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RWS-210296

Rel-18 standardisation from automotive viewpoints

3GPP TSG-RAN Rel-18 workshop

Electronic Meeting, June 28 – July 2, 2021

Agenda Item: 4.3 (Cross-Functionalities for both eMBB and non-eMBB Evolution)

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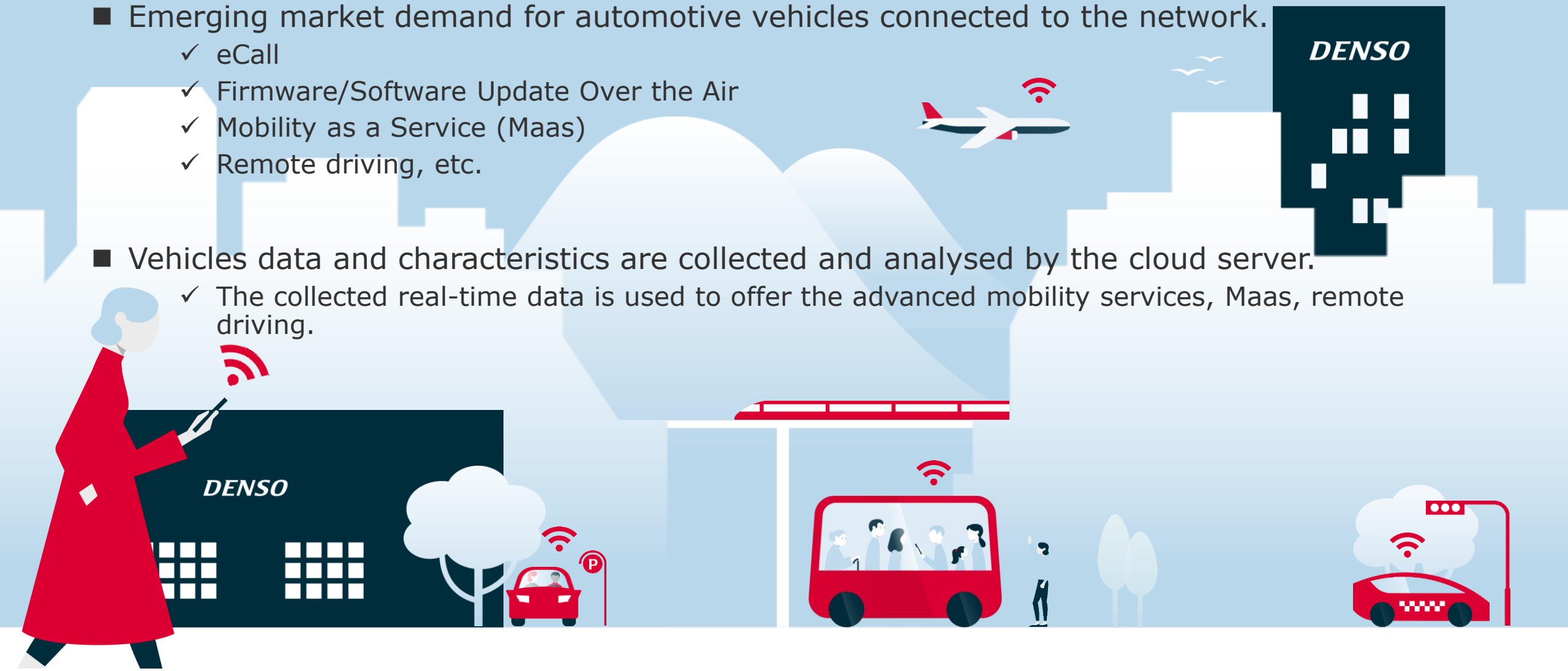
Outline

1. Automotive use cases
2. Issues for automotive use cases
3. Potential technologies

Automotive use cases

- Emerging market demand for automotive vehicles connected to the network.
  - ✓ eCall
  - ✓ Firmware/Software Update Over the Air
  - ✓ Mobility as a Service (Maas)
  - ✓ Remote driving, etc.

