



Security, Privacy and Ethical Issues in next-gen Automotive

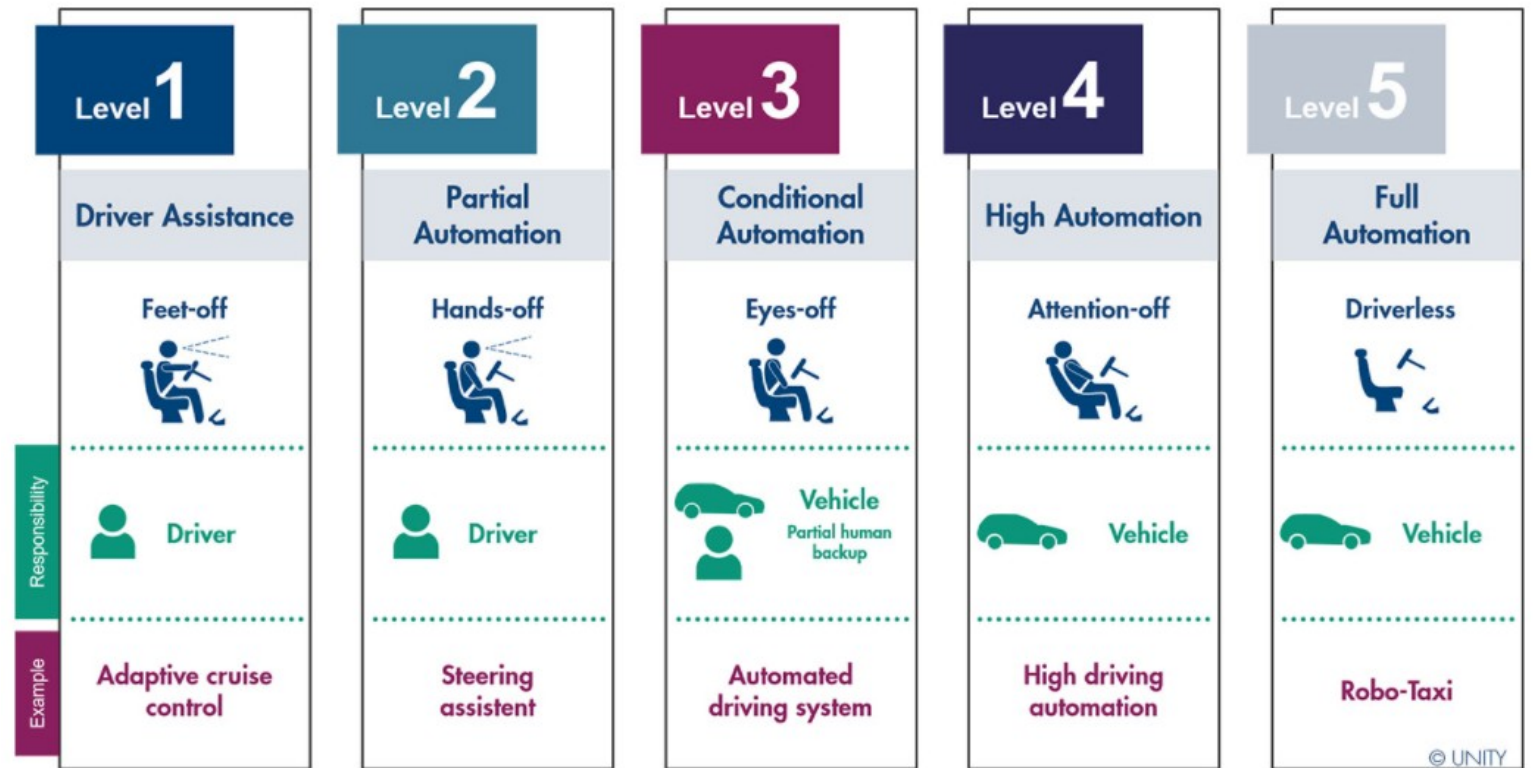
Ashish Ashutosh

FIT Europe 2022



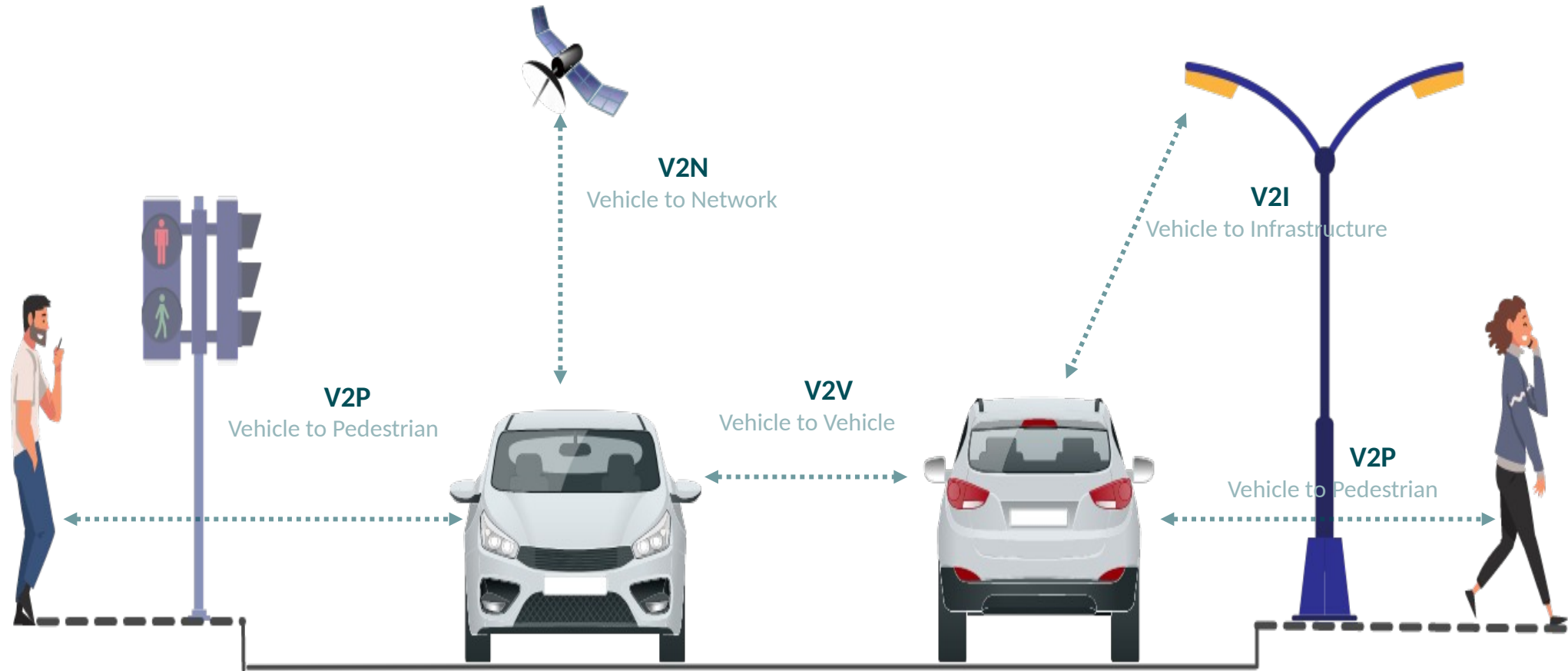
Carl Benz Patents World's First Automobile

