requested eDRX parameters for Red Cap.

TABLE 1

IEI	Information Element	Type/Reference	Presence	Format	Length
	Extended protocol discriminator	Extended Protocol discriminator 9.2	M	V	1
	Security header type	Security header type 9.3	M	V	½
	Spare half octet	Spare half octet 9.5	M	V	½
	Registration request message identity	Message type 9.7	M	V	1
	5GS registration type	5GS registration type 9.11.3.7	M	V	½
	ngKSI	NAS key set identifier 9.11.3.32	M	V	½
	5GS mobile identity	5GS mobile identity 9.11.3.4	M	LV-E	6-n
C-	Non-current native NAS key set identifier	NAS key set identifier 9.11.3.32	O	TV	1
10	5GMM capability	5GMM capability 9.11.3.1	O	TLV	3-15
2E	UE security capability	UE security capability 9.11.3.54	O	TLV	4-10
2F	Requested NSSAI	NSSAI 9.11.3.37	O	TLV	4-74
52	Last visited registered TAI	5GS tracking area identity 9.11.3.8	O	TV	7
17	S1 UE network capability	S1 UE network capability 9.11.3.48	O	TLV	4-15
40	Uplink data status	Uplink data status 9.11.3.57	O	TLV	4-34
50	PDU session status	PDU session status 9.11.3.44	O	TLV	4-34
B-	MICO indication	MICO indication 9.11.3.31	O	TV	1
2B	UE status	UE status 9.11.3.56	O	TLV	3
77	Additional GUTI	5GS mobile identity 9.11.3.4	O	TLV-E	14
25	Allowed PDU session status	Allowed PDU session status 9.11.3.13	O	TLV	4-34
18	UE's usage setting	UE's usage setting 9.11.3.55	O	TLV	3
51	Requested DRX parameters	5GS DRX parameters 9.11.3.2A	O	TLV	3
70	EPS NAS message container	EPS NAS message container 9.11.3.24	O	TLV-E	4-n
74	LADN indication	LADN indication 9.11.3.29	O	TLV-E	3-811
8-	Payload container type	Payload container type 9.11.3.40	O	TV	1
7B	Payload container	Payload container 9.11.3.39	O	TLV-E	4-65538
9-	Network slicing indication	Network slicing indication 9.11.3.36	O	TV	1
53	5GS update type	5GS update type 9.11.3.9A	O	TLV	3

TABLE 1-continued

IEI	Information Element	Type/Reference	Presence	Format	Length
41	Mobile station classmark 2	Mobile station classmark 2 9.11.3.31C	O	TLV	5
42	Supported codecs	Supported codec list 9.11.3.51A	O	TLV	5-n
71	NAS message container	NAS message container 9.11.3.33	O	TLV-E	4-n
60	EPS bearer context status	EPS bearer context status 9.11.3.23A	O	TLV	4
6E	Requested extended DRX parameters	Extended DRX parameters 9.11.3.26A	O	TLV	3
6A	T3324 value	GPRS timer 3 9.11.2.5	O	TLV	3
67	UE radio capability ID	UE radio capability ID 9.11.3.68	O	TLV	3-n
35	Requested mapped NSSAI	Mapped NSSAI 9.11.3.31B	O	TLV	3-42
48	Additional information requested	Additional information requested 9.11.3.12A	O	TLV	3
1A	Requested WUS assistance information	WUS assistance information 9.11.3.71	O	TLV	3-n
A-	N5GC indication	N5GC indication 9.11.3.72	O	T	1
30	Requested NB-N1 mode DRX parameters	NB-N1 mode DRX parameters 9.11.3.73	O	TLV	3
X	Requested extended DRX parameters for NR		O	TLV	3
X	Requested extended DRX parameters for RedCap		O	TLV	3

[0048] Each of the eDRX parameters for NR and Red Cap NR may comprise PTW and eDRX cycle. One eDRX cycle may comprise a PTW and a sleeping time interval. During the PTW, the UE **102** is configured to be capable of receiving paging signals (messages) from the BS **104**. On the other hand, during the sleeping time interval, the UE **102** is configured to be not capable of receiving paging signals from the BS **104**. The UE **102** is not capable of receiving paging signals from the BS **104** during the sleeping time interval because the UE **102** sleeps during the sleeping time interval.

[0049] Because, in this embodiment, the eDRX parameters for normal NR and Red Cap NR are separately provided in addition to existing eDRX parameter(s), the existing eDRX parameter(s)—"Requested extended eDRX parameter"—may be set to be used for WB-E-UTRA and NB-IoT.

[0050] In one embodiment, the eDRX parameters may be selectively included in the Registration Request message **402**. For example, the UE **102** may determine a need to reduce power consumption of the UE **102** and as a result of the UE **102** determining that there is a need to reduce power consumption of the UE **102**, the UE **102** may selectively include within the Registration Request message **402** the eDRX parameters. There may be different ways of determining the need to reduce power consumption of the UE **102**. For example, the UE **102** may be a battery-powered device and may compare the remaining battery level of the UE **102** to a threshold level. Based on the determination that the remaining battery level of the UE **102** is less than and/or equal to the threshold level, the UE **102** may determine that the UE needs to reduce the power consumption of the UE **102**.

[0051] In some embodiments, if the eDRX parameters or normal NR and the eDRX parameters for Red Cap NR are the same, the UE may just include the eDRX parameters for NR.

[0052] Referring back to FIG. **4**, after the new AMF **302** determines to register the UE **102**, the new AMF **302** may transmit toward the UE **102** a Registration Accept message **404**. The Registration Accept message **404** indicates to the UE **102** that the UE **102** has been registered. The paragraph below lists various information elements (IEs) that can be included in the Registration Accept message **404**.

[0053] New AMF to UE: Registration Accept (5G-GUTI, Registration Area, [Mobility restrictions], [PDU Session status], [Allowed NSSAI], [Mapping Of Allowed NSSAI], [Configured NSSAI for the Serving PLMN], [Mapping Of Configured NSSAI], [rejected S-NSSAIs], [Pending NSSAI], [Mapping Of Pending NSSAI], [Periodic Registration Update timer], [Active Time], [Strictly Periodic Registration Timer Indication], [LADN Information], [accepted MICO mode], [IMS Voice over PS session supported Indication], [Emergency Service Support indicator], [Accepted DRX parameters for E-UTRA and NR], [Accepted DRX parameters for NB-IoT], [extended idle mode DRX parameters], [extended idle mode DRX parameters for NR], [extended idle mode DRX parameters for RedCap][Paging Time Window], [Network support of Interworking without N26], [Access Stratum Connection Establishment NSSAI Inclusion Mode], [Network Slicing Subscription Change Indication], [Operator-defined access category definitions], [List of equivalent PLMNs], [Enhanced Coverage Restricted information], [Supported Network Behaviour], [Service Gap Time], [PLMN-assigned UE Radio Capability ID], [PLMN-assigned UE Radio Capability ID deletion], [WUS Assistance Information], [Truncated 5G-S-TMSI Configuration]).

[0054] In some embodiments, if the eDRX parameters for normal NR and the eDRX parameters for Red Cap NR are the same, the UE may just include the eDRX parameters for NR.

[0055] Table 2 shows the content of the Registration Accept message **404** according to one embodiment. As shown in the Table 2 below, the Registration Accept message **404** may comprise one or more negotiated eDRX parameters for NR and one or more requested eDRX parameters for Red Cap.

