

NR Release 17 WID Positioning Enhancements: Motivation to study integrity in the position domain

Sitges, December 2019

Integrity as it relates to navigation is the measure of the trust can be placed in the correctness of the information supplied by a positioning system. Note, this is not applicable only to GNSS although this is the most known example due to its adoption in civil aviation.

TR 22.872 HYPOS defines position integrity as a ‘measure of the trust in the accuracy of the position-related data provided by the positioning system and the ability to provide timely and valid warnings to the UE and/or the user when the positioning system does not fulfil the condition for intended operation.’

Motivation



NR Rel-16 adds support for higher accuracy both for RAT-dependent (better than 10 metre) and RAT-independent techniques (below 1 metre - e.g., GNSS SSR Assistance Data). Emerging autonomous applications will require both accuracy and integrity features such as protection levels, alert limits, false alarms events, etc. in order to guarantee safe operation.

SA1 WG has identified the need to for integrity in Release 15 already (TR 22.872 HYPOS): 'The 5G system shall be able to determine the reliability, and the uncertainty or confidence level, of the position-related data.'

It is crucial for applications requiring absolute and relative positioning accuracy to support the intended function (both individually and for hybrid positioning modes). Key use cases TR 22.872 include: Emergency & Mission Critical, Road, V2X, eHealth, LBS, Rail & Maritime, Aerial (e.g. UAVs). Further examples are given in RP-191919. As a matter of fact, all use cases for outdoor scenarios benefit from enhanced Integrity.

Potential use cases (1/2)

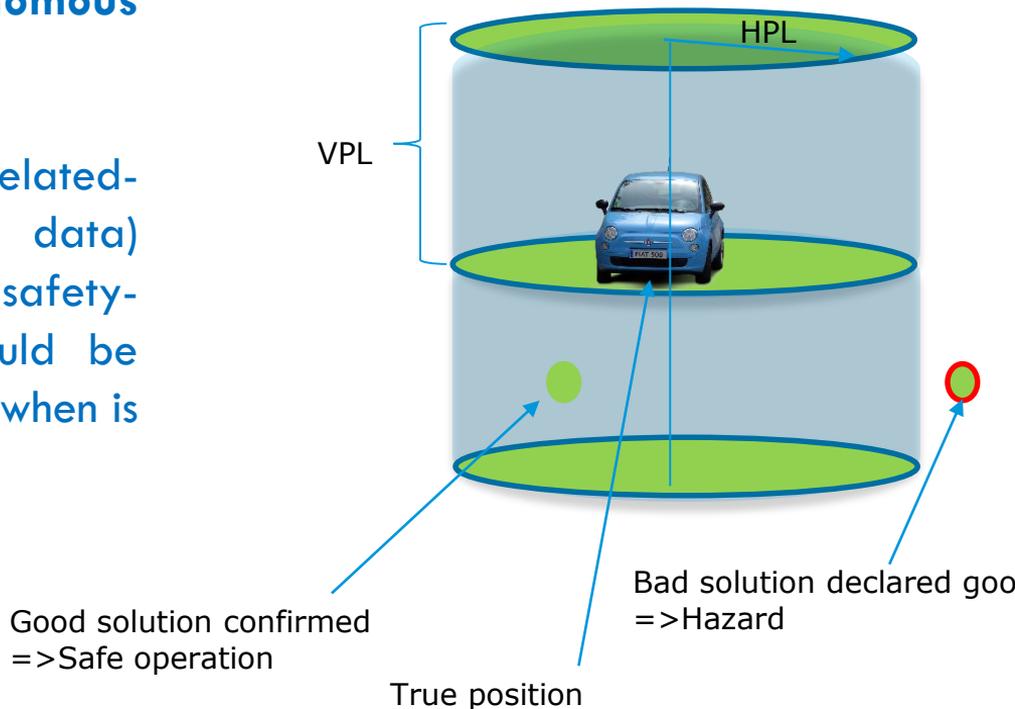


HPL – Horizontal Protection Level

VPL – Vertical Protection Level

Safe Operation of connected and autonomous vehicles

The absence of integrity in the position related-information (i.e., location and assistance data) represents an impairment in use cases with safety-related aspects (e.g., V2X): hazards could be missed or false alarms could be announced when is not the case.