SAE J3016



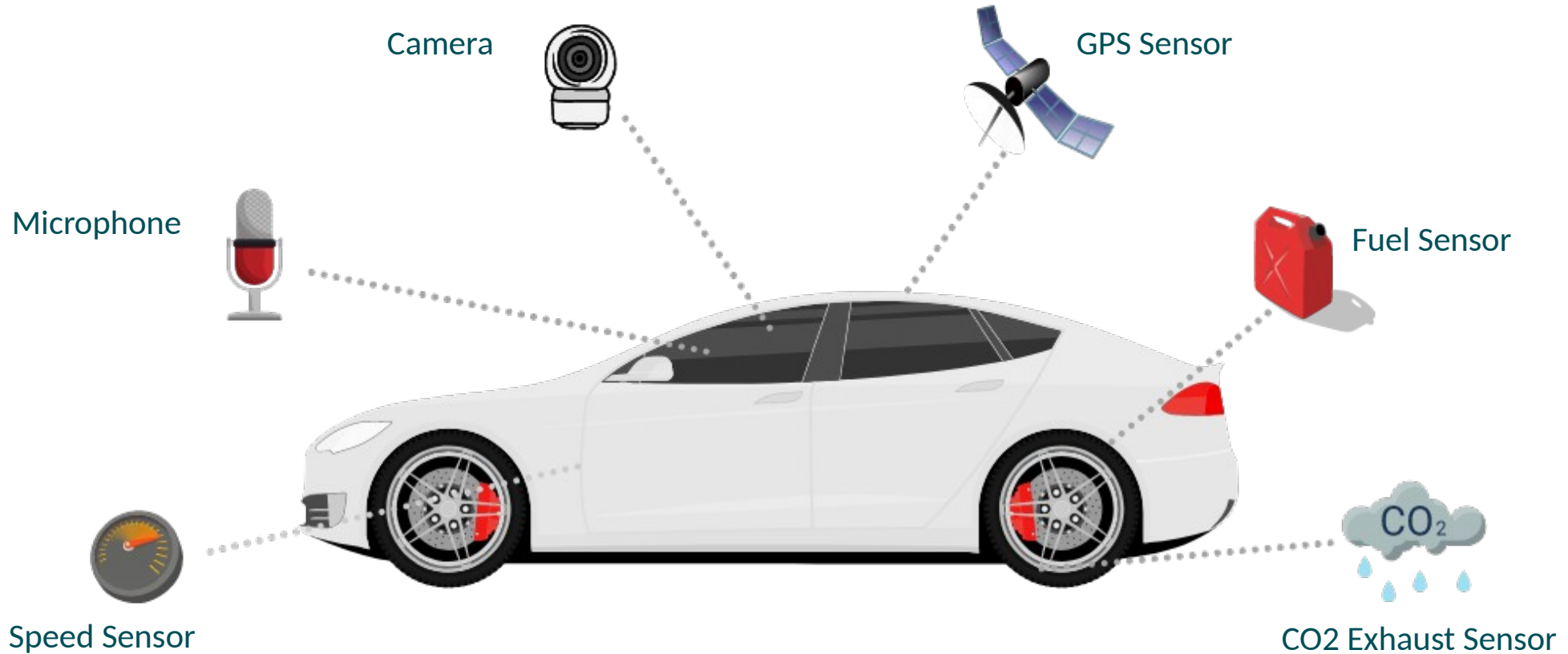
Levels of Automation(<https://www.unity.de/en/services/systems-engineering/automated-driving-through-systems-engineering/>)

