

CLAIMS

1. A method of providing a location service at a radio access network (RAN) comprising a first RAN node in wireless communication, comprising: receiving a request from a user equipment (UE), indicating that the UE supports a ranging based location service session; receiving an internal identifier (ID) allocated by a core network for identifying information, associated with the UE, between the first RAN node and the core network during the ranging based location service session; allocating radio resources, associated with the internal ID, to the UE for transmitting a ranging signal in a ranging operation in the ranging based location service session involving a plurality of devices including the UE; and transmitting a response to the UE, indicating the radio resources allocated for performing the ranging operation.
2. The method of claim 1, further comprising: forwarding the request to a core network entity in the core network, the core network entity configured to select a location management function (LMF) in the core network that supports the ranging based location service session; and transmitting a message to the UE, indicating an external identifier (ID) determined by the core network entity for identifying a location result of the UE transmitted by the RAN.
3. The method of claim 2, further comprising: receiving, from the UE, a resource based ranging report generated by the ranging operation, the resource based ranging report comprising ranging results indexed by radio resources allocated to the plurality of devices; converting the resource based ranging report to an internal ID based ranging report, the internal ID based ranging report comprising the ranging results indexed by internal IDs associated with the plurality of devices; and transmitting the internal ID based ranging report to the LMF.
4. The method of claim 3, further comprising: receiving the location result from the LMF; and transmitting, to the UE, the location result identified by the external ID.
5. The method of claim 3, wherein the receiving the resource based ranging report comprises: receiving the resource based ranging report at a second RAN node; and forwarding the resource based ranging report to the first RAN node that originally received the request from the UE.
6. The method of claim 3, further comprising: receiving, at a second RAN node included in the RAN, the resource based ranging report; and receiving, at the second RAN node, internal ID to radio resources mapping information from the first RAN node for converting the resource based ranging report to the internal ID based ranging report.
7. The method of claim 2, further comprising: receiving, from the UE in an idle mode, a resource based ranging report generated by the ranging operation, the resource based ranging report encapsulated in a positioning protocol message comprising the external ID of the UE; and transmitting the positioning protocol message including the resource based ranging report to the LMF.

8. The method of claim 7, further comprising: receiving, from the LMF, a positioning protocol message comprising the location result; and transmitting the location result, identified by the external ID, to the UE.
9. The method of claim 1, further comprising: receiving an internal ID update from the core network in response to the UE transitioning from the first RAN node to a second RAN node of the RAN.
10. The method of claim 1, wherein the allocating radio resources comprises: allocating first radio resources to the UE for performing the ranging operation in a first area; and allocating, based on a location result determined using the first radio resources, second radio resources to the UE for performing the ranging operation in a second area that is smaller than the first area.
11. A method of operating a user equipment (UE) in a communication network, comprising: transmitting a request to a radio access network (RAN), indicating that the UE supports a ranging based location service session; receiving, from the RAN, an allocation of radio resources for transmitting a ranging signal in a ranging operation in the ranging based location service session; receiving an external identifier (ID) from the RAN, the external ID allocated by a core network for identifying a location result of the UE based on the ranging operation; and receiving the location result generated by the core network in the ranging based location service session, the location result being identified by the external ID associated with the UE.
12. The method of claim 11, further comprising: performing the ranging operation to generate a ranging report; and transmitting the ranging report to the RAN, the ranging report comprising at least one of time of arrival (TOA) data, a sequence ID, or a radio resource index associated with the ranging operation.
13. The method of claim 12, further comprising encapsulating the ranging report in a positioning protocol message destined for a location management function (LMF) in the core network, the LMF configured to determine the location result based on the ranging report.
14. The method of claim 12, wherein the transmitting the ranging report comprises transmitting the ranging report while the UE is in a radio resource control (RRC) idle mode with no active connection with the RAN.
15. The method of claim 12, further comprising encapsulating the ranging report and the external ID in a positioning protocol message.
16. The method of claim 11, wherein the receiving the location result comprises: receiving a dedicated message to the UE comprising the location result; or receiving a broadcast message comprising the location result.

17. The method of claim 11, further comprising: transmitting the request to a first RAN node of the RAN; and receiving the location result from a second RAN node of the RAN, different from the first RAN node.

18. The method of claim 17, further comprising: receiving an allocation of radio resources from the second RAN node for performing the ranging operation.

19. The method of claim 11, further comprising: transmitting the request to a first RAN node of the RAN; transitioning from the first RAN node to a second RAN node of the RAN; and transmitting a ranging report to the second RAN node.

