TIMING CONFIGURATION IN WIRELESS COMMUNICATION SYSTEMS

TECHNICAL FIELD

This document is directed generally to wireless communications.

BACKGROUND

Wireless communication technologies are moving the world toward an increasingly connected and networked society. The rapid growth of wireless communications and advances in technology has led to greater demand for capacity and connectivity. Other aspects, such as energy consumption, device cost, spectral efficiency, and latency are also important to meeting the needs of various communication scenarios. In comparison with the existing wireless networks, next generation systems and wireless communication techniques will provide support for an increased number of users and devices, as well as support for higher data rates.

SUMMARY

This document relates to methods, systems, and devices for timing configuration in mobile communication technology, including 5th Generation (5G) and New Radio (NR) communication systems.

In ~~one exemplary~~a first aspect, a wireless communication method is disclosed. The method includes operating a wireless device to receive, by the wireless device from a network node, a message, and configuring, based on the message, the wireless device to establish a connection with the network node.

In ~~another exemplary~~a second aspect, a wireless communication method is disclosed. The method includes transmitting, by a network node to a wireless device, a message, wherein the message configures the wireless device to establish a connection with the network node.

In ~~yet another exemplary~~a third aspect, a wireless communication method is disclosed. The method includes receiving, by a wireless device from a network node, a message comprising a medium access control (MAC) layer timing control, and selectively starting, based on a rule and subsequent to ~~the~~ receiving the message, a time alignment timer, wherein the rule specifies the time alignment timer is not started when the MAC layer is performing a resource configuration transmission and the time alignment timer is started when the MAC layer is not

performing the resource

configuration transmission.

In yet another exemplary ~~aspect~~example, a wireless communication method is disclosed. The method includes receiving, by a wireless device from a network node, a message comprising an increment for a timing adjustment that is applicable to all wireless devices in the non-terrestrial network, and adjusting a local timing based on the increment for the timing adjustment.

In yet another exemplary ~~aspect~~example, a wireless communication method is disclosed. The method includes transmitting, by a network node to a plurality of wireless devices, a message comprising an increment for a timing adjustment, such that the increment is identical for each of the plurality of wireless devices being served by the network node.

In yet another exemplary ~~aspect~~example, the above-described methods are embodied in the form of processor-executable code and stored in a computer-readable program medium.

In yet another exemplary embodiment, a ~~device~~ wireless communication apparatus comprising a processor and a memory, wherein the processor ~~that~~ is configured ~~or operable~~ to read code from the memory and ~~perform~~ implement ~~the above-described~~a method~~s~~ ~~is disclosed~~according to the first, second or third aspect.

The above and other aspects and their implementations are described in greater detail in the drawings, the descriptions, and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows an example of a network node (e.g., base station or gNodeB) and a wireless device (e.g., user equipment (UE)) in wireless communication.

FIG. 2 shows shows an example of carrying a Timing Advance Control (TAC) MAC Control Element (CE) with an RRC message or downlink (DL) data from a NodeB to a UE.

FIG. 3 shows an example of the MAC of a UE starting a time alignment timer upon reception of an indication from the RRC.

FIG. 4 shows an example of a NodeB transmitting a Preconfigured Uplink Resource (PUR) configuration and a PUR identity to the UE.

FIG. 5 shows an example of a NodeB transmitting an RRC message and a PUR identity to the UE.

FIGS. 6A–6E show examples of wireless communication methods.

FIG. 7 is a block diagram representation of a portion of an apparatus that can be used to implement methods and techniques described in this document.

CLAIMS

1. A method of wireless communication, comprising:

operating a wireless device to receive, by the wireless device from a network node, a message; and

configuring, based on the message, the wireless device to establish a connection with the network node.

2. The method of claim 1, wherein a medium access control (MAC) layer timing control is multiplexed with the message, the method further comprising:.

~~3. The method of claim 2, further comprising:~~

starting, based on the MAC layer timing control being multiplexed with the message, a time alignment timer in the MAC layer.

43. The method of claim 2 ~~or 3~~, wherein the MAC layer timing control is a timing advance control (TAC) MAC control element (CE).

54. The method of claim 1, further comprising:

sending, ~~by~~ from a Radio Resource Control (RRC) layer and based on receiving the message, an indicator to a medium access control (MAC) layer; and.

~~6. The method of claim 5, further comprising:~~

starting, based on the indicator from the RRC layer, a time alignment timer in the MAC layer.

