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CEWiT INDIA

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Views on study of sidelink based positioning in Rel. 18

CEWiT, India

Contents

- Motivation
- Sidelink Positioning definition
- Possible Architecture Modifications
- Objectives of study

Motivation

- Indoor and deep indoor UE positioning has various commercial and public safety requirements
- Positioning information is indispensable to V2X use cases
  - Required accuracy varies from 10 m to 0.2 m both horizontal and vertical
  - Required latency requirement 1s to 10ms
  - Positioning service availability, TTFF and integrity are other important parameters for mission critical applications are stringent
- GNSS or its differential complement Real-time Kinematic (RTK), is the most basic positioning method in V2X but,
  - Same GNSS accuracy may not be available everywhere e.g., tunnels, dense urban areas, basements, metro stations etc.
- Sensor based positioning in V2X has higher cost and vulnerability to the surrounding environment which limits its application.
- Cellular network based high- accuracy positioning techniques are supported over Uu link in 5G

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Contd …

- RAT dependent methods mostly based on triangulation requires more than three gNBs/TRPs for positioning.
  - This may not be possible for some scenarios like partial coverage and out of coverage
    - Even in some in-coverage deep indoor scenarios e.g., tunnels, basements, mining areas etc.
  - NLOS condition in Uu link compromises the positioning accuracy even in case of sufficient gNB/TRP links with target UE
- In such scenarios, sidelink positioning is another technique to improve UE positioning with limited number of gNBs/TRPs
  - Improvement will be with respect to accuracy, latency, positioning service availability and integrity.

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Sidelink Positioning

- In sidelink positioning, UEs and/or roadside units (RSUs) will help each other for positioning, which can improve both coverage and accuracy.
- Positioning reference signal transmission and measurement are performed on sidelink over PC5 link.
- UE should be able to send and receive the positioning reference signal (PRS) over sidelink (PC5 link)
- It will include three main operations:
  1. The sidelink positioning configuration,
  2. The Sidelink PRS transmission and measurement
  3. The position calculation
- The UE-based and UE-assisted positioning architecture in Uu link can be adopted for sidelink positioning with minimum modifications

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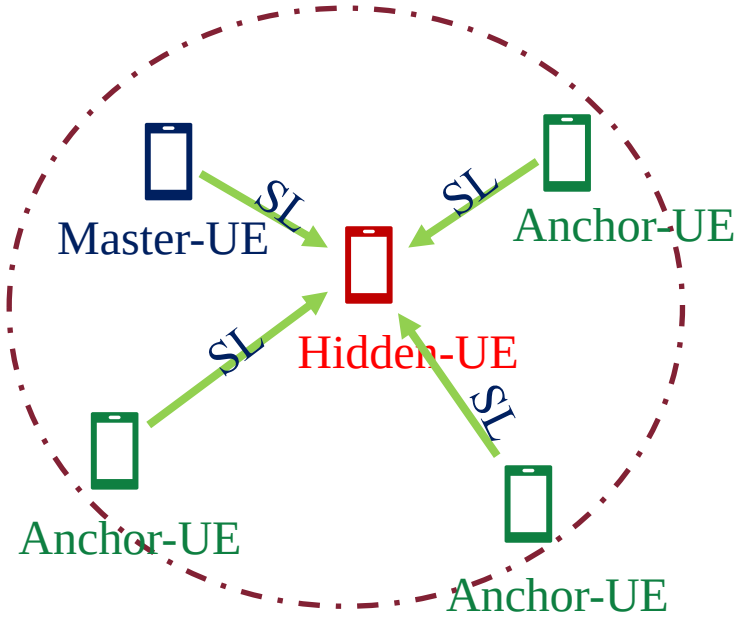
Possible Architecture Modifications

- UE-configured and UE-based sidelink positioning [3]
  - Positioning operations will happen within target/hidden UE and anchor UEs
  - Uu link or network-based location server is not involved in positioning
  - Useful for out of coverage scenarios

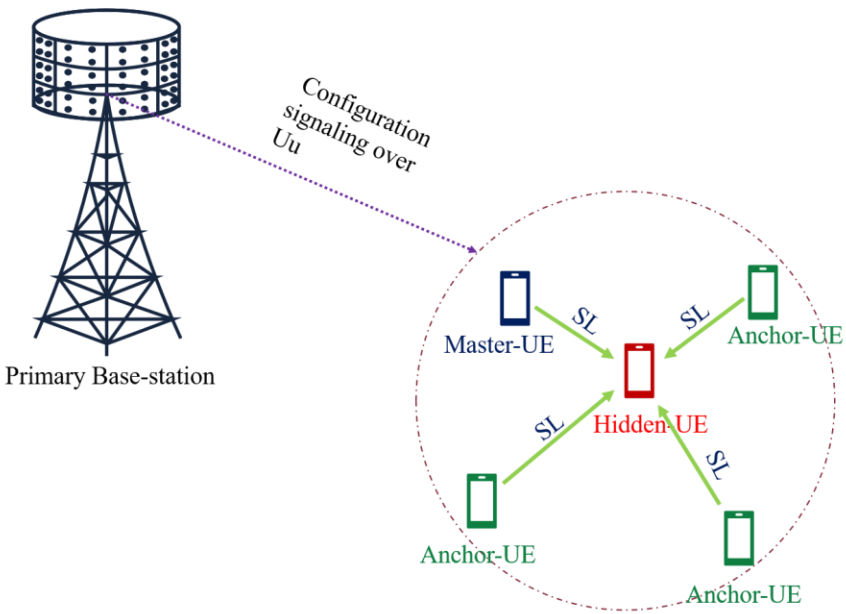
Figure 1: Shows UE-configured and UE-based sidelink positioning architecture. Anchor UE will participate in positioning of the Hidden UE. Hidden node or master node will calculate the final position. No Uu link assistance will be used. Here UE can be handheld device, vehicle or RSU.