Connected Vehicle Ecosystem



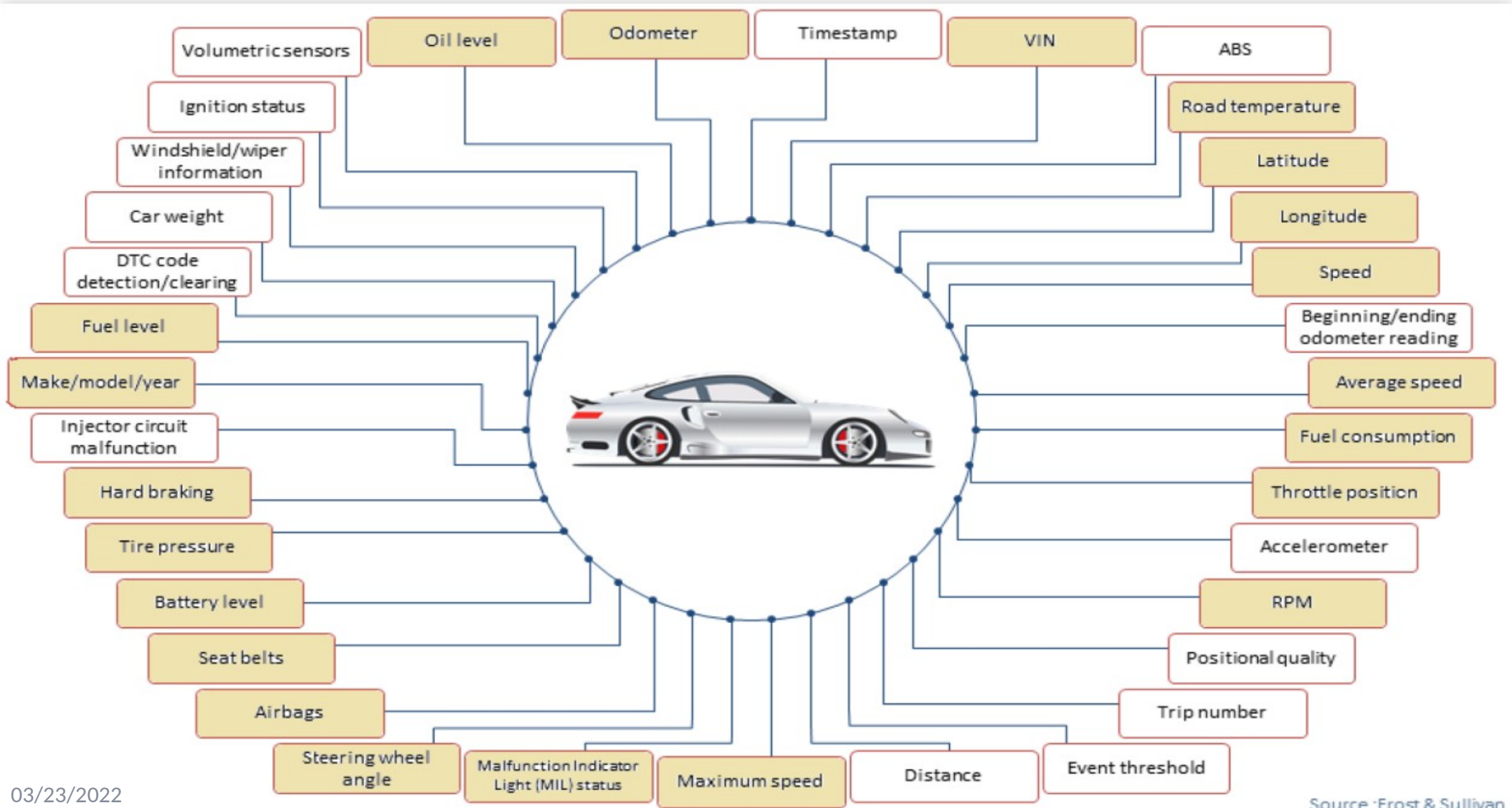
V2X Communication

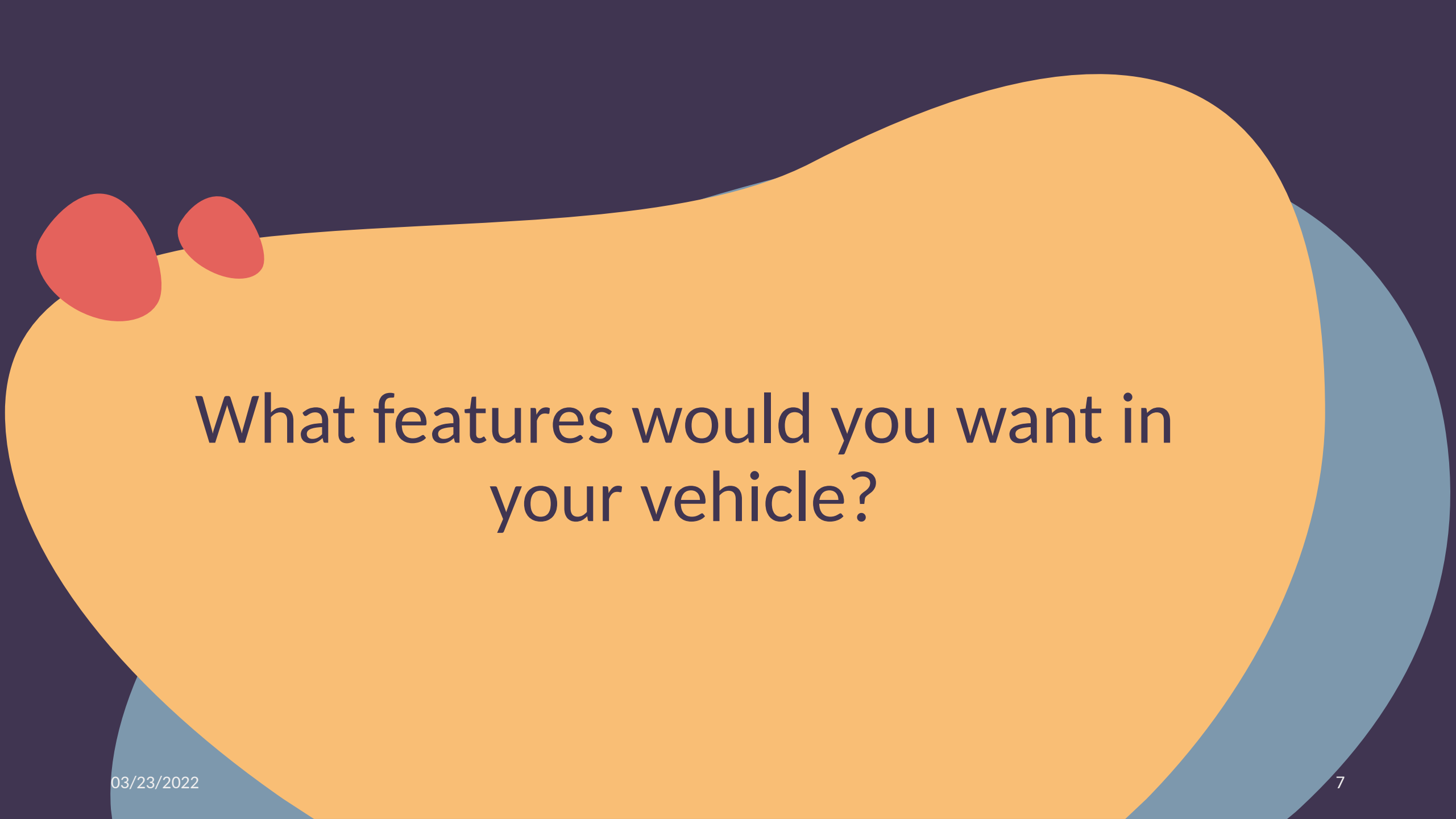
Vehicle Data



Examples of sensor data generated inside a vehicle

More Vehicle Data





What features would you want in
your vehicle?



<https://auto.hindustantimes.com/auto/cars/this-electric-batmobile-tumbler-replica-is-batman-s-green-ride-could-be-yours-41645407269573.html>

Privacy related attacks

3 main types of privacy attacks [2]:

- 1. Driver fingerprinting:** Identifying a driver among a set of other driver candidates.
 - Enev and team [1] study – data from 15 sensors
- 2. Location inference:** Identifying location even when not explicitly disclosed
 - Dewri and team [3] study – speed and steering wheel angle data.
- 3. Driving behavior analysis**
 - Data collected by Usage Based Insurance (UBI) companies – mileage, speed, acceleration, hard braking – to detect distracted or drunk driving.

Risks related to different sensors

1. Riskiest sensors
 - Location, current speed, steering wheel angle
2. Riskiest sensors in combination
 - Fuel consumption and hard breaking
3. Least privacy risks
 - Outside temperature, average speed, maximum speed, battery level, check engine light on, oil level