TABLE 2

IEI	Information Element	Type/Reference	Presence	Format	Length
	Extended protocol discriminator	Extended protocol discriminator 9.2	M	V	1
	Security header type	Security header type 9.3	M	V	½
	Spare half octet	Spare half octet 9.5	M	V	½
	Registration accept message identity	Message type 9.7	M	V	1
	5GS registration result	5GS registration result 9.11.3.6	M	LV	2
77	5G-GUTI	5GS mobile identity 9.11.3.4	O	TLV-E	14
4A	Equivalent PLMNs	PLMN list 9.11.3.45	O	TLV	5-47
54	TAI list	5GS tracking area identity list 9.11.3.9	O	TLV	9-114
15	Allowed NSSAI	NSSAI 9.11.3.37	O	TLV	4-74
11	Rejected NSSAI	Rejected NSSAI 9.11.3.46	O	TLV	4-42
31	Configured NSSAI	NSSAI 9.11.3.37	O	TLV	4-146
21	5GS network feature support	5GS network feature support 9.11.3.5	O	TLV	3-5
50	PDU session status	PDU session status 9.11.3.44	O	TLV	4-34
26	PDU session reactivation result	PDU session reactivation result 9.11.3.42	O	TLV	4-34
72	PDU session reactivation result error cause	PDU session reactivation result error cause 9.11.3.43	O	TLV-E	5-515
79	LADN information	LADN information 9.11.3.30	O	TLV-E	12-1715
B-	MICO indication	MICO indication 9.11.3.31	O	TV	1
9-	Network slicing indication	Network slicing indication 9.11.3.36	O	TV	1
27	Service area list	Service area list 9.11.3.49	O	TLV	6-114
5E	T3512 value	GPRS timer 3 9.11.2.5	O	TLV	3
5D	Non-3GPP de-registration timer value	GPRS timer 2 9.11.2.4	O	TLV	3
16	T3502 value	GPRS timer 2 9.11.2.4	O	TLV	3
34	Emergency number list	Emergency number list 9.11.3.23	O	TLV	5-50
7A	Extended emergency number list	Extended emergency number list 9.11.3.26	O	TLV-E	7-65538
73	SOR transparent container	SOR transparent container 9.11.3.51	O	TLV-E	20-n
78	EAP message	EAP message 9.11.2.2	O	TLV-E	7-1503
A-	NSSAI inclusion mode	NSSAI inclusion mode 9.11.3.37A	O	TV	1
76	Operator-defined access category definitions	Operator-defined access category definitions 9.11.3.38	O	TLV-E	3-n
51	Negotiated DRX parameters	5GS DRX parameters 9.11.3.2A	O	TLV	3
D-	Non-3GPP NW policies	Non-3GPP NW provided policies 9.11.3.36A	O	TV	1
60	EPS bearer context status	EPS bearer context status 9.11.3.23A	O	TLV	4
6E	Negotiated extended DRX parameters	Extended DRX parameters 9.11.3.26A	O	TLV	3
6C	T3447 value	GPRS timer 3 9.11.2.5	O	TLV	3
6B	T3448 value	GPRS timer 2 9.11.2.4	O	TLV	3

TABLE 2-continued

IEI	Information Element	Type/Reference	Presence	Format	Length
6A	T3324 value	GPRS timer 3 9.11.2.5	O	TLV	3
67	UE radio capability ID	UE radio capability ID 9.11.3.68	O	TLV	3-n
E-	UE radio capability ID deletion indication	UE radio capability ID deletion indication 9.11.3.69	O	TV	1
39	Pending NSSAI	NSSAI 9.11.3.37	O	TLV	4-146
74	Ciphering key data	Ciphering key data 9.11.3.18C	O	TLV-E	34-n
75	CAG information list	CAG information list 9.11.3.18A	O	TLV-E	3-n
1B	Truncated 5G-S-TMSI configuration	Truncated 5G-S-TMSI configuration 9.11.3.70	O	TLV	3
1C	Negotiated WUS assistance information	WUS assistance information 9.11.3.71	O	TLV	3-n
29	Negotiated NB-N1 mode DRX parameters	NB-N1 mode DRX parameters 9.11.3.73	O	TLV	3
X	Negotiated extended DRX parameters for NR	X	O	TLV	3
X	Negotiated extended DRX parameters for RedCap	X	O	TLV	3

[0056] The negotiated eDRX parameters may be stored in UE context that is stored in the BS **104**. Using these different eDRX parameters for different cells (e.g., gNB, WB-E-UTRA), the AMF can formulate RA including TAs that contain cells for NB, WB-E-UTRA, NR with Red Cap Support.

[0057] Each of the eDRX parameters for NR and Red Cap NR may comprise PTW and eDRX cycle. One eDRX cycle may comprise a PTW and a sleeping time interval. During the PTW, the UE **102** is configured to be capable of receiving paging signals from the BS **104**. On the other hand, during the sleeping time interval, the UE **102** is configured to be not capable of receiving paging signals from the BS **104**. The UE **102** is not capable of receiving paging signals from the BS **104** during the sleeping time interval because the UE **102** sleeps during the sleeping time interval.

[0058] Because, in this embodiment, the eDRX parameters for NR and Red Cap NR for normal NR and Red Cap NR are separately provided in addition to existing eDRX parameter(s), the existing eDRX parameter(s)—"Requested extended eDRX parameter"—may be set to be used for WB-E-UTRA and NB-IoT.

eDRX Information for NR and/or NR Red Cap in NGAP Message(s)

[0059] In one embodiment, the AMF **302** may transmit to the BS **104** (e.g, gNB serving NG-RAN) message(s) including information regarding eDRX mode ("Paging eDRX Information") for NR UEs and/or Red Cap NR UEs via NG Application Protocol (NGAP) especially whenever the context of the UE **102** (UE context) needs to be established or modified in the NG-RAN. Similarly, the AMF **302** may transmit to NG-eNB message(s) including information regarding eDRX mode for WB-E-UTRAN. A

[0060] The NGAP messages including the Paging eDRX information for NR UEs and/or Red Cap NR UEs may be a NGAP paging message, an Initial Context Setup Request message, a Handover Request message, a Path Switch Request Acknowledge message, and UE context modification message. Any of the NGAP messages may include Core Network (CN) Assistance Information for RRC Inactive, which includes the Paging eDRX information for NR and for Red Cap NR.

[0061] In case the NGAP message is a NGAP paging message, as shown in FIG. **6**, the AMF **302** may formulate the NGAP paging message **602** that includes the Paging eDRX information for NR UEs and/or Red Cap NR UEs, and transmit the message **602** toward the BS **104**.

[0062] In case the NGAP message is one of an Initial Context Setup Request message, a Handover Request message, a Path Switch Request Acknowledge message, and UE context modification message, the AMF **302** may transmit the Paging eDRX information to the BS **104**, as illustrated in FIG. **5**. Using the received paging eDRX information, the BS **104** may formulate and transmit paging message(s) to the UE **102** in the RRC Inactive state (which is in Tracking Area(s)).

[0063] Table 3 provided below shows a list of information elements that may be included in the Initial Context Setup Request message (as specified in TS 38.413) transmitted from the AMF **302** to the BS **104** according to the above embodiment. The Initial Context Setup Request message is for requesting to set up a UE context.