20. A first radio access network (RAN) node of a radio access network, comprising: a communication interface configured for wireless communication; a memory; and a processor operatively coupled to the communication interface and the memory, wherein the processor and the memory are configured to: receive a request from a user equipment (UE), indicating that the UE supports a ranging based location service session; receive an internal identifier (ID) allocated by a core network for identifying information, associated with the UE, between the first RAN node and the core network during the ranging based location service session; allocate radio resources, associated with the internal ID, to the UE for transmitting a ranging signal in a ranging operation in the ranging based location service session involving a plurality of devices including the UE; and transmit a response to the UE, indicating the radio resources allocated for performing the ranging operation.

21. The first RAN node of claim 20, wherein the processor and the memory are further configured to: forward the request to a core network entity in the core network, the core network entity configured to select a location management function (LMF) in the core network that supports the ranging based location service session; and transmit a message to the UE, indicating an external identifier (ID) determined by the core network entity for identifying a location result of the UE transmitted by the RAN.

22. The first RAN node of claim 21, wherein the processor and the memory are further configured to: receive, from the UE, a resource based ranging report generated by the ranging operation, the resource based ranging report comprising ranging results indexed by radio resources allocated to the plurality of devices; convert the resource based ranging report to an internal ID based ranging report, the internal ID based ranging report comprising the ranging results indexed by internal IDs associated with the plurality of devices; and transmit the internal ID based ranging report to the LMF.

23. The first RAN node of claim 22, wherein the processor and the memory are further configured to: receive the location result from the LMF; and transmit, to the UE, the location result identified by the external ID.

24. The first RAN node of claim 22, wherein the processor and the memory are further

configured to: receive the resource based ranging report that is forwarded by a second RAN node of the radio access network.

25. The first RAN node of claim 24, wherein the processor and the memory are further configured to: transmit mapping information to the second RAN node that received the resource based ranging report, for mapping the resource based ranging report to an internal ID based ranging report.

26. The first RAN node of claim 21, wherein the processor and the memory are further configured to: receive, from the UE in an idle mode, a resource based ranging report generated by the ranging operation, the resource based ranging report encapsulated in a positioning protocol message comprising the external ID of the UE; and transmit the positioning protocol message including the resource based ranging report to the LMF.

27. The first RAN node of claim 26, wherein the processor and the memory are further configured to: receive, from the LMF, a positioning protocol message comprising the location result; and transmit the location result, identified by the external ID, to the UE.

28. The first RAN node of claim 20, wherein the processor and the memory are further configured to: receive an internal ID update from the core network in response to the UE transitioning from the first RAN node to a second RAN node of the RAN.

29. The first RAN node of claim 20, wherein the processor and the memory are further configured to: allocate first radio resources to the UE for performing the ranging operation in a first area; and allocate, based on a location result determined using the first radio resources, second radio resources to the UE for performing the ranging operation in a second area that is smaller than the first area.

30. A user equipment (UE) in a communication network, comprising: a communication interface configured for wireless communication; a memory; and a processor operatively coupled to the communication interface and the memory, wherein the processor and the memory are configured to: transmit a request to a radio access network (RAN), indicating that the UE supports a ranging based location service session; receive, from the RAN, an allocation of radio resources for transmitting a ranging signal in a ranging operation in the ranging based location service session; receive an external identifier (ID) from the RAN, the external ID allocated by a core network for identifying a location result of the UE based on the ranging operation; and receive the location result generated by the core network in the ranging based location service session, the location result being identified by the external ID associated with the UE.

31. The UE of claim 30, wherein the processor and the memory are further configured to: perform the ranging operation to generate a ranging report; and transmit the ranging report to the RAN, the ranging report comprising at least one of time of arrival (TOA) data, a sequence ID, or a radio resource index associated with the ranging operation.

32. The UE of claim 31, wherein the processor and the memory are further configured to: encapsulate the ranging report in a positioning protocol message destined for a location management function (LMF) in the core network, the LMF configured to determine the location result based on the ranging report.

33. The UE of claim 31, wherein the processor and the memory are further configured to: transmit the ranging report while the UE is in a radio resource control (RRC) idle mode with no active connection with the RAN.

34. The UE of claim 31, wherein the processor and the memory are further configured to: encapsulate the ranging report and the external ID in a positioning protocol message.

35. The UE of claim 30, wherein the processor and the memory are further configured to: receive a dedicated message to the UE comprising the location result; or receive a broadcast message comprising the location result.

36. The UE of claim 30, wherein the processor and the memory are further configured to: transmit the request to a first RAN node of the RAN; and receive the location result from a second RAN node of the RAN, different from the first RAN node.

37. The UE of claim 36, wherein the processor and the memory are further configured to: receive an allocation of radio resources from the second RAN node for performing the ranging operation.

38. The UE of claim 30, wherein the processor and the memory are further configured to: transmit the request to a first RAN node of the RAN; transition from the first RAN node to a second RAN node of the RAN; and transmit a ranging report to the second RAN node.