VCOM-Stage 1
## Experimental validation of vehicular communication protocols

GOALS

- Allbesmart LDA offers outsource engineering services to design and develop customized software implementations of 3GPP Radio Access Networks protocols.

- The main objective of this experiment is to test and validate a scheduling protocol for C-V2X mode 4.

OPORTUNITIES AND CHALLENGES

- In mode 4, vehicles autonomously select the radio resources for their direct V2V communications.

- The performance of C-V2X mode 4 is highly dependent on the right configuration of the distributed scheduling protocol that is used by vehicles to reserve resources for their transmissions.

DEMO SETUP

- The Sensing based Semi-Persistent Scheduling protocol (SPS) was tested using the IRIS wireless testbed. Vehicles are emulated by USRPs running the open source srsV2V implementation.
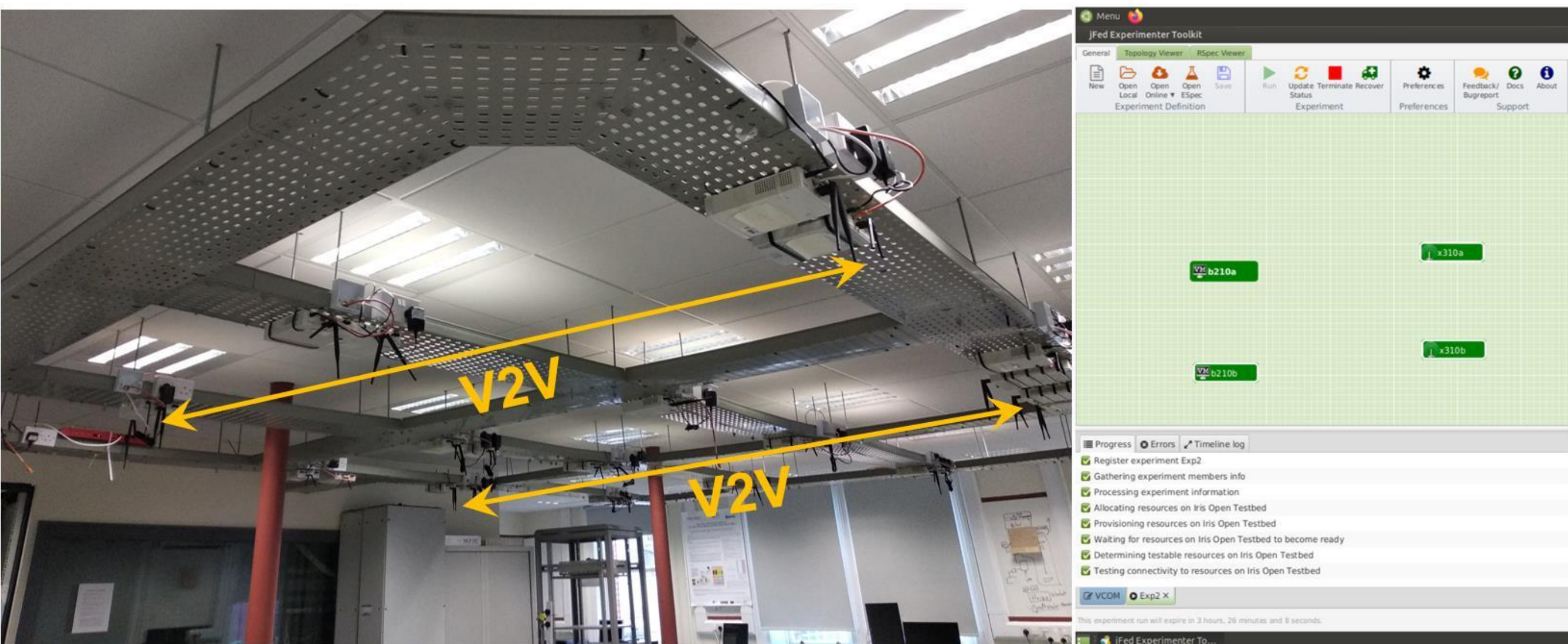
DEMO SETUP