TABLE 3

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.3.1.1		YES	reject
AMF UE NGAP ID	M		9.3.3.1		YES	reject
RAN UE NGAP ID	M		9.3.3.2		YES	reject

TABLE 3-continued

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Old AMF	O		AMF Name 9.3.3.21		YES	reject
UE Aggregate Maximum Bit Rate	C-ifPDUsessionResourceSetup		9.3.1.58		YES	reject
Core Network Assistance Information for RRC INACTIVE	O		9.3.1.15		YES	ignore
GUAMI	M		9.3.3.3		YES	reject
PDU Session Resource Setup Request List		0 . . . 1			YES	reject
>PDU Session Resource Setup Request Item		1 . . . <maxnoofPDUSessions>			—	
>>PDU Session ID	M		9.3.1.50		—	
>>PDU Session NAS-PDU	O		NAS-PDU 9.3.3.4		—	
>>S-NSSAI	M		9.3.1.24		—	
>>PDU Session Resource Setup Request Transfer	M		OCTET STRING	Containing the PDU Session Resource Setup Request Transfer IE specified in subclause 9.3.4.1.	—	
Allowed NSSAI	M		9.3.1.31	Indicates the S-NSSAIs permitted by the network	YES	reject
UE Security Capabilities	M		9.3.1.86		YES	reject
Security Key	M		9.3.1.87		YES	reject
Trace Activation	O		9.3.1.14		YES	ignore
Mobility Restriction List	O		9.3.1.85		YES	ignore
UE Radio Capability	O		9.3.1.74		YES	ignore
Index to RAT/Frequency Selection Priority	O		9.3.1.61		YES	ignore
Masked IMEISV	O		9.3.1.54		YES	ignore
NAS-PDU	O		9.3.3.4		YES	ignore
Emergency Fallback Indicator	O		9.3.1.26		YES	reject
RRC Inactive Transition Report Request	O		9.3.1.91		YES	ignore
UE Radio Capability for Paging	O		9.3.1.68		YES	ignore
Redirection for Voice EPS Fallback	O		9.3.1.116		YES	ignore
Location Reporting Request Type	O		9.3.1.65		YES	ignore
CN Assisted RAN Parameters Tuning	O		9.3.1.119		YES	ignore
SRVCC Operation Possible	O		9.3.1.128		YES	ignore
IAB Authorized	O		9.3.1.129		YES	ignore
Enhanced Coverage Restriction	O		9.3.1.140		YES	ignore
Extended Connected Time	O		9.3.3.31		YES	ignore
UE Differentiation Information	O		9.3.1.144		YES	ignore
NR V2X Services Authorized	O		9.3.1.146		YES	ignore
LTE V2X Services Authorized	O		9.3.1.147		YES	ignore
NR UE Sidelink Aggregate Maximum Bit Rate	O		9.3.1.148	This IE applies only if the UE is authorized for NR V2X services.	YES	ignore
LTE UE Sidelink Aggregate Maximum Bit Rate	0O		9.3.1.149	This IE applies only if the UE is authorized for LTE V2X services.	YES	ignore
PC5 QoS Parameters	O		9.3.1.150	This IE applies only if the UE is authorized for NR V2X services.	YES	ignore
CE-mode-B Restricted	O		9.3.1.155		YES	ignore
UE User Plane CIoT	O		9.3.1.160		YES	ignore

TABLE 3-continued

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Support Indicator RG Level Wireline Access Characteristics	O		OCTET STRING	Specified in TS 23.316 [34]. Indicates the wireline access technology specific QoS information corresponding to a specific wireline access subscription.	YES	ignore
Management Based MDT PLMN List	O		MDT PLMN List 9.3.1.168		YES	ignore
UE Radio Capability ID	O		9.3.1.142		YES	reject

[0064] Table 4 provided below shows a list of information elements that may be included in the Core Network (CN) Assistance Information for RRC Inactive. The Core Network (CN) Assistance Information for RRC Inactive is the information element providing assistance information for RRC_INACTIVE configuration.

TABLE 4

IE/Group Name	Presence	Range	IE type and reference	Semantics description
UE Identity Index Value	M		9.3.3.23	
UE Specific DRX	O		Paging DRX 9.3.1.90	
Periodic Registration Update Timer	M		9.3.3.24	
MICO Mode Indication	O		9.3.1.23	
TAI List for RRC Inactive		1		
>TAI List for RRC Inactive Item		1 . . . <maxnoofTAIforInactive>		
>>TAI	M		9.3.3.11	
Expected UE Behaviour	O		9.3.1.93	
Paging eDRX Information	O		9.3.1.154	
Paging eDRX information for NR	O		9.3.1.xx	
Paging eDRX Information for RedCap	O		9.3.1.yy	

-

[0065] The Paging eDRX information for NR is an information element indicating paging eDRX parameters for NR UEs.

[0066] Table 5 provided below shows a list of information elements that may be included in the Paging eDRX information for NR (as specified in TS 38.304).

TABLE 5

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Paging eDRX Cycle for Idle	M		ENUMERATED (hfhalf, hf1, hf2, hf4, hf6, hf8, hf10, hf12, hf14, hf16, hf32, hf64, hf128, hf256, . . . , hf512, hf1024)	TeDRX defined in TS 38.304. Unit: [number of hyperframes].
Paging eDRX Cycle for Inactive	M		ENUMERATED (hfhalf, hf1, hf2, hf4, hf6, hf8, hf10, hf12, hf14, hf16, hf32, hf64, hf128, hf256, . . . , hf512, hf1024, TBD)	TeDRX defined in TS 38.304. Unit: [number of hyperframes].

TABLE 5-continued

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Paging Time Window	O		ENUMERATED (s1, s2, s3, s4, s5, s6, s7, s8, s9, s10, s11, s12, s13, s14, s15, s16, . . .)	Unit: [1.28 second].

[0067] The Paging eDRX information for Red Cap is an information element indicating paging eDRX parameters for NR Red Cap UEs.

[0068] Table 6 provided below shows a list of information elements that may be included in the Paging eDRX information for NR Red Cap (as specified in TS 38.304).

TABLE 6

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Paging eDRX Cycle for Idle	M		ENUMERATED (hfhalf, hf1, hf2, hf4, hf6, hf8, hf10, hf12, hf14, hf16, hf32, hf64, hf128, hf256, . . . , hf512, hf1024)	TeDRX defined in TS 38.304. Unit: [number of hyperframes].
Paging eDRX Cycle for Inactive	M		ENUMERATED (hfhalf, hf1, hf2, hf4, hf6, hf8, hf10, hf12, hf14, hf16, hf32, hf64, hf128, hf256, . . . , hf512, hf1024, maximum TBD)	TeDRX defined in TS 38.304. Unit: [number of hyperframes].
Paging Time Window	O		ENUMERATED (s1, s2, s3, s4, s5, s6, s7, s8, s9, s10, s11, s12, s13, s14, s15, s16, . . .)	Unit: [1.28 second].

[0069] The BS **104** may use the eDRX information provided by the AMF **302** when the BS **104** triggers the RAN paging for UEs in RRC inactive state.

