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RWS-210014

3GPP TSG RAN Rel-18 workshop
Electronic Meeting, June 28 - July 2, 2021
Agenda Item: 4.2

On Aerial Support in NR

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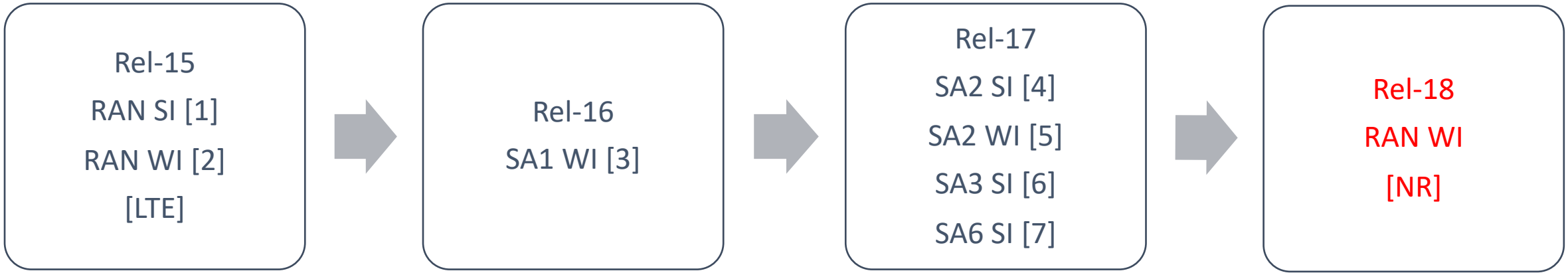
5G

Drones in 3GPP



[1] RP-171050, SID on Enhanced Support for Aerial Vehicles
[2] RP-172826, WID on Enhanced LTE Support for Aerial Vehicles
[3] SP-180771, New WID on Remote Identification of Unmanned Aerial Systems
[4] SP-181114, Study on supporting Unmanned Aerial Systems Connectivity, Identification, and Tracking
[5] SP-200979, New WID on Support of Aerial Systems Connectivity, Identification, and Tracking
[6] SP-200352, Study on security aspects of Unmanned Aerial Systems
[7] SP-181252, New SID Study on application layer support for UAS service

Background: 3GPP Rel-15

- **Rel-15 RAN SI concluded that LTE network is capable of serving Aerial UEs, but there may be challenges related to uplink & downlink interference as well as mobility (see TR 36.777).**

- As a result, the following RAN features were introduced in Rel-15:
  - Interference mitigation with a dedicated UE-specific *alpha* for PUSCH power control and extended *P0* range.
  - Measurement reporting and mobility enhancement
    - UE-triggered height reporting when UE's altitude crosses a network-configured reference threshold.
    - New events H1/H2
      - Threshold can be -420m .. 8880m with 2m granularity
    - As Aerial UEs can see more cells in line of sight, enhancement to reduce measurement reporting overhead
      - Measurement reporting is triggered only when a configured number of cells (>=1) fulfills the triggering criteria simultaneously.
    - Location information reporting including UE's horizontal and vertical velocity.
    - Signaling of flight path information from UE to E-UTRAN.
  - Subscription-based Aerial UE identification and authorization as specified in 23.401 Section 4.3.