- SPS is not a collision-free protocol and therefore requires a careful configuration of two transmission parameters: Number of subchannels allocated to Sidelink communications and the Resource reservation interval.
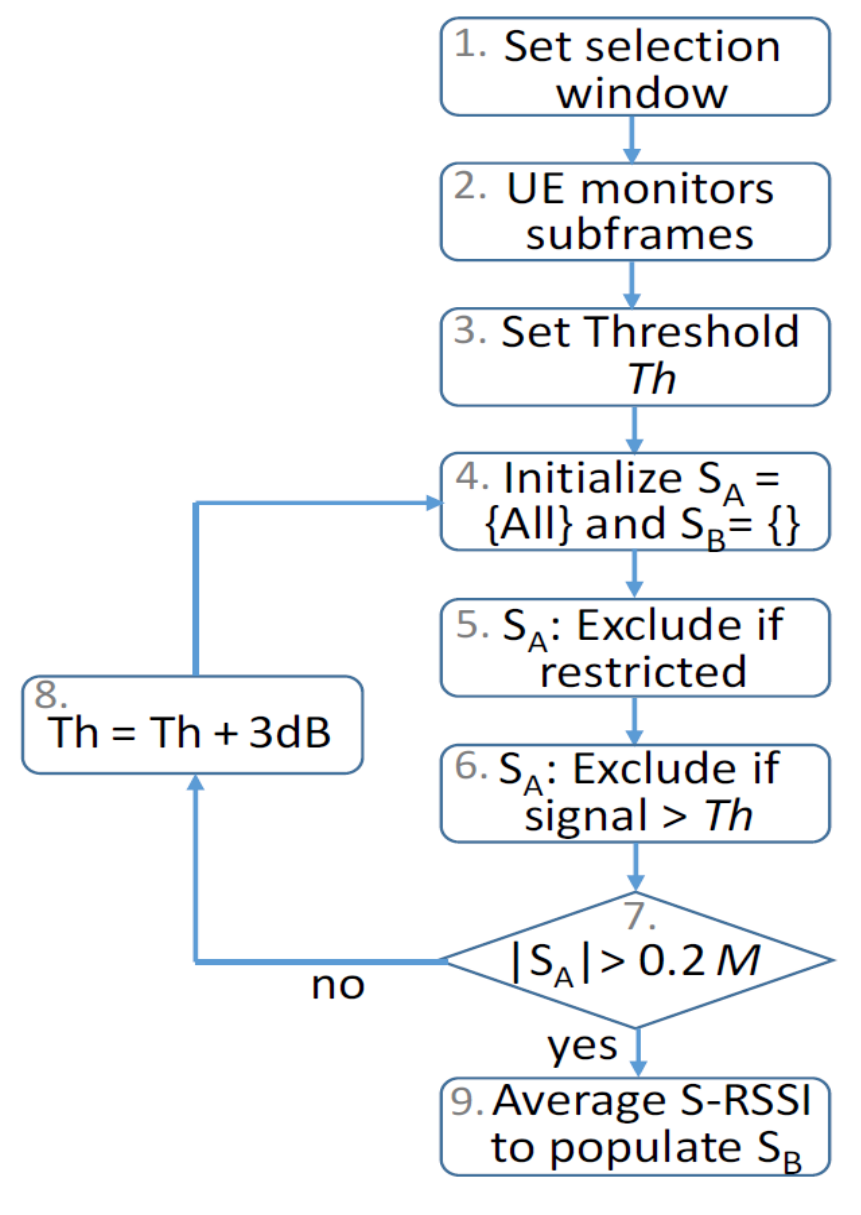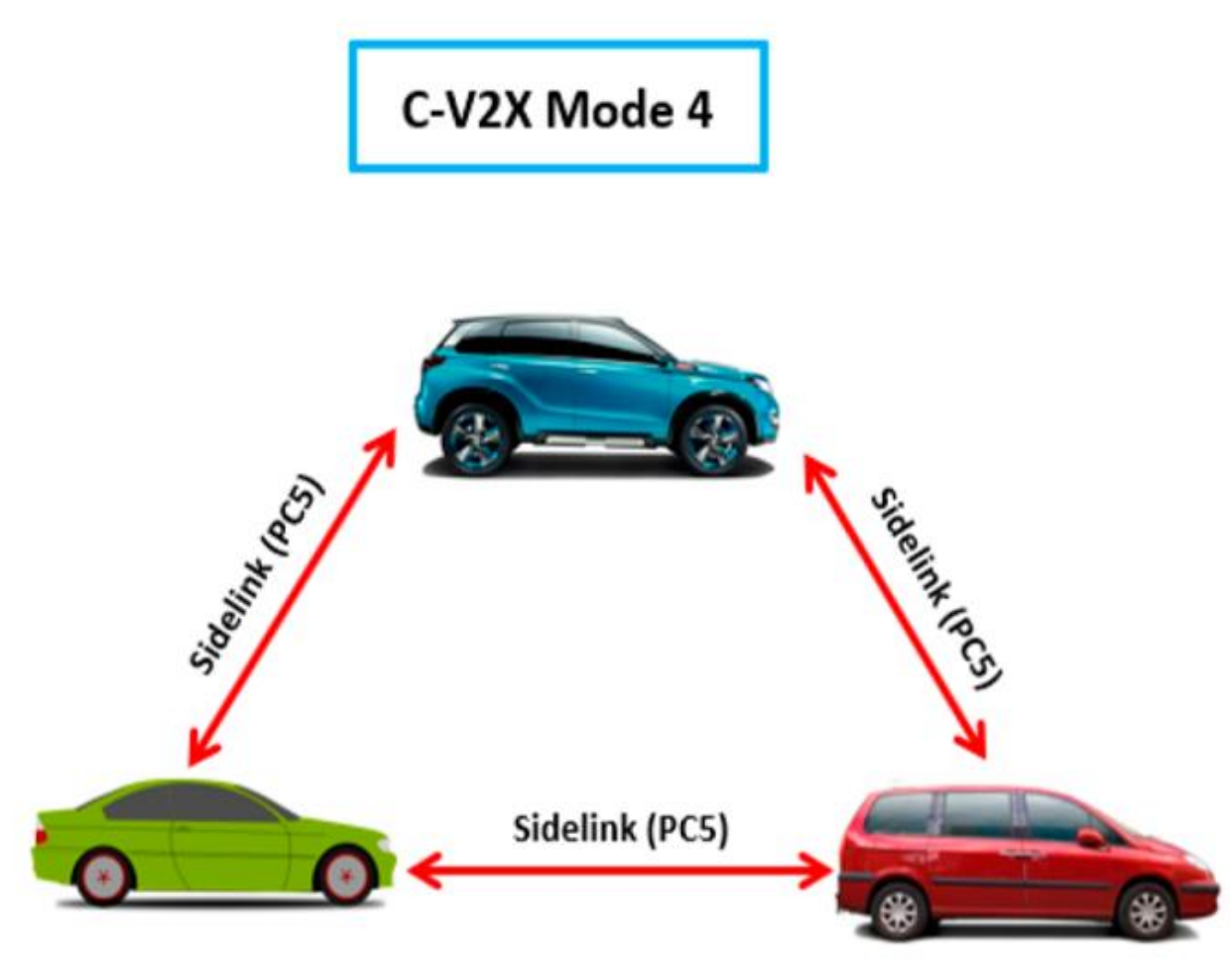
Source: European Telecommunications Standards Institute (ETSI), "Physical layer procedures (Release 14)," 3GPP TS 36.213, V14.2.0, April 2017.