[0070] FIG. **6** shows a message flow diagram. As shown in the FIG. **6**, the AMF **302** transmits to the BS **104** a message **4***b* that includes Core Network Assistance Information for RRC INACTIVE. As discussed above, the Core Network Assistance Information for RRC INACTIVE may include Paging eDRX information for NR and the Paging eDRX information for Red Cap NR. Using the received Paging eDRX information for NR and the Paging eDRX information for Red Cap NR, the BS **104** may transmit a paging message **4***b* to the UE **102**.

[0071] Table 7 provided below shows a list of information elements that may be included in the NGAP message(s) (as specified in TS 38.413) transmitted from the AMF **302** to the BS **104** according to the above embodiment.

TABLE 7

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.3.1.1		YES	ignore
UE Paging Identity	M		9.3.3.18		YES	ignore
Paging DRX	O		9.3.1.90		YES	ignore
TAI List for Paging		1			YES	ignore
>TAI List for Paging Item		1 . . . <maxnoofTAIforPaging>			—	
>>TAI	M		9.3.3.11		—	
Paging Priority	O		9.3.1.78		YES	ignore
UE Radio Capability for Paging	O		9.3.1.68		YES	ignore
Paging Origin	O		9.3.3.22		YES	ignore
Assistance Data for Paging	O		9.3.1.69		YES	ignore
NB-IoT Paging eDRX Information	O		9.3.1.138		YES	ignore

TABLE 7-continued

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
NB-IoT Paging DRX	O		9.3.1.139	If this IE is present, the Paging DRX IE is ignored.	YES	ignore
Enhanced Coverage Restriction	O		9.3.1.140		YES	ignore
WUS Assistance Information	O		9.3.1.143		YES	ignore
Paging eDRX Information	O		9.3.1.154		YES	ignore
CE-mode-B Restricted	O		9.3.1.155		YES	ignore
Paging eDRX Information for NR	O		9.3.1.xx	Only present if NG-RAN node is gNB		
Paging eDRX Information for RedCap	O		9.3.1.yy	Only present if NG-RAN node is gNB		

eDRX Signaling for NR and/or NR Red Cap in Split gNB

[0072] The functions of the BS **104** (e.g., gNB) may be divided between a central unit (CU) and distributed units (DUs). The CU is a logical node performing certain gNB functions like mobility control, transfer of user data, etc. The CU controls the operation of the DUs over front-haul (Fs) interface. Each of the DUs is a logical node performing a subset of gNB functions and its operation is controlled by the CU.

[0073] In one embodiment, in gNB CU-DU split, information regarding eDRX mode ("Paging eDRX Information") for NR UEs and/or Red Cap NR UEs is transmitted from the CU to the DUs. For example, the CU may formulate paging message(s) that includes the Paging eDRX Information, and transmit the paging message(s) toward the DUs via F1AP interface. The Paging eDRX information may include information related to eDRX mode (e.g., eDRX cycle).

[0074] After receiving the paging message(s) that includes the Paging eDRX information, each of the DUs can use the Paging eDRX Information to transmit paging message(s) to UEs in RRC inactive state. For example, each of the DUs may use the eDRX cycle indicated in the Paging eDRX Information as a cycle of transmitting paging message(s) to UEs.

[0075] Table 8 provided below shows a list of information elements that may be included in the paging message(s) (as specified in TS 38.473) transmitted from the CU to the DUs.

TABLE 8

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.3.1.1		YES	ignore
UE Identity Index value	M		9.3.1.39		YES	reject
CHOICE Paging Identity	M				YES	reject
>RAN UE Paging identity	M		9.3.1.43		—	
>CN UE paging identity	M		9.3.1.44		—	
Paging DRX	O		9.3.1.40	It is defined as the minimum between the RAN UE Paging DRX and CN UE Paging DRX	YES	ignore
Paging Priority	O		9.3.1.41		YES	ignore
Paging Cell List		1			YES	ignore
>Paging Cell Item IEs		1 . . . <maxnoofPagingCells>			EACH	ignore
>>NR CGI	M		9.3.1.12		—	
Paging Origin	O		9.3.1.79		YES	ignore
Paging eDRX Information for NR	O		9.3.1.xx			
Paging eDRX Information for RedCap	O		9.3.1.yy			

eDRX Signaling for NR and/or NR Red Cap Between gNB

[0076] In one embodiment, information regarding eDRX mode ("Paging eDRX Information") for NR UEs and/or Red Cap NR UEs may be transmitted from one network function (e.g., gNB) to another network function (e.g., gNB) in all context moving procedures in XnAP, as it is supported in NGAP.

[0077] For example, in case RAN paging area covers multiple gNBs, the anchor gNB may formulate RAN paging message(s) that includes the Paging eDRX Information and transmit the RAN paging message(s) to other non-anchor gNB(s) via XnAP interface. After receiving the paging message(s) that includes the Paging eDRX information, each of the non-anchor gNB(s) can use the Paging eDRX Information to transmit paging message(s) to UEs in RRC inactive state.

[0078] Table 9 provided below shows a list of information elements that may be included in the RAN paging message (s) (as specified in TS 38.423).

TABLE 9

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3.1		YES	reject
CHOICE UE Identity Index Value	M				YES	reject
>Length-10						
>>Index Length-10	M		BIT STRING (SIZE(10))	Coded as specified in TS 38.304 [33] and TS 36.304 [34].	—	
UE RAN Paging Identity	M		9.2.3.43		YES	ignore
Paging DRX	M		9.2.3.66		YES	ignore
RAN Paging Area	M		9.2.3.38		YES	reject
Paging Priority	O		9.2.3.44		YES	ignore
Assistance Data for RAN Paging	O		9.2.3.41		YES	ignore
UE Radio Capability for Paging	O		9.2.3.91		YES	ignore
Paging eDRX Information for NR	O		9.2.3.xx	Only present if NG-RAN node is gNB		
Paging eDRX Information for RedCap	O		9.2.3.yy	Only present if NG-RAN node is gNB		

Shared eDRX Signaling

[0079] Even though, in the embodiments described above, the "eDRX parameters for NR" and the "eDRX parameters for RedCap" are separately signaled, in case the "eDRX parameters for NR" and the "eDRX parameters for RedCap" are the same, only one of the "eDRX parameters for NR" and the "eDRX parameters for RedCap" may be signaled.

[0080] Similarly, even though, in the embodiments described above, the "eDRX information for NR" and the "eDRX information for RedCap" are separately signaled, in case the "eDRX information for NR" and the "eDRX information for RedCap" are the same, only one of the "eDRX information for NR" and the "eDRX information for RedCap" may be signaled.

[0081] Furthermore, in case the eDRX information/parameters for NR, the eDRX information/parameters for Red Cap NR, and the eDRX information/parameters for WB-E-UTRA are the same, then the existing eDRX information/parameters (in Non-Access Stratum (NAS) and NGAP) may be used to represent the eDRX information/parameters for all three network accessing technologies.

[0082] All of the functions and/or steps described above may be virtualized in a cloud implementation.

[0083] FIG. **7** shows a process **700** performed by the UE **102** according to one embodiment. The process **700** may begin with step s**702**. Step s**702** comprises determining whether to transmit toward a network function first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs. Step s**704** comprises, based on the determination, including the first power saving information in a first message. Step s**706** comprises transmitting the first message toward the network function.

[0084] In some embodiments, the process further comprises receiving a second message from the network function and the second message comprises second power saving information associated with NR UEs and/or NR RedCap UEs.

