ACCESS CONTROL FOR USER EQUIPMENT IN A CONNECTED MODE

BACKGROUND

Wireless communication systems include a network of base stations (which are also referred to as radio access networks, gNodeBs, eNodeBs, or access points) that provide wireless connectivity to one or more user equipment within corresponding geographic areas or cells. In order to conserve battery power, a user equipment is able to operate in an idle mode that consumes less power but does not permit the user equipment to transmit uplink data to a core network. The user equipment is required to transmit an access attempt to the base station to acquire a radio connection and enter the connected mode, which permits the user equipment to transmit uplink data. The base station and/or the core network can become overloaded if too many user equipment use or attempt to use network resources. Some access attempts by idle user equipment are therefore barred (*i.e*., prevented or prohibited) to reduce or limit resource consumption by the user equipment. For example, a network that operates according to Fourth Generation (4G) standards defined by the Third Generation Partnership Project (3GPP) such as Long Term Evolution (LTE) standards imposes access restrictions on idle user equipment to prevent the idle user equipment from registering or establishing a radio resource control (RRC) connection to the network. Access barring is typically performed by transmitting a barring configuration to the user equipment so that the user equipment can determine when an access attempt is barred.

SUMMARY

In one aspect, the present disclosure refers to an apparatus comprising: at least one processor; and at least one memory including computer program code; the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to: determine that lower layers indicate that an access attempt is barred, in response to determining that an

event which triggered the access attempt is a request to send a mobile originated SMS over non-access stratum, and the apparatus is registered to a network via both 3GPP access and non-3GPP access, transmit an uplink non-access stratum transport message via non-3GPP access.

In another aspect, the present disclosure refers to a method comprising: determining, in an apparatus, that lower layers indicate that an access attempt is barred, in response to determining that an event which triggered the access attempt is a request to send a mobile originated SMS over non-access stratum, and the apparatus is registered to a network via both 3GPP access and non-3GPP access, transmitting, in the apparatus, an uplink non-access stratum transport message via non-3GPP access.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure may be better understood, and its numerous features and advantages made apparent to those skilled in the art by referencing the accompanying drawings. The use of the same reference symbols in different drawings indicates similar or identical items.

WHAT IS CLAIMED IS:

1. An apparatus comprising:

at least one processor; and

at least one memory including computer program code;

the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to:

determine that lower layers indicate that an access attempt is barred,

in response to determining that an event which triggered the access attempt is a request to send a mobile originated SMS over non-access stratum, and the apparatus is registered to a network via both 3GPP access and non-3GPP access, transmit an uplink non-access stratum transport message via non-3GPP access.

2. The apparatus according to claim 1, wherein the computer program code is configured to, with the at least one processor, cause the apparatus to:

otherwise, start mobile-initiated non-access stratum transport procedure, when the lower layers indicate that barring is alleviated.

3. The apparatus according to claim 1, wherein the computer program code is configured to, with the at least one processor, cause the apparatus to determine that the lower layers indicate that the access attempt is barred and to determine if the event which triggered the access attempt is the request from the upper layers to send the mobile originated SMS over non-access stratum, at a non-access stratum layer.

4. The apparatus according to claim 1, wherein the computer program code is configured to, with the at least one processor, cause the apparatus to determine that the lower layers indicate that the access attempt via 3GPP access is barred.

5. The apparatus according to claim 1, wherein the computer program code is configured to, with the at least one processor, cause the apparatus to transmit the uplink non-access stratum transport message, if it is determined that the lower layers indicate that the access attempt is barred.

6. The apparatus according to claim 1, wherein the uplink non-access stratum transport message carries the mobile originated SMS and is transmitted via non-3GPP access.

7. The apparatus according to claim 1, wherein the computer program code is configured to, with the at least one processor, cause the apparatus to:

determine if the apparatus is registered to the network via both 3GPP access and non-3GPP access.

8. The apparatus according to claim 1, wherein the computer program code is further configured to, with the at least one processor, cause the apparatus to:

transmit the uplink non-access stratum transport message carrying the mobile originated SMS via non-3GPP access, if non-3GPP access is available,

otherwise, transmit the uplink non-access stratum transport message carrying the mobile originated SMS via 3GPP access, if the lower layers indicate that barring is alleviated.

9. A method comprising:

determining, in an apparatus, that lower layers indicate that an access attempt is barred,

in response to determining that an event which triggered the access attempt is a request to send a mobile originated SMS over non-access stratum, and the apparatus is registered to a network via both 3GPP access and non-3GPP access, transmitting, in the apparatus, an uplink non-access stratum transport message via non-3GPP access.

10. The method according to claim 9, further comprising:

otherwise, starting mobile-initiated non-access stratum transport procedure, when the lower layers indicate that barring is alleviated.

11. The method according to claim 9, wherein said determining that the lower layers indicate that the access attempt is barred comprises determining if the event which triggered the access attempt is the request from the upper layers to send the mobile originated SMS over non-access stratum, at a non-access stratum layer.

12. The method according to claim 9, wherein said determining that lower layers indicate that an access attempt is barred comprises determining that the lower layers indicate that the access attempt via 3GPP access is barred.

13. The method according to claim 9, wherein the uplink non-access stratum transport message carries the mobile originated SMS and is transmitted via non-3GPP access.

14. The method according to claim 9, further comprising:

determining if the apparatus is registered to the network via both 3GPP access and non-3GPP access.

15. The method according to claim 9, further comprising:

transmitting the uplink non-access stratum transport message carrying the mobile originated SMS via non-3GPP access, if non-3GPP access is available,

otherwise, transmitting the uplink non-access stratum transport message carrying the mobile originated SMS via 3GPP access, if the lower layers indicate that barring is alleviated.