75. A method of wireless communication, comprising:

transmitting, by a network node to a wireless device, a message, wherein the message configures the wireless device to establish a connection with the network node.

6. The method of claim 5, wherein a medium access control (MAC) layer timing control is multiplexed with the message, and wherein a time alignment timer in the MAC layer is started at the wireless device based on the MAC layer timing control being multiplexed with the message, and wherein the MAC layer timing control is a timing advance control (TAC) MAC control element (CE).

~~8~~7. The method of any of claims 1 to ~~7~~6, wherein the message is a Radio Resource Control (RRC) message or a downlink (DL) grant, and wherein the connection is an RRC connection or comprises entering an RRC connected mode.

~~9~~8. A method of wireless communication, comprising:

receiving, by a wireless device from a network node, a message comprising a medium access control (MAC) layer timing control; and

selectively starting, based on a rule and subsequent to ~~the~~ receiving the message, a time alignment timer, wherein the rule specifies the time alignment timer is not started when the MAC layer is performing a resource configuration transmission and the time alignment timer is started when the MAC layer is not performing the resource configuration transmission.

~~10~~9. The method of claim ~~9~~8, wherein performing the resource configuration transmission corresponds to the MAC layer comprising an identifier associated with the resource configuration transmission.

~~11~~10. The method of claim ~~9~~8, wherein performing the resource configuration transmission corresponds to a resource configuration response window timer being inactive.

~~12~~11. The method of claim ~~9~~8, wherein not performing the resource configuration transmission corresponds to receiving a Timing Advance Command MAC control element indicated by a Physical Downlink Control Channel (PDCCH) addressed to a Cell-Radio Network Temporary Identifier (C-RNTI).

~~13~~12. The method of claim ~~9~~8, wherein performing the resource configuration transmission corresponds to the MAC layer deleting the time alignment timer based on an indication from a Radio Resource Control (RRC).

~~14~~13. The method of any of claims ~~9~~8 to ~~13~~12, wherein the message is a Radio Resource Control (RRC) message, a MAC Control Element (CE) or a Physical Downlink Control Channel (PDCCH).

~~15~~14. The method of claim ~~14~~13, wherein the MAC layer timing control is a Timing Advance Command (TAC) MAC Control Element (CE), wherein the resource configuration transmission is a preconfigured uplink resource (PUR) transmission, and wherein the identifier associated with the resource configuration transmission is a PUR-Radio Network Temporary Identifier

(RNTI), and wherein the resource configuration response window timer is a PUR respond window timer.

~~16. A method of wireless communication, comprising:~~

~~receiving, by a wireless device from a network node, a message comprising an increment for a timing adjustment that is applicable to all wireless devices in the non-terrestrial network; and~~

~~adjusting a local timing based on the increment for the timing adjustment.~~

~~17. The method of claim 16, wherein adjusting the local timing comprises:~~

~~adding or subtracting the increment for timing adjustment to or from a previous timing adjustment, respectively.~~

~~18. The method of claim 16, further comprising:~~

~~receiving information corresponding to a movement of the network node, wherein adjusting the local timing is further based on the information.~~

~~19. A method of wireless communication, comprising:~~

~~transmitting, by a network node to a plurality of wireless devices, a message comprising an increment for a timing adjustment, such that the increment is identical for each of the plurality of wireless devices being served by the network node.~~

~~20. The method of claim 19, further comprising:~~

~~transmitting information corresponding to a movement of the network node, wherein adjusting the local timing is further based on the information.~~

~~21. The method of claim 18 or 20, wherein the information comprises a speed, a height, and an angle corresponding to a trajectory of the network node.~~

~~22. The method of any of claims 16 to 21, wherein adjusting the local timing is further based on a distance between the wireless device and the network node.~~

~~23. The method of any of claims 16 to 22, wherein the message is a Radio Resource Control (RRC) message or a system information block (SIB).~~

~~24. The method of any of claims 16 to 23, wherein the network node is a node in a non-terrestrial network (NTN).~~

~~25~~15. A wireless communications apparatus comprising a processor and a memory, wherein the processor is configured to read code from the memory and implement a method recited in any of claims 1 to ~~24~~14.

~~26. A computer program product comprising a computer-readable program medium code stored thereupon, the code, when executed by a processor, causing the processor to implement a method recited in any of claims 1 to 24.~~