[0085] In some embodiments, the first power saving information comprises Requested extended discontinuous reception (eDRX) parameters for NR and/or Requested eDRX parameters for RedCap, and the second power saving information comprises Negotiated eDRX parameters for NR and/or Negotiated eDRX parameters for RedCap.

[0086] In some embodiments, (i) the Requested eDRX parameters for NR and the Negotiated eDRX parameters for NR are different and/or (ii) the Requested eDRX parameters for RedCap and the Negotiated eDRX parameters for RedCap are different. The process further comprises the UE attempting to receive a paging message triggered by the network function using the Negotiated eDRX parameters for NR and/or the Negotiated eDRX parameters for RedCap.

[0087] In some embodiments, (i) the Requested eDRX parameters for NR and the Requested eDRX parameters for RedCap are the same and/or (ii) the Negotiated eDRX parameters for NR and the Negotiated eDRX parameters for RedCap are the same. The process further comprises the UE attempting to receive a paging message triggered by the

network function using any of the Negotiated eDRX parameters for NR and the Negotiated eDRX parameters for RedCap.

[0088] In some embodiments, the first message is a Registration Request message for requesting the network function to register the UE, and the second message is a Registration Accept message indicating that the network function has registered the UE.

[0089] In some embodiments, the method further comprises determining a need to reduce power consumption of the UE, wherein whether to transmit toward the network function the first power saving information comprising Requested (eDRX) parameters for NR and/or Requested eDRX parameters for RedCap is determined based on the determination of the need to reduce the power consumption of the UE.

[0090] FIG. **8** shows a process **800** performed by a network function according to one embodiment. The process **800** may begin with step s**802**. Step s**802** comprises receiving a first message including first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs. The first message was transmitted by a user equipment (UE). Step s**804** comprises determining whether the UE can use the first power saving information for power saving. Step s**806** comprises based on the determination, transmitting toward the UE a second message comprising second power saving information associated with NR UEs and/or NR (RedCap) UEs.

[0091] In some embodiments, the first power saving information comprises Requested extended discontinuous reception (eDRX) parameters for NR and/or Requested eDRX parameters for RedCap, and the second power saving information comprises Negotiated eDRX parameters for NR and/or Negotiated eDRX parameters for RedCap.

[0092] In some embodiments, determining whether the UE can use the first power saving information for power saving comprises determining that the UE cannot use the first power saving information for power saving, and

[0093] In some embodiments, (i) the Requested eDRX parameters for NR and the Negotiated eDRX parameters for NR are different and/or (ii) the Requested eDRX parameters for RedCap and the Negotiated eDRX parameters for RedCap are different.

[0094] In some embodiments, the first message is a Registration Request message for requesting the network function to register the UE, and the second message is a Registration Accept message indicating that the network function has registered the UE.

[0095] FIG. **9** shows a process **900** performed by a first network function according to one embodiment. The process **900** may being with step s**902**. Step s**902** comprises transmitting toward a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs. The power saving information is used for transmitting a paging message towards a user equipment (UE) from the second network function.

[0096] In some embodiments, the message is any one of an Initial Context Setup Request message, a Handover Request message, a Path Switch Request Acknowledge message, and a UE Context Modification message, and the power saving information is Core Network (CN) Assistance Information for Radio Resource Control (RRC) inactive state information.

[0097] In some embodiments, the Core Network Assistance Information for RRC inactive state information comprises paging eDRX information for NR and/or paging eDRX information for RedCap. Each of the paging eDRX information for NR and the paging eDRX information for RedCap comprises: (i) paging eDRX cycle for idle, wherein the paging eDRX cycle for idle indicates a cycle of eDRX operation to be performed by the UE in idle state; (ii) paging eDRX cycle for inactive, wherein the paging eDRX cycle for inactive indicates a cycle of eDRX operation to be performed by the UE in inactive state; and/or (iii) paging time window, wherein the paging time window indicates the length of a paging time window (PTW) during which the second network function is configured to transmit the paging message toward the UE.

[0098] In some embodiments, the first network function is AMF, the second network function is a gNB, the message transmitted toward the gNB is a NGAP paging message formulated by the AMF, and the power saving information is for UEs in CM-IDLE state.

[0099] FIG. **10** shows a process **1000** performed by a first network function according to one embodiment. The process **1000** may begin with step s**1002**. Step s**1002** comprises receiving from a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs. Step s**1004** comprises based on the power saving information, transmitting a UE paging message towards a user equipment (UE).

[0100] In some embodiments, the first network function is a gNB, and the second network function is access and mobility and management function (AMF). The AMF transmitted the message to the gNB using new generation application protocol (NGAP), and the UE receiving the UE paging message is in connection management (CM) connected state with radio resource control (RRC) inactive state or CM idle state.

[0101] In some embodiments, the message is any one of an Initial Context Setup Request message, a Handover Request message, a Path Switch Request Acknowledge message, and a UE Context Modification message, and the power saving information is Core Network Assistance Information for Radio Resource Control (RRC) inactive state information.

[0102] In some embodiment, the Core Network Assistance Information for RRC inactive state information comprises paging eDRX information for NR and/or paging eDRX information for RedCap. Each of the paging eDRX information for NR and the paging eDRX information for RedCap comprises: (i) paging eDRX cycle for idle, wherein the paging eDRX cycle for idle indicates a cycle of eDRX operation to be performed by the UE in idle state; (ii) paging eDRX cycle for inactive, wherein the paging eDRX cycle for inactive indicates a cycle of eDRX operation to be performed by the UE in inactive state; and/or (iii) paging time window, wherein the paging time window indicates the length of a paging time window (PTW) during which the second network function is configured to transmit the UE paging message toward the UE.

[0103] In some embodiments, the first network function is a gNB distributed unit (DU), the second network function is a gNB central unit (CU) and the received message is a gNB

paging message. Triggered by downlink signaling and data, the gNB CU transmitted the gNB paging message toward the gNB DU via F1 interface, and the UE receiving the UE paging message is in connection management (CM) connected state with radio resource control (RRC) inactive state.

[0104] In some embodiments, the first network function is a non-anchor gNB, the second network function is an anchor gNB, the received message is a gNB paging message, and triggered by downlink signaling and data, the anchor gNB transmitted the gNB paging message toward the non-anchor gNB via Xn interface, and the UE receiving the UE paging message is in connection management (CM) connected state with radio resource control (RRC) inactive state.