RESULTS

- Effect of the number of dedicated subchannels on the performance of the SPS protocol.

  - The overlap between the subchannels reserved by two or more transmitting UEs (Vehicles) causes the packets to collide at the intended receiver.

  - The larger number of SL (Sidelink) subchannels that is available to the UEs to select the resources from, the lower the probability that more than one UE chooses the same resource.

Number of SL subchannels	2	4	6	8	10
Packet Delivery Ratio	76 %	88%	92%	98%	100%

- Effect of the SPS resource reservation interval on the performance of the SPS protocol .

  - As the resource reservation interval increases, the number of used resources by a UE within a given period decreases. Consequently, the probability of reserving the same resource by more than one UE decreases and the overall PDR increases.

  - It should be noted that increasing the resource reservation degrades the data rate and increases the packet delay. Consequently, there is a trade-off between these performance measures.

Resource reservation interval [ms]	100	200	300	400	500
Packet Delivery Ratio	71 %	81%	93%	97%	100%

CONCLUSIONS

- The performance of C-V2X mode 4 is highly dependent on the right configuration of the distributed scheduling protocol that is used by vehicles to reserve resources for their transmissions.

- Without Fed4FIRE+ the experimental validation of the scheduling protocol SPS would have been limited to simulation.

POST MORTEM

- Stage 2 of this experiment will start by extending this lab validation to realistic road scenarios, provided by the Smart Highway testbed available in the City of Things Antwerp testbed (imec).

- We also aim to test other vehicular communication protocols and C-ITS services in the smart highway testbed in Antwerp.

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