Potential of Cooperative Systems for Automated Driving

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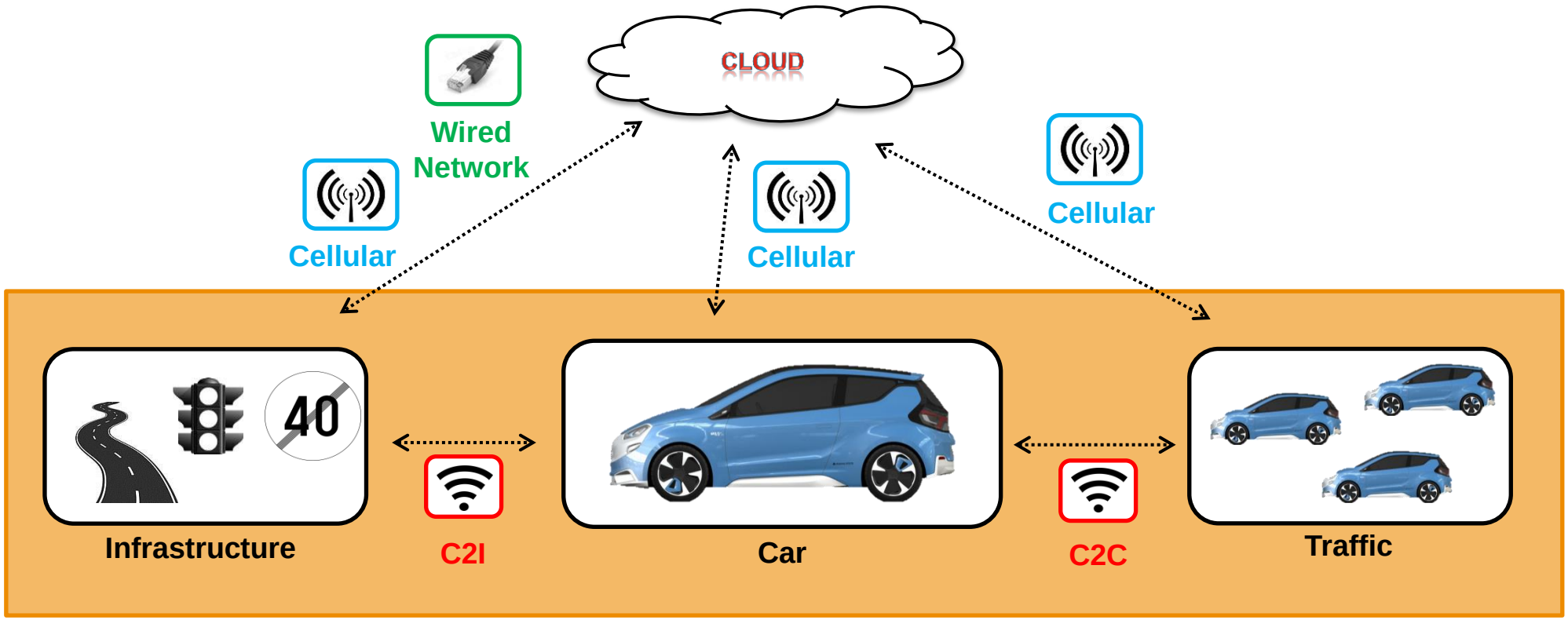
„The Connected Vehicle“