Possible Architecture Contd…

- Network-configured and UE-based sidelink positioning [3]
  - Sidelink positioning operations are controlled by the network or the location server
  - But Positioning operations will happen among target/hidden UE and anchor UEs
  - Useful for in coverage but poor channel condition or partial coverage scenarios

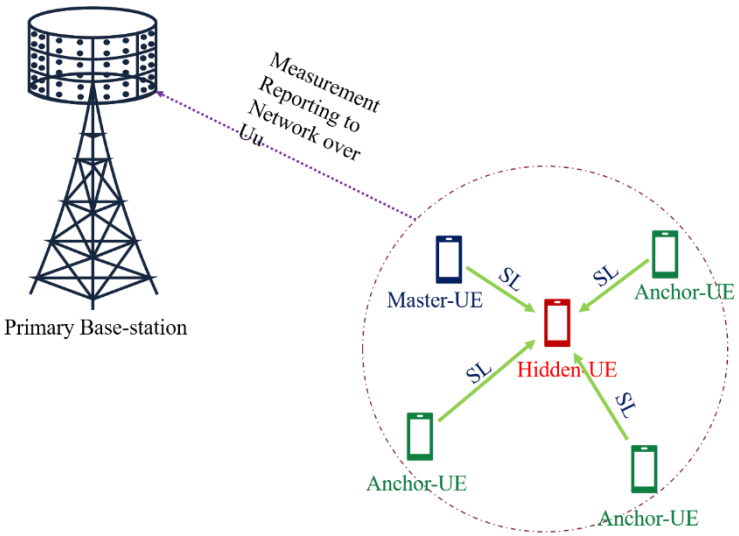
Figure 2: Shows Network-configured and UE-based sidelink positioning architecture. gNB will configure the necessary signaling. Anchor UE will participate in positioning of the Hidden UE. Hidden node or master node will calculate the final position.



Possible Architecture Contd…

- UE-configured and UE-assisted sidelink positioning [3]
  - The sidelink positioning configuration, the PRS transmission/reception through sidelink and the measurement are done by the UEs of the sidelink positioning group
  - The final position calculation is done by the network or the location server, rather than the UEs of the sidelink positioning group
  - Measurements are reported to network or location server
  - Reduce the positioning calculation burden from UEs so as to save computational power

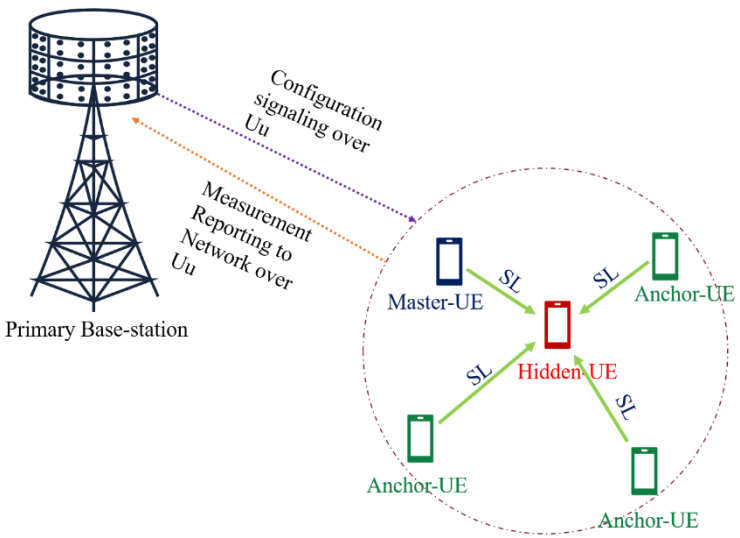
Figure 3: Shows UE-configured and UE-assisted sidelink positioning architecture. Anchor UE will participate in positioning of the Hidden UE. UEs will report measurements to gNB over Uu link.



Possible Architecture Contd…

- Network-configured and UE-assisted sidelink positioning [3]
  - The configuration is controlled by the network or the location server
  - UE will measure the PRS for configured positioning method and provide the measurements to the network for final positioning calculation
  - This will be more like UE assisted positioning on Uu link but sidelink will be configured in this case.
  - Useful for in coverage UEs but NLOS channel conditions or limited gNBs' coverage

Figure 4: Shows Network-configured and UE-assisted sidelink positioning Signaling. gNB will configure the necessary signaling. Anchor UE will participate in positioning the Hidden UE. UEs will report measurements to gNB over Uu link



Objectives

- Study enhancements and solutions necessary to support sidelink positioning
  - Define the scenarios applicable and corresponding requirements
  - Possible architecture for sidelink positioning
  - Anchor UE selection and co-ordination procedure
  - Evaluate the positioning accuracy using sidelink in in-coverage, partial coverage and out of coverage scenarios
  - Identify the positioning techniques used for the side link-based positioning (Uu link positioning methods will be baseline), sidelink positioning reference signals, signaling and procedures required to be enhanced
- Based on study output, define specification enhancement scope including
  - Positioning architecture changes
  - Anchor UE selection procedure
  - Signaling changes wrt PRS, assistance information, measurement and reporting enhancements etc.

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References

[1] 3GPP TS 22.261 : "Service requirements for the 5G system"

[2] 3GPP TS 22.186 v16.2.0: "Enhancement of 3GPP support for V2X scenarios"

[3] 3GPP RP-210040 : "Reply LS to RP-201390 on requirements of in-coverage, partial coverage, and out-of-coverage positioning use cases," (source: 5GAA)

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THANK YOU

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