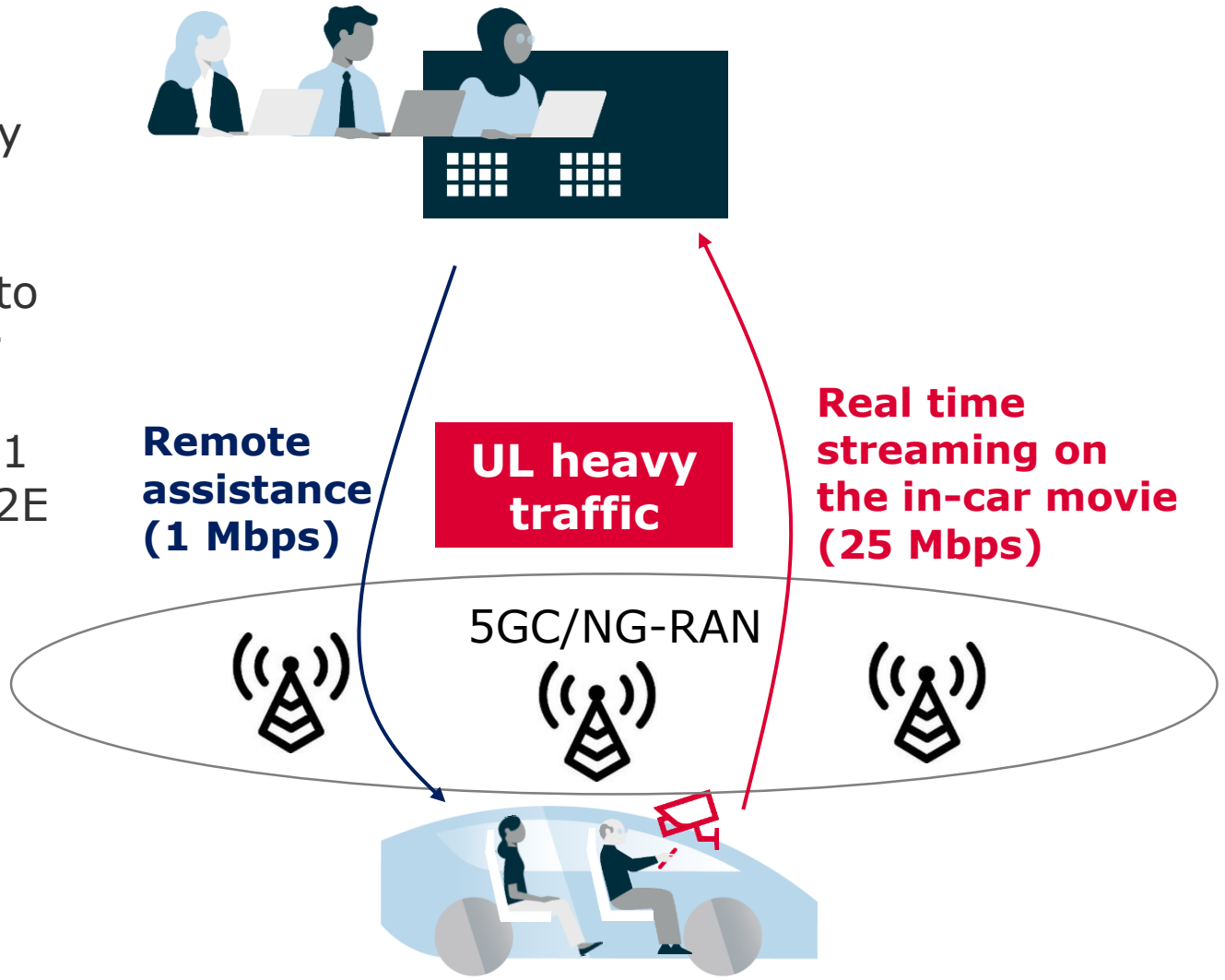
- Vehicles data and characteristics are collected and analysed by the cloud server.
  - ✓ The collected real-time data is used to offer the advanced mobility services, Maas, remote driving.