[0105] FIG. **11** is a block diagram of UE **102**, according to some embodiments. As shown in FIG. **11**, UE **102** may comprise: processing circuitry (PC) **1102**, which may include one or more processors (P) **1155** (e.g., one or more general purpose microprocessors and/or one or more other processors, such as an application specific integrated circuit (ASIC), field-programmable gate arrays (FPGAs), and the like); communication circuitry **1148**, which is coupled to an antenna arrangement **1149** comprising one or more antennas and which comprises a transmitter (Tx) **1145** and a receiver (Rx) **1147** for enabling UE **102** to transmit data and receive data (e.g., wirelessly transmit/receive data); and a local storage unit (a.k.a., "data storage system") **1108**, which may include one or more non-volatile storage devices and/or one or more volatile storage devices. In embodiments where PC **1102** includes a programmable processor, a computer program product (CPP) **1141** may be provided. CPP **1141** includes a computer readable medium (CRM) **1142** storing a computer program (CP) **1143** comprising computer readable instructions (CRI) **1144**. CRM **1142** may be a non-transitory computer readable medium, such as, magnetic media (e.g., a hard disk), optical media, memory devices (e.g., random access memory, flash memory), and the like. In some embodiments, the CRI **1144** of computer program **1143** is configured such that when executed by PC **1102**, the CRI causes UE **102** to perform steps described herein (e.g., steps described herein with reference to the flow charts). In other embodiments, UE **102** may be configured to perform steps described herein without the need for code. That is, for example, PC **1102** may consist merely of one or more ASICs. Hence, the features of the embodiments described herein may be implemented in hardware and/or software

[0106] FIG. **12** is a block diagram of network function **1200** implementing at least a part of BS **104** or AMF **302**, according to some embodiments. As shown in FIG. **12**, network function **1200** may comprise: processing circuitry (PC) **1202**, which may include one or more processors (P) **1255** (e.g., one or more general purpose microprocessors and/or one or more other processors, such as an application specific integrated circuit (ASIC), field-programmable gate arrays (FPGAs), and the like), which processors may be co-located in a single housing or in a single data center or may be geographically distributed (i.e., network function **1200** may be a distributed computing apparatus); at least one network interface **1248** (e.g., a physical interface or air interface) comprising a transmitter (Tx) **1245** and a receiver (Rx) **1247** for enabling network function **1200** to transmit data to and receive data from other nodes connected to a network **110** (e.g., an Internet Protocol (IP) network) to which network interface **1248** is connected (physically or wirelessly) (e.g., network interface **1248** may be coupled to an antenna arrangement comprising one or more antennas for enabling network function **1200** to wirelessly transmit/receive data); and a local storage unit (a.k.a., "data storage system") **1208**, which may include one or more non-volatile storage devices and/or one or more volatile storage devices. In embodiments where PC **1202** includes a programmable processor, a computer program product (CPP) **1241** may be provided. CPP **1241** includes a computer readable medium (CRM) **1242** storing a computer program (CP) **1243** comprising computer readable instructions (CRI) **1244**. CRM **1242** may be a non-transitory computer readable medium, such as, magnetic media (e.g., a hard disk), optical media, memory devices (e.g., random access memory, flash memory), and the like. In some embodiments, the CRI **1244** of computer program **1243** is configured such that when executed by PC **1202**, the CRI causes network function **1200** to perform steps described herein (e.g., steps described herein with reference to the flow charts). In other embodiments, network function **1200** may be configured to perform steps described herein without the need for code. That is, for example, PC **1202** may consist merely of one or more ASICs. Hence, the features of the embodiments described herein may be implemented in hardware and/or software.

[0107] In case the network function **1200** is the BS **104**, the network function **1200** may additionally include an antenna and a communication circuitry that includes a transmitter, a receiver, and/or a transceiver. Using the antenna and the communication circuitry, the BS **104** is capable of performing a wireless communication with other network functions or UEs.

Summary of Various Embodiments

[0108] A1. A method (**700**) performed by a user equipment (UE) (**102**), the method comprising:

[0109] determining (s**702**) whether to transmit toward a network function first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs;

[0110] based on the determination, including (s**704**) the first power saving information in a first message; and

[0111] transmitting (s**706**) the first message toward the network function.

[0112] A2. The method of embodiment A1, wherein

[0113] the method further comprises receiving a second message from the network function,

[0114] the second message comprises second power saving information associated with NR UEs and/or NR RedCap UEs.

[0115] A3. The method of embodiment A2, wherein

[0116] the first power saving information comprises Requested extended discontinuous reception (eDRX) parameters for NR and/or Requested eDRX parameters for RedCap, and

[0117] the second power saving information comprises Negotiated eDRX parameters for NR and/or Negotiated eDRX parameters for RedCap.

[0118] A4. The method of embodiment A3, wherein

[0119] (i) the Requested eDRX parameters for NR and the Negotiated eDRX parameters for NR are different and/or (ii) the Requested eDRX parameters for RedCap and the Negotiated eDRX parameters for RedCap are different,

[0120] the method further comprises the UE attempting to receive a paging message triggered by the network

function using the Negotiated eDRX parameters for NR and/or the Negotiated eDRX parameters for RedCap.

[0121] A4b. The method of embodiment A3, wherein

[0122] (i) the Requested eDRX parameters for NR and the Requested eDRX parameters for RedCap are the same and/or (ii) the Negotiated eDRX parameters for NR and the Negotiated eDRX parameters for RedCap are the same, and

[0123] the method further comprises the UE attempting to receive a paging message triggered by the network function using any of the Negotiated eDRX parameters for NR and the Negotiated eDRX parameters for RedCap.

[0124] A5. The method of embodiment A2, wherein

[0125] the first message is a Registration Request message for requesting the network function to register the UE, and

[0126] the second message is a Registration Accept message indicating that the network function has registered the UE.

[0127] A6. The method of embodiment A2, the method further comprising determining a need to reduce power consumption of the UE, wherein whether to transmit toward the network function the first power saving information comprising Requested (eDRX) parameters for NR and/or Requested eDRX parameters for RedCap is determined based on the determination of the need to reduce the power consumption of the UE.

[0128] B1. A method (**800**) performed by a network function (**302**), the method comprising:

[0129] receiving (s**802**) a first message including first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, wherein the first message was transmitted by a user equipment (UE) (**102**);

[0130] determining (s**804**) whether the UE can use the first power saving information for power saving; and

[0131] based on the determination, transmitting (s**806**) toward the UE a second message comprising second power saving information associated with NR UEs and/or NR (RedCap) UEs.

[0132] B2. The method of embodiment B1, wherein

[0133] the first power saving information comprises Requested extended discontinuous reception (eDRX) parameters for NR and/or Requested eDRX parameters for RedCap, and

[0134] the second power saving information comprises Negotiated eDRX parameters for NR and/or Negotiated eDRX parameters for RedCap.

[0135] B3. The method of embodiment B2, wherein

[0136] determining whether the UE can use the first power saving information for power saving comprises determining that the UE cannot use the first power saving information for power saving, and

[0137] (i) the Requested eDRX parameters for NR and the Negotiated eDRX parameters for NR are different and/or (ii) the Requested eDRX parameters for RedCap and the Negotiated eDRX parameters for RedCap are different.

[0138] B4. The method of embodiment B2, wherein

[0139] the first message is a Registration Request message for requesting the network function to register the UE, and

[0140] the second message is a Registration Accept message indicating that the network function has registered the UE.

[0141] C1. A method (**900**) performed by a first network function (**302**), the method comprising:

[0142] transmitting (s**902**) toward a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, wherein the power saving information is used for transmitting a paging message towards a user equipment (UE) from the second network function.

[0143] C2. The method of embodiment C1, wherein

[0144] the message is any one of an Initial Context Setup Request message, a Handover Request message, a Path Switch Request Acknowledge message, and a UE Context Modification message, and

[0145] the power saving information is Core Network (CN) Assistance Information for Radio Resource Control (RRC) inactive state information.