Car-2-X Communication

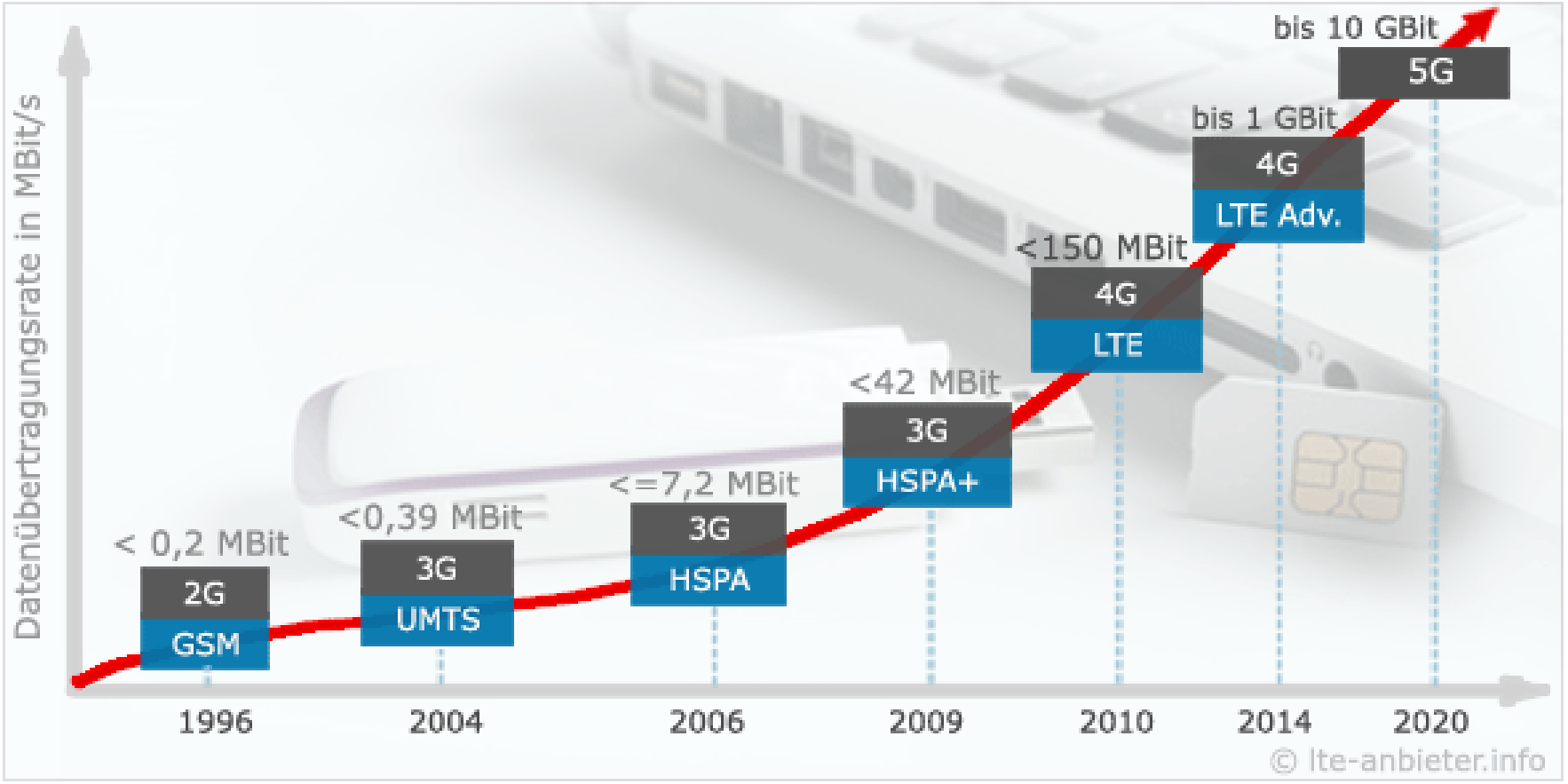
- Driver gets informed about an upcoming dangerous situation at an early stage
- Potentials are improved road safety, reduced traffic congestion and more environmentally friendly driving

IEEE 802.11p

- Modification of 802.11a
- In Europe called ITS-G5 (band, channel allocation)