Issues for automotive use cases (1/3)

Sustainable QoS and Connectivity

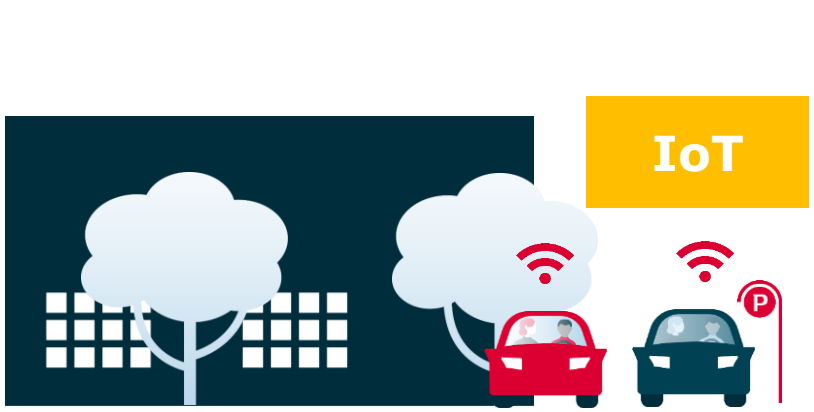
- For the services on driver/passenger safety, required QoS (data loss, delay) and reliability is different from smart phones.
- A major hurdle of the existing 4G/5G NW is to guarantee sustainable QoS and reliability for vehicles throughout their operations.
  - ✓ E.g. for remote driving, UL 25 Mbps, DL 1 Mbps, 99.999% reliability and 5 ms of E2E up to 250 km/h (as in TS 22.186)
- Mobility characteristics (e.g. moving speed) are different from pedestrian users.

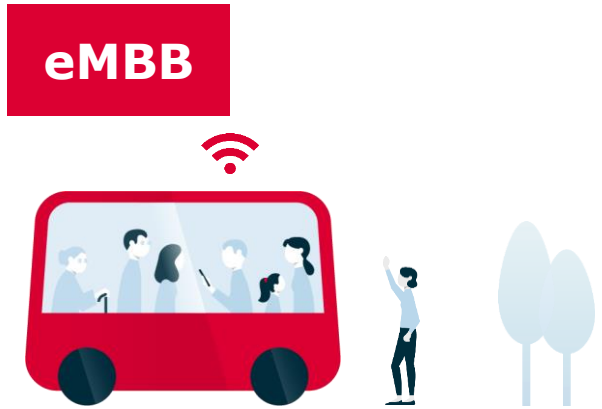


Issues for automotive use cases (2/3)

Use case variation

- eMBB/URLCC are required when a vehicle is powered on.
- A vehicle behaves like IoT devices, requiring battery saving and reduced capabilities when the engine is powered off in the car park.
- A vehicle UE requires eMBB/URLLC and IoT functionalities, hinging on the vehicle status.