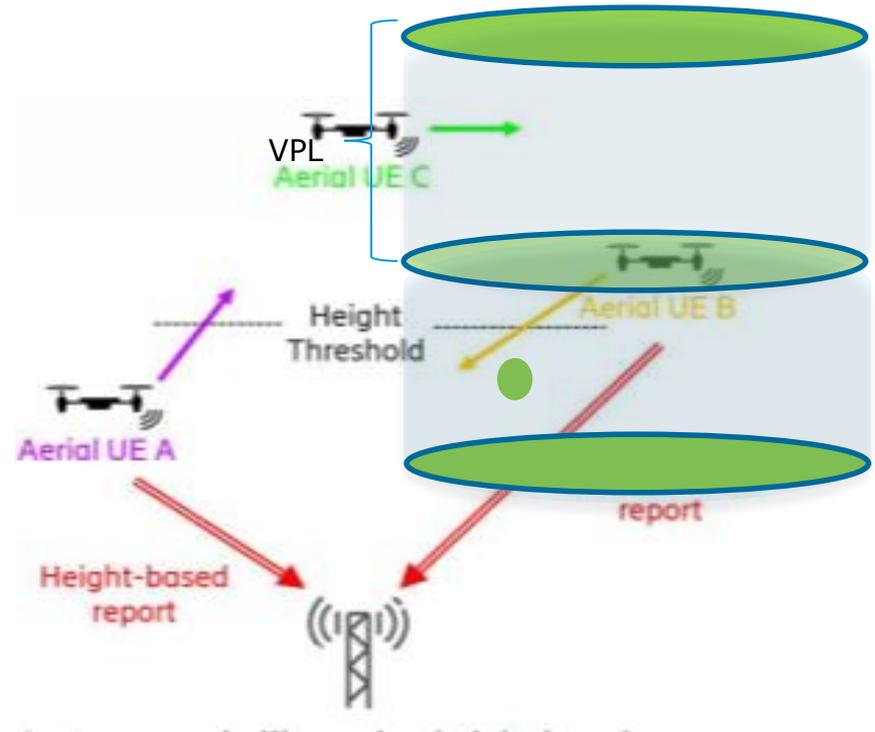
Potential use case (2/2)

HPL – Horizontal Protection Level
VPL – Vertical Protection Level

Reliable height information as a mean to reduce interference created by aerial UEs

When an aerial UE equipped with communication payload is flying above a certain height, both the uplink and downlink interference increase. By configuring an aerial UE with appropriate height threshold, the network can detect interference early when an aerial UE crosses the configured height threshold and sends a height-based report. A height-based measurement report may include the height, the location, and the horizontal/vertical speeds of the aerial UE.

False reporting can happen (triggered by errors in the height determination)! A concept similar to the idea of protection levels can be used in order to reduce the false reporting.



Conclusions



In the email discussion summarized in RP-192412 a significant number of companies have proposed and motivated the inclusion of integrity topic in the list of priorities of Release 17 WID on NR positioning. However, the list of objectives of the proposed WID is not including integrity concept.

Therefore, it is proposed to add integrity to the list of items to be studied/specified during NR Release 17:

Study and, if appropriate, specify positioning enhancements focused on the concept of integrity in the position domain (i.e., location and assistance data).

- a. Define positioning integrity KPIs (e.g., alert limit, false alarms, etc.) and extensions to NR positioning protocols to enhance integrity, authenticity, and reliability of assistance data and position information.
- b. Study real-time integrity support to assess the position estimate accuracy.
- c. Study support of sidelink based / assisted positioning techniques for reduced V2P false alarms caused by inaccurate positioning.



Thank you!