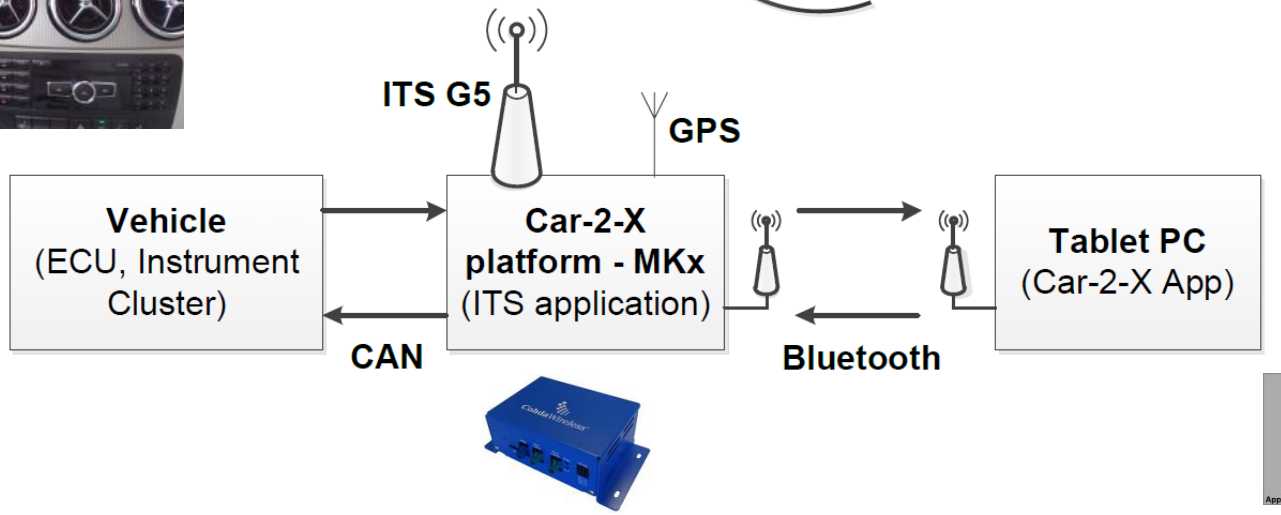
	IEEE 802.11a	**IEEE 802.11p**
Data Rate	6, 9, 12, 18, 24, 36, 48, 54 Mbps	3, 4.5, 6, 9, 12, 18, 24, 27 Mbps
Modulation	BPSK OFDM QPSK OFDM 16-QAM OFDM 64-QAM OFDM	same
Error Correction Coding	Convolutional Coding with K=7	same
Coding Rate	1/2, 2/3, 3/4	same
OFDM Symbol Duration	4 μs	8 μs
Guard Period	0.8 μs	1.6 μs
Bandwidth	20 MHz	10 MHz
Frequency Range	5.180 GHz - 5.825 GHz	5.850 - 5.925 GHz

The Road to 5G



Source: http://www.lte-anbieter.info/5g/

Car-2-X Demonstrator System



[Car-2-X Demo Video]

Car-2-X and Automated Driving

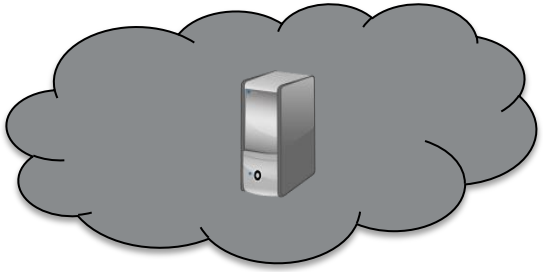
Audi piloted driving
Source: wired.com

DARPA 2005 winner „Stanley“
Source: wikipedia

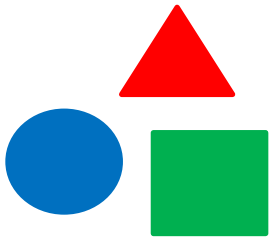
- So far automated car demos have been sensor based

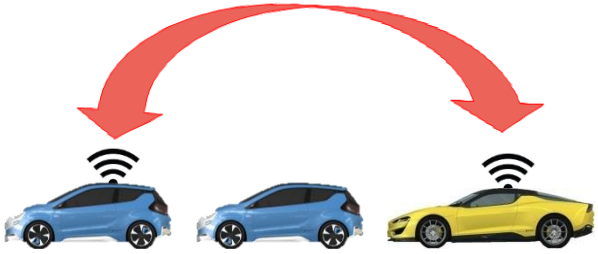
→ Unlock the potential of cooperative systems for automated driving

Google Driverless Car
Source: dpa

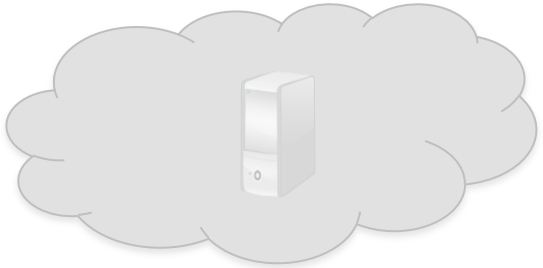


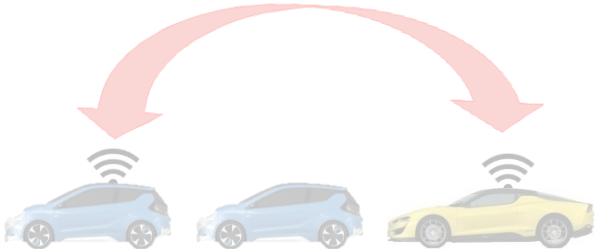
Why Car-2-X?



