ACCESS CONTROL FOR ENERGY SAVING MODE

FIELD

[0001] Various example embodiments of the present disclosure generally relate to the field of telecommunication and in particular, to methods, devices, apparatuses and computer readable storage medium for access control for energy saving mode.

BACKGROUND

[0002] Reducing the energy consumption of mobile networks, and particularly of the radio access network (RAN), which consumes the largest part of the total energy consumption in the network, has gained significant attention. Accordingly, means for obtaining network energy saving in the fifth generation (5G) communication system have been proposed. Studies on the network energy saving are mainly focused on the radio access network and aim at identifying adaptation techniques of transmissions and/or receptions in time, frequency, spatial, and power domains, with potential support and/or feedback from user equipment (UE), potential UE assistance information, and information exchange and/or coordination over network interfaces.

SUMMARY

[0003] In a first aspect of the present disclosure, there is provided a terminal device. The terminal device comprises at least one processor; and at least one memory storing instructions that, when executed by the at least one processor, cause the terminal device at least to perform: receiving, from a network device, a plurality of barring configurations corresponding to a plurality of energy saving modes of the network device; receiving, from the network device, a first mode indication that the network device operates in a first energy saving mode of the plurality of energy saving modes; and performing a first operation associated with an access to the network device based on a first barring configuration, of the plurality of barring configurations, corresponding to the first energy saving mode.

[0004] In a second aspect of the present disclosure, there is provided a network device. The network device comprises at least one processor; and at least one memory storing instructions that, when executed by the at least one processor, cause the network device at least to perform:

transmitting, to a terminal device, a plurality of barring configurations corresponding to a plurality of energy saving modes of the network device; determining whether the network device operates in an energy saving mode of the plurality of energy saving modes; and in accordance with a determination that the network device operates in a first energy saving mode of the plurality of energy saving modes, transmitting to the terminal device a first mode indication that the network device operates in the first energy saving mode.

[0005] In a third aspect of the present disclosure, there is provided a method. The method comprises: receiving, at a terminal device from a network device, a plurality of barring configurations corresponding to a plurality of energy saving modes of the network device; receiving, from the network device, a first mode indication that the network device operates in a first energy saving mode of the plurality of energy saving modes; and performing a first operation associated with an access to the network device based on a first barring configuration, of the plurality of barring configurations, corresponding to the first energy saving mode.

[0006] There is provided a method. The method comprises: transmitting, from a second device to a first device, at least one barring configuration corresponding to at least one energy saving mode of the second device; determining whether the second device operates in an energy saving mode of the at least one energy saving mode; and in accordance with a determination that the second device operates in a first energy saving mode of the at least one energy saving mode, transmitting to the first device a first mode indication that the second device operates in the first energy saving mode.

[0007] There is provided a first apparatus. The first apparatus comprises means for receiving, from a second apparatus, at least one barring configuration corresponding to at least one energy saving mode of the second apparatus; means for receiving, from the second apparatus, a first mode indication that the second apparatus operates in a first energy saving mode of the at least one energy saving mode; and means for performing a first operation associated with an access to the second apparatus based on a first barring configuration, of the at least one barring configuration, corresponding to the first energy saving mode.

[0008] There is provided a second apparatus. The second apparatus comprises means for transmitting, to a first apparatus, at least one barring configuration corresponding to at least one energy saving mode of the second apparatus; means for determining whether the second apparatus operates in an energy saving

mode of the at least one energy saving mode; and means for in accordance with a determination that the second apparatus operates in a first energy saving mode of the at least one energy saving mode, transmitting to the first apparatus a first mode indication that the second apparatus operates in the first energy saving mode.

[0009] There is provided a computer readable medium. The computer readable medium comprises instructions stored thereon for causing an apparatus to perform at least the method according to the first aspect.

[0010] There is provided a computer readable medium. The computer readable medium comprises instructions stored thereon for causing an apparatus to perform at least the method according to the second aspect.

[0011] It is to be understood that the Summary section is not intended to identify key or essential features of embodiments of the present disclosure, nor is it intended to be used to limit the scope of the present disclosure. Other features of the present disclosure will become easily comprehensible through the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Some example embodiments will now be described with reference to the accompanying drawings, where:

[0013] FIG. 1 illustrates an example communication environment in which example embodiments of the present disclosure can be implemented;

[0014] FIG. 2 illustrates a signaling chart for access control according to some example embodiments of the present disclosure;

[0015] FIG. 3 illustrates a flowchart of a method implemented at a first device according to some example embodiments of the present disclosure;

[0016] FIG. 4 illustrates a flowchart of a method implemented at a second device according to some example embodiments of the present disclosure;

[0017] FIG. 5 illustrates a simplified block diagram of a device that is suitable for implementing example embodiments of the present disclosure; and

[0018] FIG. 6 illustrates a block diagram of an example computer readable medium in accordance with some example embodiments of the present disclosure.