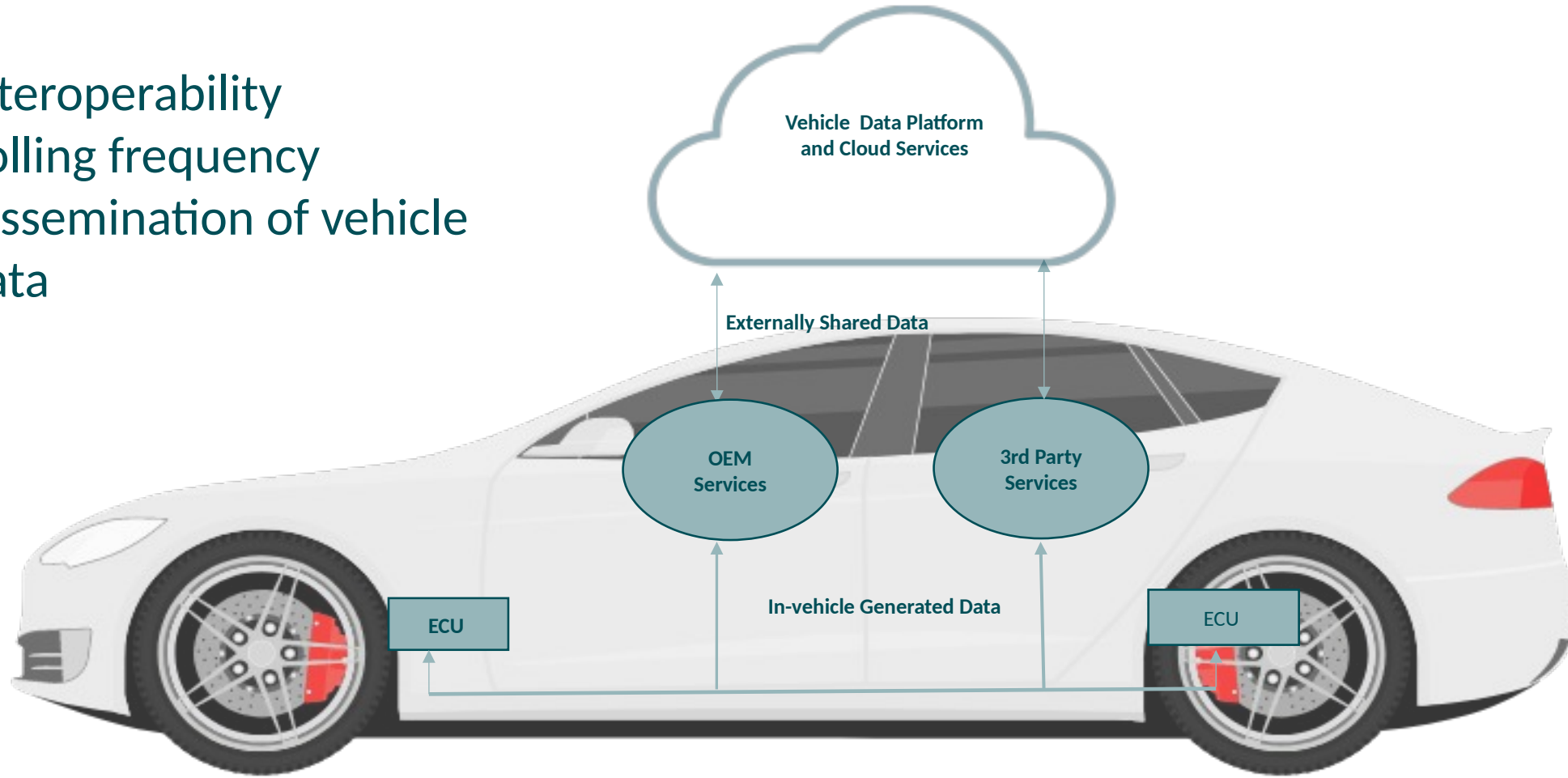


Possible solutions to protect sensor data?