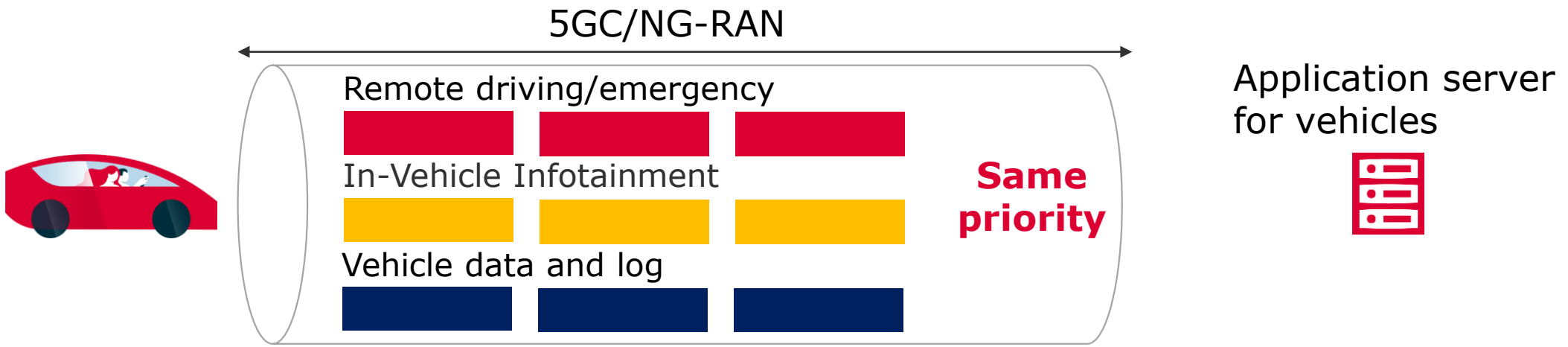




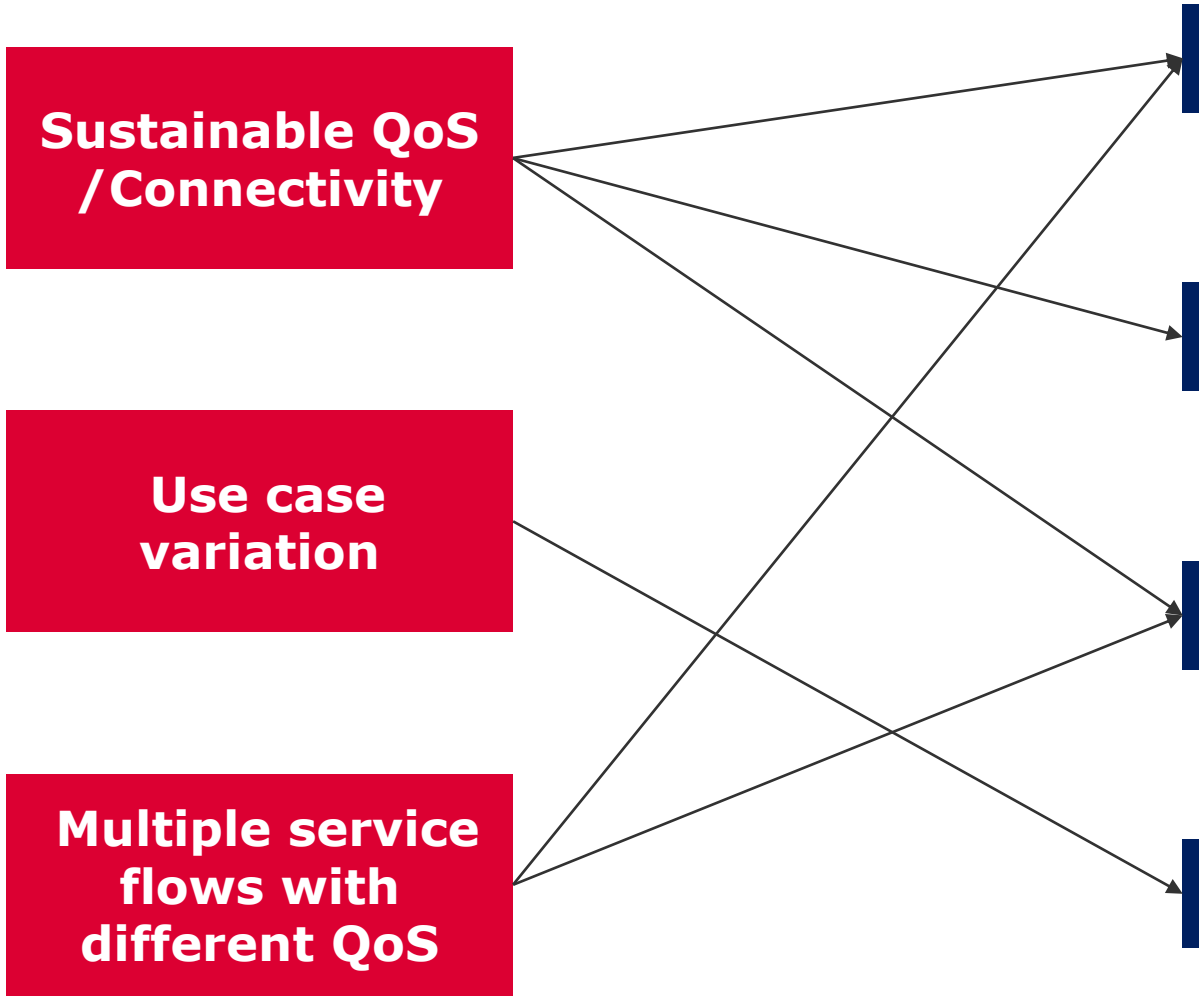
Issues for automotive use cases (3/3)

Multiple service flow with different QoS

- A vehicle might originate multiple application flows simultaneously which require different QoS handling.
  - ✓ Higher QoS for remote driving and emergency services
  - ✓ Moderate QoS for In-Vehicle Infotainment (IVI),
  - ✓ Delay tolerant for uploading vehicle data and log to the cloud server
- Since QoS flow/radio bearers are controlled by operators, UL data might not be delivered properly, as the vehicle wishes to deliver.
  - ➢ Today, one (default) bearer is established to deliver all flows in most of the existing 4G networks (except for emergency call).
- When vehicles are exported across the regions (e.g. used cars), uniformed QoS handling cannot be guaranteed, due to different NW configuration amongst operators.