[0019] Throughout the drawings, the same or similar reference numerals represent the same

WHAT IS CLAIMED IS:

1. A terminal device comprising:

at least one processor; and

at least one memory storing instructions that, when executed by the at least one processor, cause the terminal device at least to perform:

receiving, from a network device, a plurality of barring configurations corresponding to a plurality of energy saving modes of the network device;

receiving, from the network device, a first mode indication that the network device operates in a first energy saving mode of the plurality of energy saving modes; and

performing a first operation associated with an access to the network device based on a first barring configuration, of the plurality of barring configurations, corresponding to the first energy saving mode.

2. The terminal device of claim 1, wherein the terminal device is further caused to perform:

receiving, from the network device, a second mode indication that the network device operates in a second energy saving mode of the plurality of energy saving modes different from the first energy saving mode; and

performing a second operation associated with an access to the network device based on a second barring configuration, of the plurality of barring configurations, corresponding to the second energy saving mode.

3. The terminal device of claim 1, wherein the terminal device is further caused to perform:

receiving, from the network device, a third mode indication that the network device operates in a non-energy saving mode; and

performing a third operation associated with an access to the network device based on a third barring configuration corresponding to the non-energy saving mode.

4. The terminal device of claim 1, wherein the first barring configuration comprises a set of access barring parameters corresponding to the first energy saving mode, and performing the first operation comprises:

performing access barring check for an access attempt to the network device based

on the set of access barring parameters.

5. The terminal device of claim 4, wherein performing the access barring check comprises:

receiving, from the network device, first information indicating an association between the first energy saving mode and an access identity; and

performing the access barring check for the access attempt associated with the access identity based on the set of access barring parameters.

6. The terminal device of claim 4, wherein performing the access barring check comprises:

receiving, from the network device, second information indicating an association between the first energy saving mode and an access category; and

performing the access barring check for the access attempt associated with the access category based on the set of access barring parameters.

7. The terminal device of claim 4, wherein the set of access barring parameters comprises at least one of:

a barring indicator for the first energy saving mode,

a barring factor for the first energy saving mode,

a barring time for the first energy saving mode, or

an indication of a barring timer for the first energy saving mode.

8. The terminal device of claim 4, wherein the terminal device is further caused to perform:

determining the set of access barring parameters from the plurality of barring configurations based on the first energy saving mode and at least one of:

a beam via which the first and second devices communicate, or

a Public Land Mobile Network serving the first device.

9. The terminal device of claim 1, wherein the first barring configuration comprises a cell barring indication of whether a cell served by the network device is barred for the first energy saving mode, and performing the first operation comprises:

determining whether the cell is barred for the first energy saving mode based on the

cell barring indication;

in accordance with a determination that the cell is not barred for the first energy saving mode, camping on the cell for a subsequent access to the network device.

10. The terminal device of claim 1, wherein receiving the plurality of barring configurations comprises at least one of:

receiving at least a portion of the plurality of barring configurations in an information block broadcast by the network device, or

receiving at least a portion of the plurality of barring configurations in a message dedicated to the terminal device from the network device.

11. The terminal device of claim 1, wherein the terminal device is further caused to perform:

skipping applying a further barring configuration configured for a device not supporting the plurality of energy saving modes of the network device.

12. The terminal device of claim 11, wherein skipping applying the further barring configuration is based on receiving the plurality of barring configurations.

13. The terminal device of claim 1, wherein the terminal device is further caused to perform:

receiving, from the network device, an indication to skip applying a further barring configuration configured for a device not supporting the plurality of energy saving modes of the network device; and

skipping applying the further barring configuration based on receiving the indication.

14. A network device comprising:

at least one processor; and

at least one memory storing instructions that, when executed by the at least one processor, cause the network device at least to perform:

transmitting, to a terminal device, a plurality of barring configurations corresponding to a plurality of energy saving modes of the network device;

determining whether the network device operates in an energy saving mode of the plurality of energy saving modes; and

in accordance with a determination that the network device operates in a first energy saving mode of the plurality of energy saving modes, transmitting to the terminal device a first mode indication that the network device operates in the first energy saving mode.

15. The network device of claim 14, wherein the network device is further caused to perform:

in accordance with a determination that the network device operates in a second energy saving mode of the plurality of energy saving modes different from the first energy saving mode, transmitting to the terminal device a second mode indication that the network device operates in the second energy saving mode.

16. The network device of claim 14, wherein a first barring configuration, of the plurality of barring configurations, corresponding to the first energy saving mode comprises a set of access barring parameters corresponding to the first energy saving mode.

17. The network device of claim 14, wherein a first barring configuration, of the plurality of barring configurations, corresponding to the first energy saving mode comprises a cell barring indication of whether a cell served by the network device is barred for the first energy saving mode.

18. The network device of claim 14, wherein transmitting the plurality of barring configurations comprises at least one of:

broadcasting at least a portion of the plurality of barring configurations in an information block, or

transmitting, to the terminal device, at least a portion of the plurality of barring configurations in a message dedicated to the terminal device.

19. A method comprising:

receiving, at a terminal device from a network device, a plurality of barring configurations corresponding to a plurality of energy saving modes of the network device;

receiving, from the network device, a first mode indication that the network device operates in a first energy saving mode of the plurality of energy saving modes; and

performing a first operation associated with an access to the network device based on

a first barring configuration, of the plurality of barring configurations, corresponding to the first energy saving mode.