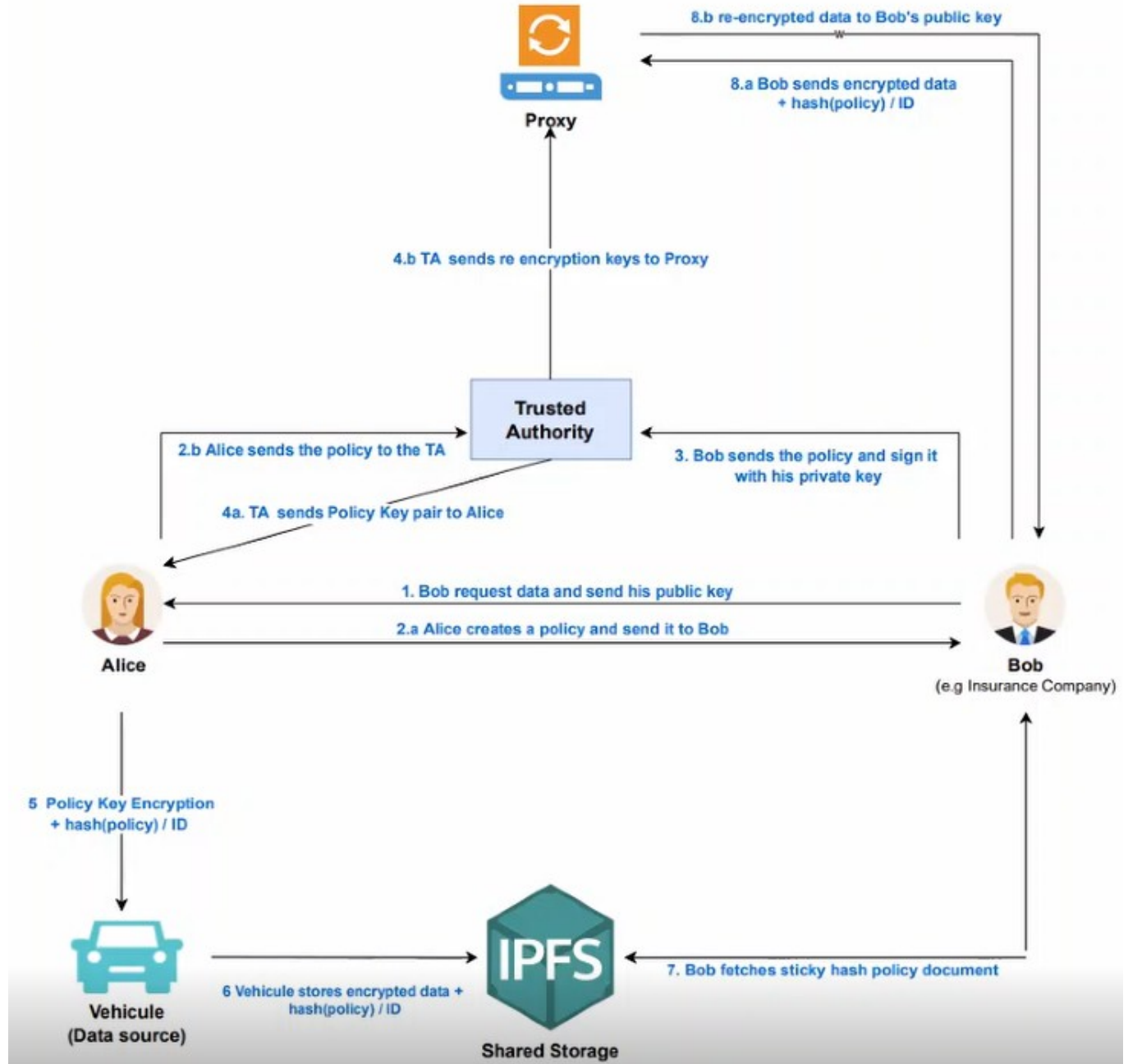
Some Challenges

1. Interoperability
2. Polling frequency
3. Dissemination of vehicle data

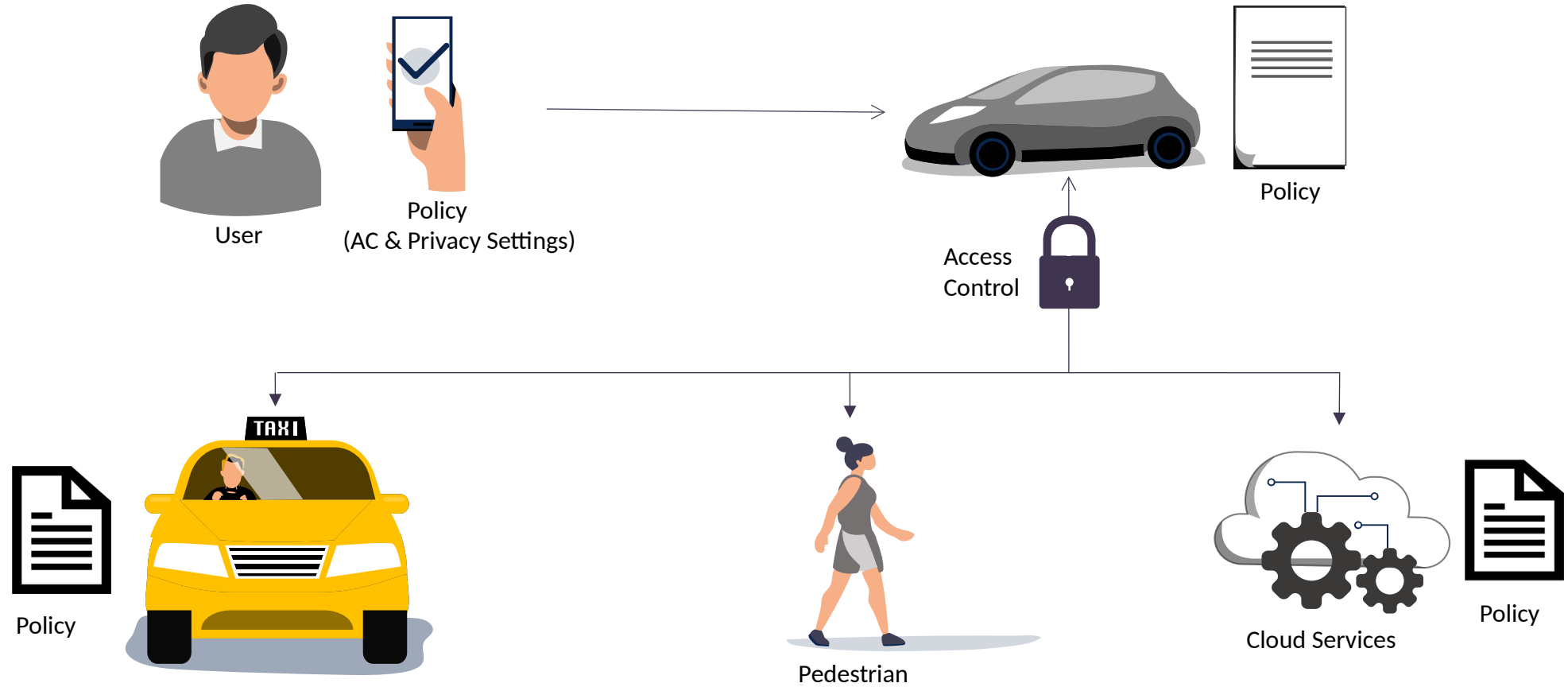
OEM: Original Equipment Manufacturers
ECU: Electronic Control Units
CAN: Controller Area Network



Dissemination of vehicle data



Vision



Ethical dilemma






Do you think Humans should control
vehicles?