Potential technologies to address automotive scenarios



Multi-SIM enhancements

- To focus on dual Rx/Tx scenarios for enhancing reliability, latency, etc.

Uplink enhancements

- To enhance UL capacity, reliability
- Possibly tailored for video streaming

AI-based optimisation

- To leverage vehicle specific mobility, QoS characteristics, via AI/ML based analysis

RedCap enhancements

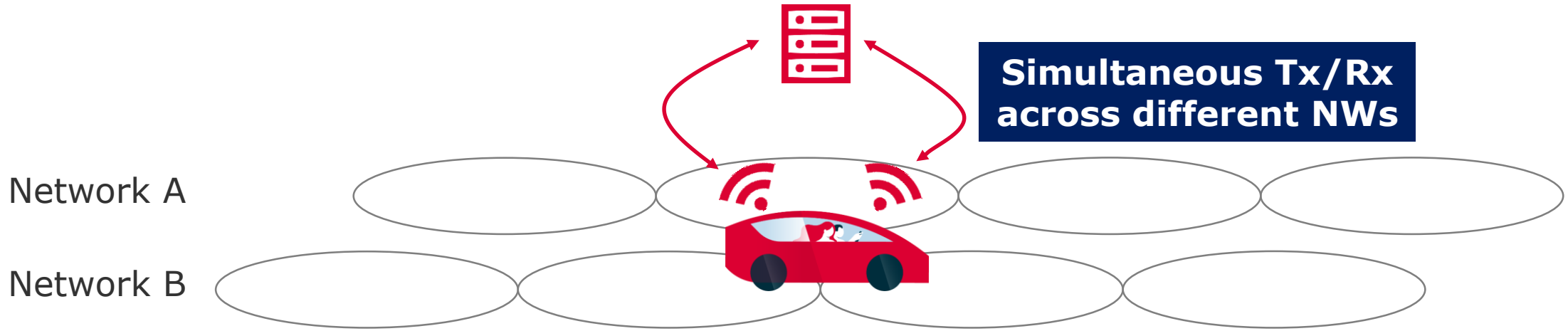
- To study the scenarios and enhancements where UE needs to support multiple use cases

Multi-SIM enhancements

- Multi-SIM UE with dual Rx/Tx can improve reliability by transmitting and receiving data across two networks simultaneously.
  - ✓ A coverage hole in one network can be compensated by the other network

