timely warnings based on assistance data provided by the network. In Release 17, the focus was on global navigation satellite system (GNSS) integrity. For Release 18, other positioning techniques as well as relevant integrity aspects of mission critical use cases relying on positioning estimates and the corresponding uncertainty estimates are considered. Integrity enables applications to make the correct decisions based on the reported position, e.g., when monitoring a robotic arm to decide whether its arm movement are within allowed limits to ensure safety distances to humans and other objects. Thus, there is a need for reliable mechanisms to allow achieving positioning integrity and accuracy of positioning and location services.

SUMMARY

[0007] It is an object of the subject disclosure to provide a mechanism contributing to achieve positioning integrity and accuracy of positioning and location services. There are provided methods and apparatuses of controlling positioning and location services to improve integrity and accuracy.

[0008] According to a first aspect of the subject disclosure, an apparatus for controlling a positioning service is provided. The apparatus according to the first aspect comprises at least one processor and at least one memory including computer program code. The computer program code causes the apparatus or user device, when executed with the at least one processor, to at least: receive a first message related to a degradation of a first positioning technique related to the positioning service, and control the positioning service based on the first message.

[0009] In some examples of the first aspect, the first message may comprise at least one of an indication indicating that a positioning quality of service (QoS) requirement for the first positioning technique is not guaranteed or an indication indicating that a positioning integrity requirement for the positioning service is not guaranteed.

[0010] In some examples of the first aspect, the indication may indicate that the positioning QoS requirement is not guaranteed for at least one of a specified area or a specified time. The specified area may, in some examples, comprise one or more transmission and reception point (TRP) identifiers and/or road side unit (RSU) identifiers. The one or more TRP identifiers and/or RSU identifiers may be defined as a list.

[0011] In some examples of the first aspect, the positioning QoS requirement may comprise at least one of a latency, a time to alert (TTA), or an accuracy.

[0020] In some examples of the first aspect, the second message is sent using LTE Positioning Protocol (LPP) or Radio Resource Control (RRC).

[0021] In some examples of the first aspect, the computer program code may further cause the apparatus, when executed with the at least one processor, to: determine the congestion which may cause the degradation.

[0022] In some examples of the first aspect, to determine the congestion, the computer program code may further cause the apparatus, when executed with the at least one processor, to: determine at least one of a positioning quality of service (QoS) and a positioning integrity is not satisfied for a number of positioning requests.

[0023] In some examples of the first aspect, to determine at least one of a positioning quality of service (QoS) and a positioning integrity is not satisfied, the computer program code may further cause the apparatus, when executed with the at least one processor, to: determine whether the number of requests for the positioning service exceeds a threshold. In some further examples, the computer program code may further cause the apparatus, when executed with the at least one processor, to: receive a configuration including the threshold.

[0024] In some examples of the first aspect, to determine the congestion, the computer program code may further cause the apparatus, when executed with the at least one processor, to: determine the congestion on at least one of a side link, an uplink, and a downlink.

[0025] In some examples of the first aspect, the computer program code may further cause the apparatus, when executed with the at least one processor, to: receive a request for information about the congestion.

[0026] In some examples of the first aspect, the first message may be received via broadcast, multicast, or dedicated unicast signaling.

[0027] In some examples of the first aspect, the first message may be received using LTE Positioning Protocol (LPP) or Radio Resource Control (RRC).

[0028] In some examples of the first aspect, the first positioning technique may comprise a radio access technology (RAT) dependent positioning service.

[0029] According to a second aspect of the subject disclosure, a method for controlling a positioning service is provided. The method may be performed by a user device or an apparatus in a user device. The method according to the second aspect comprises: receiving, by a user device, a first message related to a degradation of a

first positioning technique related to the positioning service and controlling, by the user device, the positioning service based on the first message.

receiving module) and means for controlling the positioning service based on the first message (e.g., a controlling module).

[0051] In some examples of the third aspect, the user device or apparatus may further comprise means or modules for performing one or more of the examples according to the second aspect.

[0052] According to a fourth aspect of the subject disclosure, a user device (e.g., user equipment (UE)) or an apparatus in such a user device is provided. The user device or apparatus according to the fourth aspect comprises at least one processor and at least one memory including computer program code. The computer program code causes the apparatus or user device, when executed with the at least one processor, to receive a first message (e.g., assistance data) indicating a degradation of a positioning service e.g. from a network and control use of the positioning service based on the first message (e.g., the assistance data).

[0053] According to a fifth aspect of the subject disclosure, a method for controlling a positioning service is provided. The method may be performed by a user device or an apparatus in a user device. The method according to the fifth aspect comprises: receiving a first message (e.g., assistance data) indicating a degradation of a positioning service e.g. from a network, and controlling use of the positioning service based on the first message (e.g., the assistance data).

[0054] According to a sixth aspect of the subject disclosure, an apparatus for controlling a positioning service is provided. The apparatus comprises at least one processor and at least one memory including computer program code. The computer program code causes the apparatus or network node, when executed with the at least one processor, to at least: determine a degradation of a first positioning technique, and transmit, towards a user device, a first message related to the degradation, wherein the first message triggering the user device to control a positioning service related to the first positioning technique based on the first message.