Who is responsible for accidents in
self driving cars?

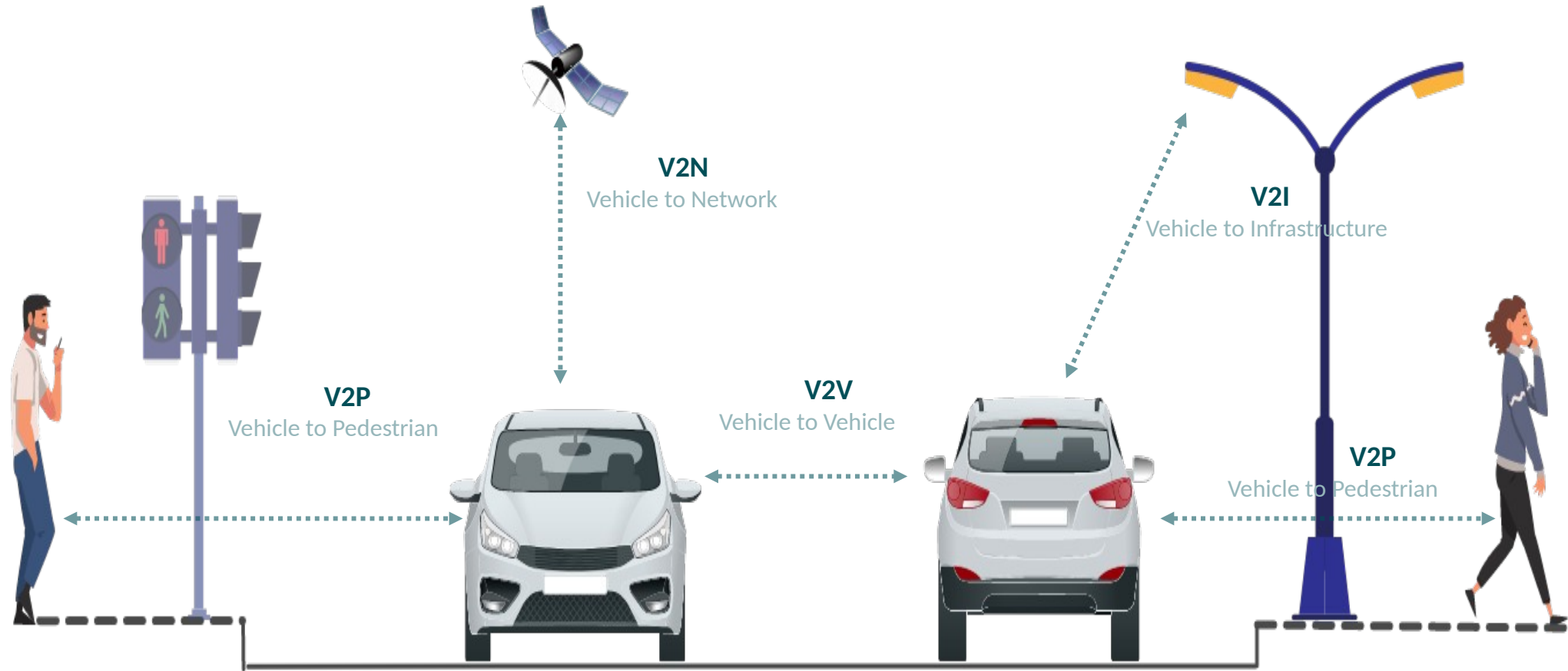


Is there a trade off between safety
and speed?



What infrastructure changes are necessary to accommodate connected vehicles?

Connected Vehicle Ecosystem



V2X Communication

References

1. Enev, M. et al., "Automobile Driver Fingerprinting," Proceedings on Privacy Enhancing Technologies 1:34-50, 2016.
2. Pesé, M. and Shin, K., "Survey of Automotive Privacy Regulations and Privacy-Related Attacks," SAE Technical Paper 2019-01-0479, 2019, <https://doi.org/10.4271/2019-01-0479>
3. Dewri, R., Annadata, P., Eltarjaman, W., and Thurimella, R., "Inferring Trip Destinations from Driving Habits Data," in Proceedings of the 12th ACM Workshop on Privacy in the Electronic Society, 267-272, ACM, November 2013).