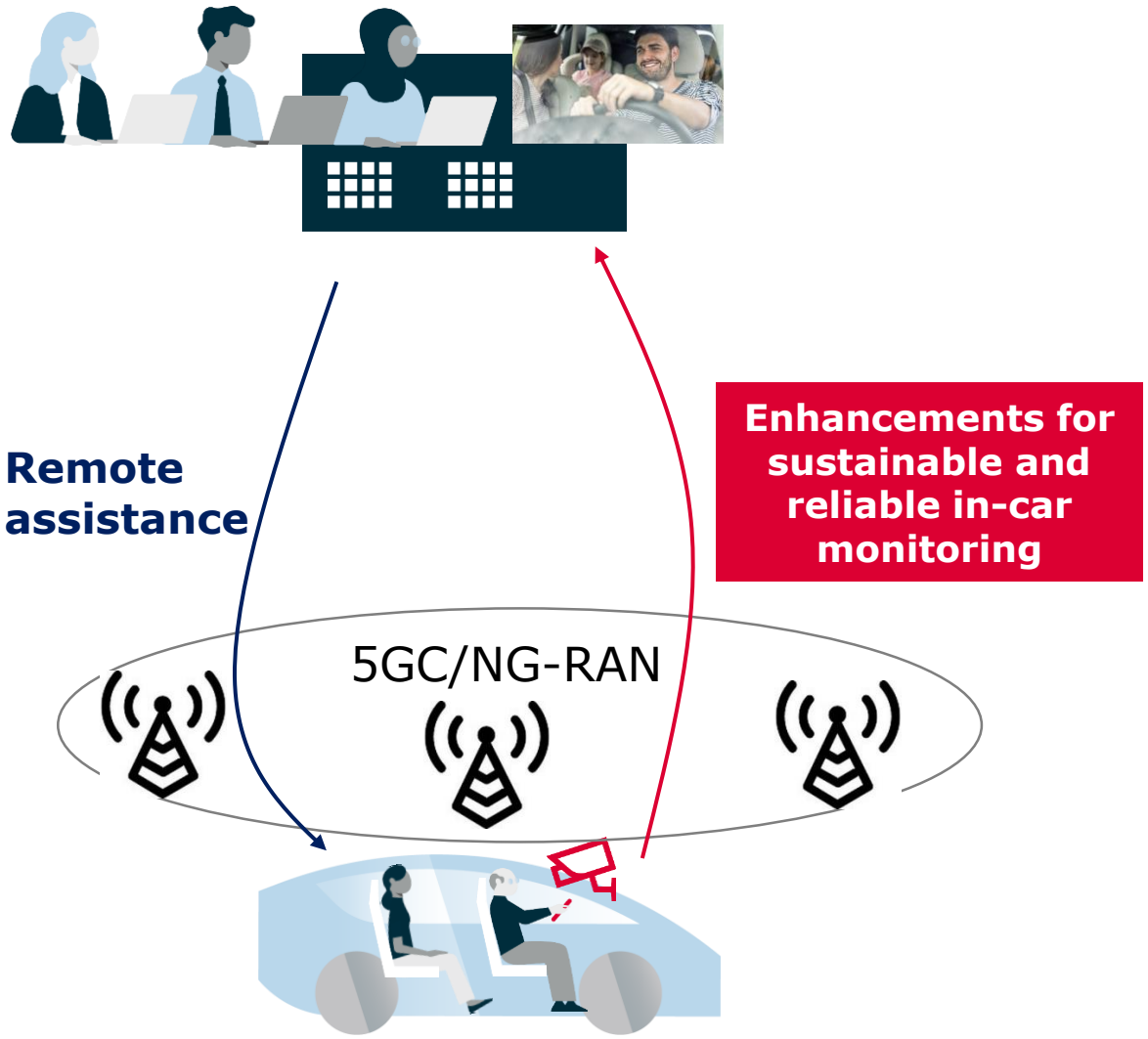
- A UE could send different application data in two networks, so that queuing latency can be reduced.
  - ✓ E.g. the high priority data is delivered from Network A, whilst the low priority data is delivered from Network B.

- Potential areas for enhancements are:
  - ✓ Power sharing in case the frequency bands in Network A and B belong to the same FR.
  - ✓ UE capability coordination across the two networks (e.g. number of antennas, carriers, etc.)