[0055] In some examples of the sixth aspect, the first message may comprise at least one of an indication indicating that a positioning quality of service, QoS, requirement for the first positioning technique is not guaranteed or an indication indicating that a positioning integrity requirement for the positioning service is not guaranteed.

[0056] In some examples of the sixth aspect, the indication may indicate that the positioning QoS requirement is not guaranteed for at least one of a specified area or a

CLAIMS

1. An apparatus for controlling a positioning service, comprising:

at least one processor; and

at least one memory including computer program code, wherein the computer program code causes the apparatus, when executed with the at least one processor, to at least:

receive a first message related to a degradation of a first positioning technique related to the positioning service; and

control the positioning service based on the first message.

2. The apparatus of claim 1, wherein the first message comprises at least one of an indication indicating that a positioning quality of service, QoS, requirement for the first positioning technique is not guaranteed or an indication indicating that a positioning integrity requirement for the positioning service is not guaranteed.

3. The apparatus of claim 2, wherein the indication indicates that the positioning QoS requirement is not guaranteed for at least one of a specified area or a specified time.

4. The apparatus of any of claims 1 to 3, wherein, to control the positioning service, the computer program code causes the apparatus, when executed with the at least one processor, to at least:

- defer transmitting a positioning request transmission related to the first positioning technique, or

- reducing a number of the positioning request transmission for the positioning service.

5. The apparatus of any of claims 1 to 3, wherein, to control the positioning service, the computer program code causes the apparatus, when executed with the at least one processor, to at least:

- defer exchanging positioning related messages related to the first positioning technique; or

- reduce a number of the exchanging positioning related messages for the positioning service.

6. The apparatus of any of claims 1 to 3, wherein the first message includes recommendation information indicating at least one positioning technique that is not available.

7. The apparatus of any of claims 1 to 3, wherein the first message includes recommendation information indicating at least one positioning technique to be available.

8. The apparatus of any one of claims 1 to 3, wherein the first message indicates a second positioning technique.

9. The apparatus of any of claims 1 to 3, wherein the computer program code further causes the apparatus, when executed with the at least one processor, to at least:

- send a second message including congestion status information with respect to one or more network performance metrics related to congestion.

10. The apparatus of claim 9, wherein the one or more network performance metrics comprises at least one of delay, throughput, latency, packet loss rate, a number of user devices per cell, a number of occupied radio resources, measured interference over resources, or occurrence of pre-defined events.

11. The apparatus of claim 9, wherein the one or more network performance metrics associated with the positioning service comprises at least one of:

- a number of user devices requesting the positioning service within a time period and/or within an area, and
- an average latency of requests for the positioning service in the time period and/or the area.

12. A method for controlling a positioning service, comprising:

- receiving, by a user device, a first message related to a degradation of a first positioning technique related to the positioning service; and
- controlling, by the user device, the positioning service based on the first message.

13. An apparatus for controlling a positioning service, comprising:

at least one processor; and

at least one memory including computer program code, wherein the computer program code causes the apparatus, when executed with the at least one processor, to at least:

- determine a degradation of a first positioning technique; and

- transmit, towards a user device, a first message related to the degradation, wherein the first message triggering the user device to control a positioning service related to the first positioning technique based on the first message.

14. The apparatus of claim 13, wherein the first message comprises at least one of an indication indicating that a positioning quality of service, QoS, requirement for the first positioning technique is not guaranteed or an indication indicating that a positioning integrity requirement for the positioning service is not guaranteed.

15. The apparatus of claim 14, wherein the indication indicates that the positioning QoS requirement is not guaranteed for at least one of a specified area or a specified time.

16. The apparatus of any of claims 13 to 15, wherein the first message includes recommendation information indicating at least one positioning technique that is not available.

17. The apparatus of any of claims 13 to 15, wherein the first message includes recommendation information indicating at least one positioning technique to be available.

18. The apparatus of any one of claims 13 to 15, wherein the first message indicates a second positioning technique.

19. The apparatus of any of claims 13 to 15, wherein the computer program code further causes the apparatus, when executed with the at least one processor, to at least:

- receive a second message including congestion status information with respect to one or more network performance metrics related to congestion.

20. The apparatus of claim 19, wherein the one or more network performance metrics comprises at least one of delay, throughput, latency, packet loss rate, a number of user

devices per cell, a number of occupied radio resources, measured interference over resources, or occurrence of pre-defined events.

21. The apparatus of claim 19, wherein the one or more network performance metrics associated with the positioning service comprises at least one of:

- a number of user devices requesting the positioning service within a time period and/or within an area, and

- an average latency of requests for the positioning service in the time period and/or the area.

22. A method for controlling a positioning service, comprising:

- determining a degradation of a first positioning technique; and

- transmitting, towards a user device, a first message related to the degradation, wherein the first message triggering the user device to control the positioning service related to the first positioning technique based on the first message.

23. A computer program product comprising program instructions stored on a computer readable medium to execute the method of claims 12 and 22, when said program is executed on a computer.

24. A non-transitory computer-readable media containing the computer program product of claim 23.