[0146] C3. The method of embodiment C2, wherein

[0147] the Core Network Assistance Information for RRC inactive state information comprises paging eDRX information for NR and/or paging eDRX information for RedCap, and

[0148] each of the paging eDRX information for NR and the paging eDRX information for RedCap comprises:

[0149] (i) paging eDRX cycle for idle, wherein the paging eDRX cycle for idle indicates a cycle of eDRX operation to be performed by the UE in idle state;

[0150] (ii) paging eDRX cycle for inactive, wherein the paging eDRX cycle for inactive indicates a cycle of eDRX operation to be performed by the UE in inactive state; and/or

[0151] (iii) paging time window, wherein the paging time window indicates the length of a paging time window (PTW) during which the second network function is configured to transmit the paging message toward the UE.

[0152] C4. The method of embodiment C1, wherein

[0153] the first network function is AMF,

[0154] the second network function is a gNB,

[0155] the message transmitted toward the gNB is a NGAP paging message formulated by the AMF, and

[0156] the power saving information is for UEs in CM-IDLE state.

[0157] D1. A method (**1000**) performed by a first network function (**104**), the method comprising:

[0158] receiving (s**1002**) from a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, and

[0159] based on the power saving information, transmitting (s**1004**) a UE paging message towards a user equipment (UE).

[0160] D2. The method of embodiment D1, wherein

[0161] the first network function is a gNB, and

[0162] the second network function is access and mobility and management function (AMF).

[0163] the AMF transmitted the message to the gNB using new generation application protocol (NGAP), and.

[0164] the UE receiving the UE paging message is in connection management (CM) connected state with radio resource control (RRC) inactive state or CM idle state.

[0165] D3. The method of embodiment D2, wherein

[0166] the message is any one of an Initial Context Setup Request message, a Handover Request message, a Path Switch Request Acknowledge message, and a UE Context Modification message, and

[0167] the power saving information is Core Network Assistance Information for Radio Resource Control (RRC) inactive state information.

[0168] D4. The method of embodiment D3, wherein

[0169] the Core Network Assistance Information for RRC inactive state information comprises paging eDRX information for NR and/or paging eDRX information for RedCap, and

[0170] each of the paging eDRX information for NR and the paging eDRX information for RedCap comprises:

[0171] (i) paging eDRX cycle for idle, wherein the paging eDRX cycle for idle indicates a cycle of eDRX operation to be performed by the UE in idle state;

[0172] (ii) paging eDRX cycle for inactive, wherein the paging eDRX cycle for inactive indicates a cycle of eDRX operation to be performed by the UE in inactive state; and/or

[0173] (iii) paging time window, wherein the paging time window indicates the length of a paging time window (PTW) during which the second network function is configured to transmit the UE paging message toward the UE.

[0174] D5. The method of embodiment D1, wherein

[0175] the first network function is a gNB distributed unit (DU),

[0176] the second network function is a gNB central unit (CU),

[0177] the received message is a gNB paging message,

[0178] triggered by downlink signaling and data, the gNB CU transmitted the gNB paging message toward the gNB DU via F1 interface, and

[0179] the UE receiving the UE paging message is in connection management (CM) connected state with radio resource control (RRC) inactive state.

[0180] D6. The method of embodiment D1, wherein

[0181] the first network function is a non-anchor gNB,

[0182] the second network function is a anchor gNB,

[0183] the received message is a gNB paging message, and

[0184] triggered by downlink signaling and data, the anchor gNB transmitted the gNB paging message toward the non-anchor gNB via Xn interface, and

[0185] the UE receiving the UE paging message is in connection management (CM) connected state with radio resource control (RRC) inactive state.

[0186] E1. A computer program (**1143**) comprising instructions (**1144**) which when executed by processing circuitry (**1102**) of a UE (**102**), causes the UE to perform the method of any one of embodiments A1-A6.

[0187] E2. A carrier containing the computer program of embodiment E1, wherein the carrier is one of an electronic signal, an optical signal, a radio signal, and a computer readable storage medium.

[0188] F1. A computer program (**1243**) comprising instructions (**1244**) which when executed by processing circuitry (**1202**) of a network function (**104** or **302**), causes the network function to perform the method of any one of embodiments B1-D6.

[0189] F2. A carrier containing the computer program of embodiment F1, wherein the carrier is one of an electronic signal, an optical signal, a radio signal, and a computer readable storage medium.

[0190] G1. A UE (**102**), the UE comprising:

[0191] processing circuitry (**1102**); and

[0192] a memory (**1142**), the memory containing instructions (**1144**) executable by the processing circuitry, whereby the UE is configured to perform any one of the embodiments A1-A6.

[0193] H1. A network function (**104** or **302**), the network function comprising:

[0194] processing circuitry (**1202**); and

[0195] a memory (**1242**), the memory containing instructions (**1244**) executable by the processing circuitry, whereby the network function is configured to perform any one of the embodiments B1-D6.

[0196] I1. A UE (**102**), the UE being configured to:

[0197] determine (s**702**) whether to transmit toward a network function first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs;

[0198] based on the determination, include (s**704**) the first power saving information in a first message; and

[0199] transmit (s**706**) the first message toward the network function.

[0200] I2. The UE of embodiment 11, wherein the UE is further configured to perform the method of any one of embodiments A2-A5.

[0201] J1. A network function (**302**), the network function being configured to:

[0202] receive (s**802**) a first message including first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, wherein the first message was transmitted by a user equipment (UE);

[0203] determine (s**804**) whether the UE can use the first power saving information for power saving; and

[0204] based on the determination, transmit (s**806**) toward the UE a second message comprising second power saving information associated with NR UEs and/or NR (RedCap) UEs.

[0205] J2. The network function of embodiment J1, wherein the network function is further configured to perform the method of any one of embodiments B2-B4.

[0206] K1. A first network function (**302**), the first network function being configured to:

[0207] transmit (s**902**) toward a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, wherein the power saving information is used for transmitting a paging message towards a user equipment (UE) from the second network function.

[0208] K2. The first network function of embodiment K1, wherein the first network function is further configured to perform the method of any one of embodiments C2-C4.

[0209] L1. A first network function (**104**), the first network function being configured to:

[0210] receive (s**1002**) from a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, and

[0211] based on the power saving information, transmit (s**1004**) a UE paging message towards a user equipment (UE).

[0212] L2. The first network function of embodiment L1, wherein the first network function is further configured to perform the method of any one of embodiments D2-D6.

[0213] While various embodiments are described herein (an in any appendix), it should be understood that they have been presented by way of example only, and not limitation. Thus, the breadth and scope of this disclosure should not be limited by any of the above-described exemplary embodiments. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the disclosure unless otherwise indicated herein or otherwise clearly contradicted by context.

[0214] Additionally, while the processes described above and illustrated in the drawings are shown as a sequence of steps, this was done solely for the sake of illustration. Accordingly, it is contemplated that some steps may be added, some steps may be omitted, the order of the steps may be re-arranged, and some steps may be performed in parallel.

1. A method performed by a first network function, the method comprising:

transmitting toward a second network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, wherein the power saving information is used for transmitting a paging message towards a user equipment (UE) from the second network function.

2. The method according to claim **1**, wherein

the message is any one of an Initial Context Setup Request message, a Handover Request message, a Path Switch Request Acknowledge message, and a UE Context Modification message; and

the power saving information is Core Network (CN) Assistance Information for Radio Resource Control (RRC) inactive state information.