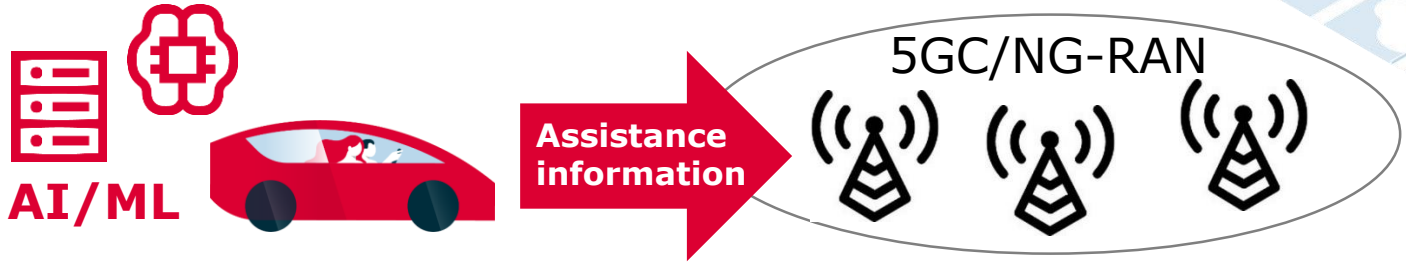
Uplink enhancements

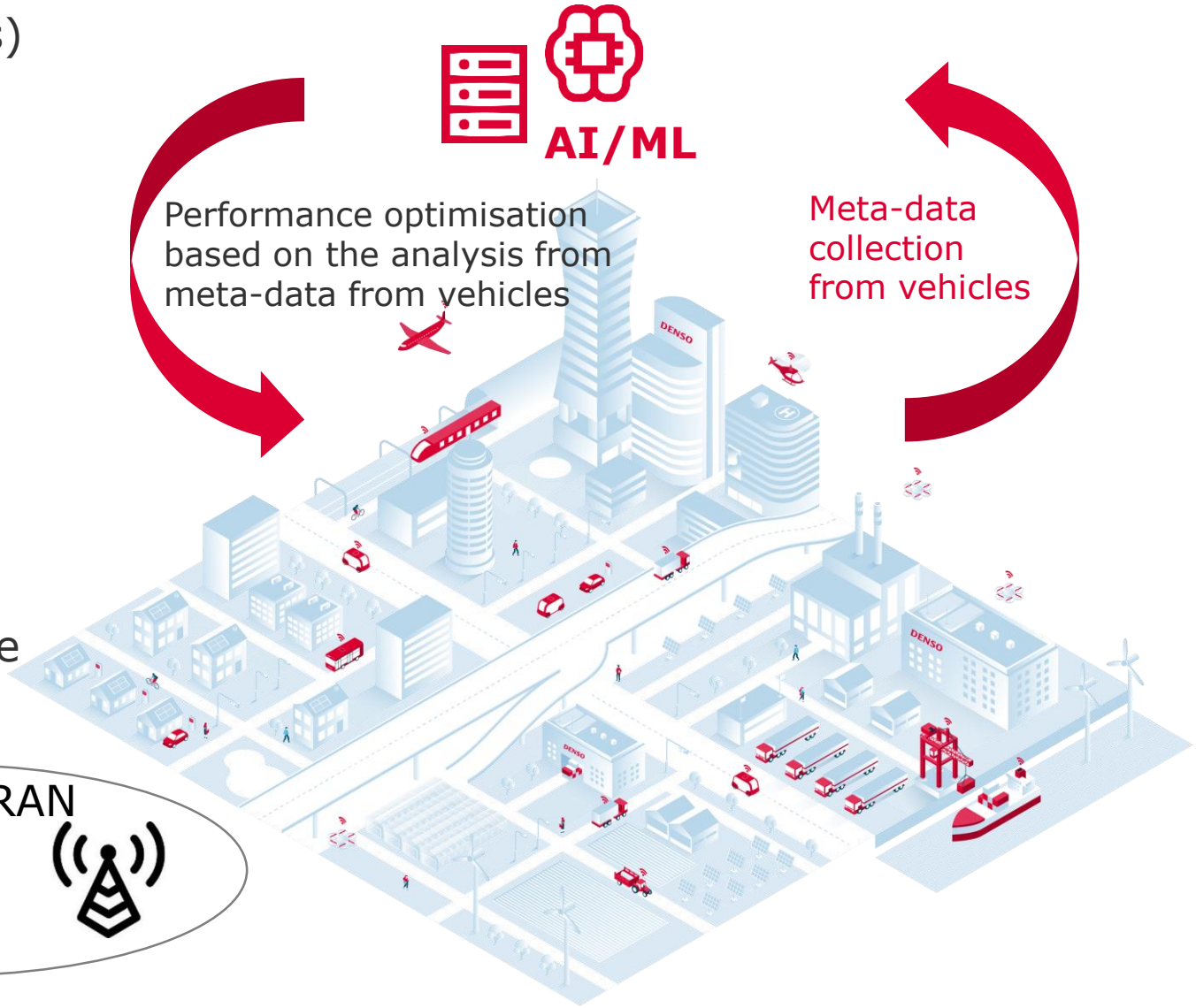
- In Rel-16, the solution was introduced that a V2X application can receive notification on QoS sustainability analytics (as in TS 23.287).
  - ✓ Upon notifying potential QoS change, the V2X application could perform adjustment, which is outside the 3GPP scope.
- Nevertheless, from the viewpoint of radio technologies, a solution to maintain QoS sustainability as much as possible.
- For remote driving, UL enhancements in Uu could be studied for tailoring to the video streaming.
  - ✓ Potentially, the outcome of XR study could be leveraged for the remote driving purpose.
- Any other technologies aimed for enhancing UL capacity, reliability could be studied.



AI-based optimisation

- AI/ML (owned by automotive manufacturers) have knowledge on mobility characteristics, radio condition and QoS statistics by analysing the meta-data from all vehicles.
- When a vehicle decides a route for driving (via the navigation system), AI/ML could predict the radio condition and mobility performance throughout the route path.
- It is worthwhile studying how the AI/ML based analysis can be leveraged for optimising the performance while the vehicle is connected to the NG-RAN/5GC.



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