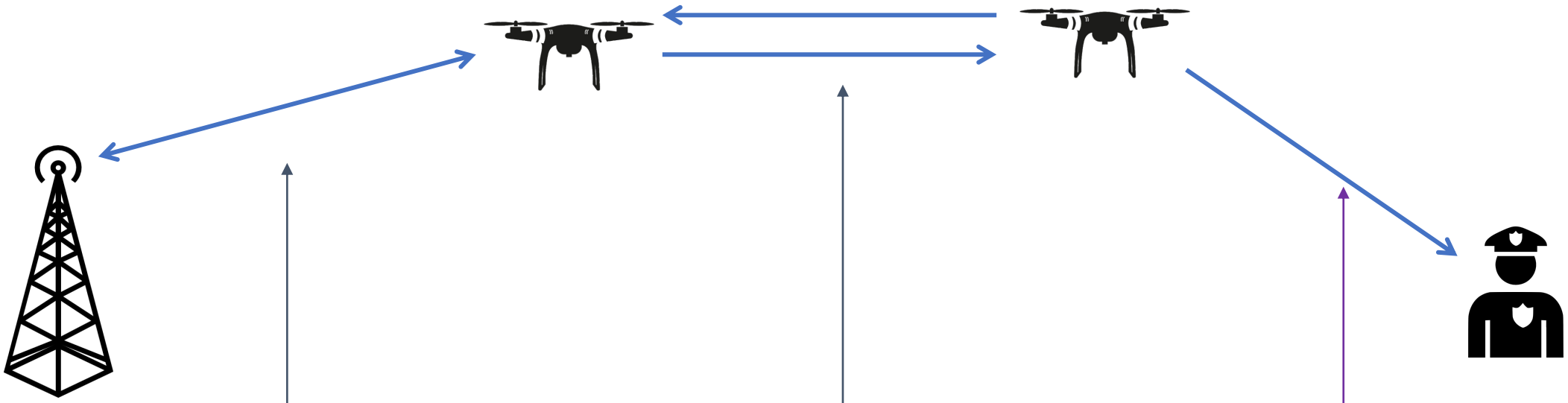
Background

- **SA1 WI** identified use cases and requirements as captured in TS 22.125, SA3 studied security aspects, and SA6 studied application layer support for UAS services.

- **More recently SA2 sent a LS to RAN (RP-202158/S2-2009228) indicating that:**
  - **SA2 has worked on** system enablers for supporting UAS Connectivity, Identification, and Tracking, **assuming the existence of the Rel-15 LTE Aerial features in the work**
  - SA2 has discussed the need for supporting aerial features for NR in order to enable large scale deployment over NR, acknowledging that the decision to carry out such work belongs to TSG RAN.

- **On the regulatory side:**
  - **ECC PT1 sent an LS to RAN4 (R4-1907924) regarding spectrum regulatory framework for the operation of UAS in mobile bands.**
    - RAN4 replied (R4-1910311) indicating a more comprehensive evaluation may be needed
  - FCC released a report on **dedicated spectrum for UAS operations**
    - 5030-5091 MHz, “Uu-like” spectrum
    - Potential additional spectrum in L-band, “PC5”-like
  - FAA deprioritized network remote ID ➔ Need broadcast remote ID – based on PC5
  - ‘Most personal devices’ should support receiving the remote ID.

Necessary features for Aerial support



Uu enhancements (UAV-Network)

- Port LTE Rel-15 aspects
- Radio optimizations
  - Beamforming / power control
- Spectrum aspects:
  - Dedicated band for UAV operation
  - Aerial-specific emission requirements (e.g., ECC PT1)

Use case: various applications (video, remote C2 etc.)

PC5 Enhancements (UAV-UAV)

- Use PC5 broadcast for collision control

Use case: U2X-DAA (detect and avoid)

PC5 Enhancements (UAV-Authority)

- Use PC5 to broadcast
  - UAV ID
  - Flight info

Use case: U2X-ID (remote identification)

- Assumes law enforcement has a dedicated device that can receive PC5 broadcast

Proposal

- Goal: start a project with the aim of making cellular technology the UAV platform of choice, by identifying the necessary features & specifying them in Rel-18 (and subsequent releases)
  - Ensure 3GPP/cellular is competitive viz-a-viz Bluetooth, WiFi, and other proprietary solutions
  - Take existing features as baseline
    - Rel-15 Aerial features defined for LTE
    - V2X upper layers solutions

- A view on detailed Rel-18 WI objectives is described in next slide.

Rel-18 WI objectives

- Uu enhancements: Take LTE Aerial features as baseline; additional enhancements not precluded.
  - Aerial UE-specific reporting [RAN2]
    - E.g., height, location, flight path reporting etc.
  - RRM enhancements [RAN2]
    - E.g., to control the amount of measurement reports
  - Subscription-based identification [RAN2/RAN3/SA2]
    - Specify NG/Xn signalling
  - Support of enhanced beamforming / beam management for FR1 [RAN1]
    - E.g., gNB uptilt beamforming, aerial UE spatial beamforming etc.
  - Mobility enhancements [RAN2]
    - E.g., CHO based on location info, airborne status, height, flight path plan etc.
  - 5GC support [RAN2]
    - Align LTE specifications to enable UAV support by ng-eNB.

- Spectrum aspects [RAN4/RAN2/RAN1]
  - Aerial-specific emission requirements, taking regulations into account.
  - Support of dedicated band for UAS operations.

- PC5 enhancements: Using existing V2X solutions as baseline, introduce enhancements (if necessary) for support of the following aerial features: [RAN2/RAN1/RAN3]
  - PC5-based ID broadcast and remote identification, PC5-based Detect-And-Avoid

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