3. The method according to claim **2**, wherein

the Core Network Assistance Information for RRC inactive state information comprises paging eDRX information for NR and/or paging eDRX information for RedCap, and

each of the paging eDRX information for NR and the paging eDRX information for RedCap comprises:

(i) paging eDRX cycle for idle, wherein the paging eDRX cycle for idle indicates a cycle of eDRX operation to be performed by the UE in idle state;

(ii) paging eDRX cycle for inactive, wherein the paging eDRX cycle for inactive indicates a cycle of eDRX operation to be performed by the UE in inactive state; and/or

(iii) paging time window, wherein the paging time window indicates the length of a paging time window (PTW) during which the second network function is configured to transmit the paging message toward the UE.

4. The method according to claim **1**, wherein

the first network function is AMF,

the second network function is a gNB,

the message transmitted toward the gNB is a NGAP paging message formulated by the AMF, and

the power saving information is for UEs in CM-IDLE state.

5. A method performed by a second network function, the method comprising:

receiving from a first network function a message including power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs; and

based on the power saving information, transmitting a UE paging message towards a user equipment (UE).

6. The method according to claim **5**, wherein

the second network function is a gNB, and the first network function is a access and mobility and management function (AMF);

the AMF transmitted the message to the gNB using new generation application protocol (NGAP); and,

the UE receiving the UE paging message is in connection management (CM) connected state with radio resource control (RRC) inactive state or CM idle state.

7. The method according to claim **6**, wherein

the message is any one of an Initial Context Setup Request message, a Handover Request message, a Path Switch Request Acknowledge message, and a UE Context Modification message; and

the power saving information is Core Network Assistance Information for Radio Resource Control (RRC) inactive state information.

8. The method according to claim **7**, wherein

the Core Network Assistance Information for RRC inactive state information comprises paging eDRX information for NR and/or paging eDRX information for RedCap, and

each of the paging eDRX information for NR and the paging eDRX information for RedCap comprises:

(i) paging eDRX cycle for idle, wherein the paging eDRX cycle for idle indicates a cycle of eDRX operation to be performed by the UE in idle state;

(ii) paging eDRX cycle for inactive, wherein the paging eDRX cycle for inactive indicates a cycle of eDRX operation to be performed by the UE in inactive state; and/or

(iii) paging time window, wherein the paging time window indicates the length of a paging time window (PTW) during which the second network function is configured to transmit the UE paging message toward the UE.

9. The method according to claim **5**, wherein

the second network function is a gNB distributed unit (DU),

the first network function is a gNB central unit (CU),

the received message is a gNB paging message,

triggered by downlink signaling and data, the gNB CU transmitted the gNB paging message toward the gNB DU via F1 interface, and

the UE receiving the UE paging message is in connection management (CM) connected state with radio resource control (RRC) inactive state.

10. The method according to claim **5**, wherein

the second network function is a non-anchor gNB,

the first network function is a anchor gNB,

the received message is a gNB paging message, and

triggered by downlink signaling and data, the anchor gNB transmitted the gNB paging message toward the non-anchor gNB via Xn interface, and

the UE receiving the UE paging message is in connection management (CM) connected state with radio resource control (RRC) inactive state.

11. A method performed by a user equipment (UE), the method comprising:

determining whether to transmit toward a network function first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs;

based on the determination, including the first power saving information in a first message; and

transmitting the first message toward the network function.

12. The method according to claim **11**, wherein

the method further comprises receiving a second message from the network function,

the second message comprises second power saving information associated with NR UEs and/or NR RedCap UEs.

13. The method according to claim **12**, wherein

the first power saving information comprises Requested extended discontinuous reception (eDRX) parameters for NR and/or Requested eDRX parameters for RedCap, and

the second power saving information comprises Negotiated eDRX parameters for NR and/or Negotiated eDRX parameters for RedCap.

14. The method according to claim **13**, wherein

(i) the Requested eDRX parameters for NR and the Negotiated eDRX parameters for NR are different and/or (ii) the Requested eDRX parameters for RedCap and the Negotiated eDRX parameters for RedCap are different,

the method further comprises the UE attempting to receive a paging message triggered by the network function using the Negotiated eDRX parameters for NR and/or the Negotiated eDRX parameters for RedCap.

15. The method according to claim **13**, wherein

(i) the Requested eDRX parameters for NR and the Requested eDRX parameters for RedCap are the same and/or (ii) the Negotiated eDRX parameters for NR and the Negotiated eDRX parameters for RedCap are the same, and

the method further comprises the UE attempting to receive a paging message triggered by the network function using any of the Negotiated eDRX parameters for NR and the Negotiated eDRX parameters for RedCap.

16. The method according to claim **12**, wherein

the first message is a Registration Request message for requesting the network function to register the UE, and

the second message is a Registration Accept message indicating that the network function has registered the UE.

17. The method according to claim **12**, the method further comprising determining a need to reduce power consumption of the UE, wherein whether to transmit toward the network function the first power saving information comprising Requested (eDRX) parameters for NR and/or Requested eDRX parameters for RedCap is determined based on the determination of the need to reduce the power consumption of the UE.

18. A method performed by a network function, the method comprising:

receiving a first message including first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, wherein the first message was transmitted by a user equipment (UE);

determining whether the UE can use the first power saving information for power saving; and

based on the determination, transmitting toward the UE a second message comprising second power saving information associated with NR UEs and/or NR (RedCap) UEs.

19. The method according to claim **18**, wherein

the first power saving information comprises Requested extended discontinuous reception (eDRX) parameters for NR and/or Requested eDRX parameters for RedCap, and

the second power saving information comprises Negotiated eDRX parameters for NR and/or Negotiated eDRX parameters for RedCap.

20. The method according to claim **19**, wherein

determining whether the UE can use the first power saving information for power saving comprises determining that the UE cannot use the first power saving information for power saving, and

(i) the Requested eDRX parameters for NR and the Negotiated eDRX parameters for NR are different and/or (ii) the Requested eDRX parameters for RedCap and the Negotiated eDRX parameters for RedCap are different.

21. The method according to claim **19**, wherein

the first message is a Registration Request message for requesting the network function to register the UE, and

the second message is a Registration Accept message indicating that the network function has registered the UE.

22-27. (canceled)

28. A UE comprising:

processing circuitry; and

a memory, the memory containing instructions executable by the processing circuitry, whereby the UE is configured to:

determine whether to transmit toward a network function first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs;

based on the determination, include the first power saving information in a first message; and

transmit the first message toward the network function.

29-35. (canceled)

36. A network function comprising:

processing circuitry; and

a memory, the memory containing instructions executable by the processing circuitry, whereby the network function is configured to perform:

(1) receiving a first message including first power saving information associated with new radio (NR) user equipments (UEs) and/or NR reduced capabilities (RedCap) UEs, wherein the first message was transmitted by a user equipment (UE), determining whether the UE can use the first power saving information for power saving, and based on the determination, transmitting toward the UE a second message comprising second power saving information associated with NR UEs and/or NR (RedCap) UEs;

(2) transmitting toward another network function a message including power saving information associated with new radio (NR) UEs and/or RedCap UEs, wherein the power saving information is used for transmitting a paging message towards a UE from said another network function; or

(3) receiving from another function a message including power saving information associated with new radio (NR) UEs and/or RedCap UEs, and based on the power saving information, transmitting a UE paging message towards a UE.

* * * * *