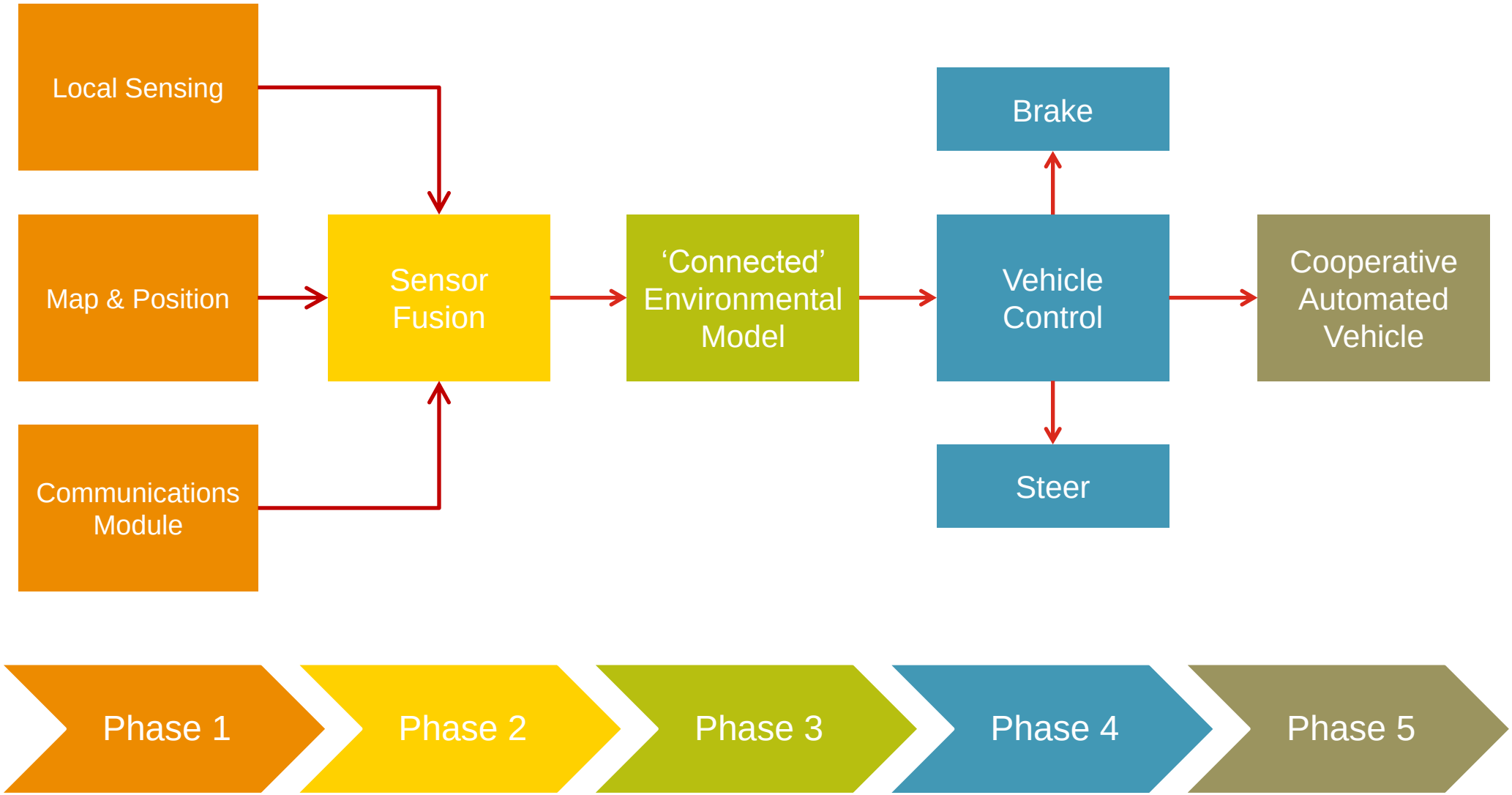


Car-2-X can play a key role in future automated driving





Deployment of Cooperative Automated Vehicles



‚Connected Environmental Model‘

- Individual vehicle knows about its local status (speed, position,…) and environment (other vehicles, pedestrians,…)

- So far just transmission of own information (‘local status’)
- Adaption: Automated vehicle should also transmit **perceived information** about the environment
  - Pedestrians, biker, potholes,…
- This information is used to update its environmental model

  → **‘connected environmental model’**

Ultra-rapid precise Positioning for crash Impact potential Calculation (UPIC)

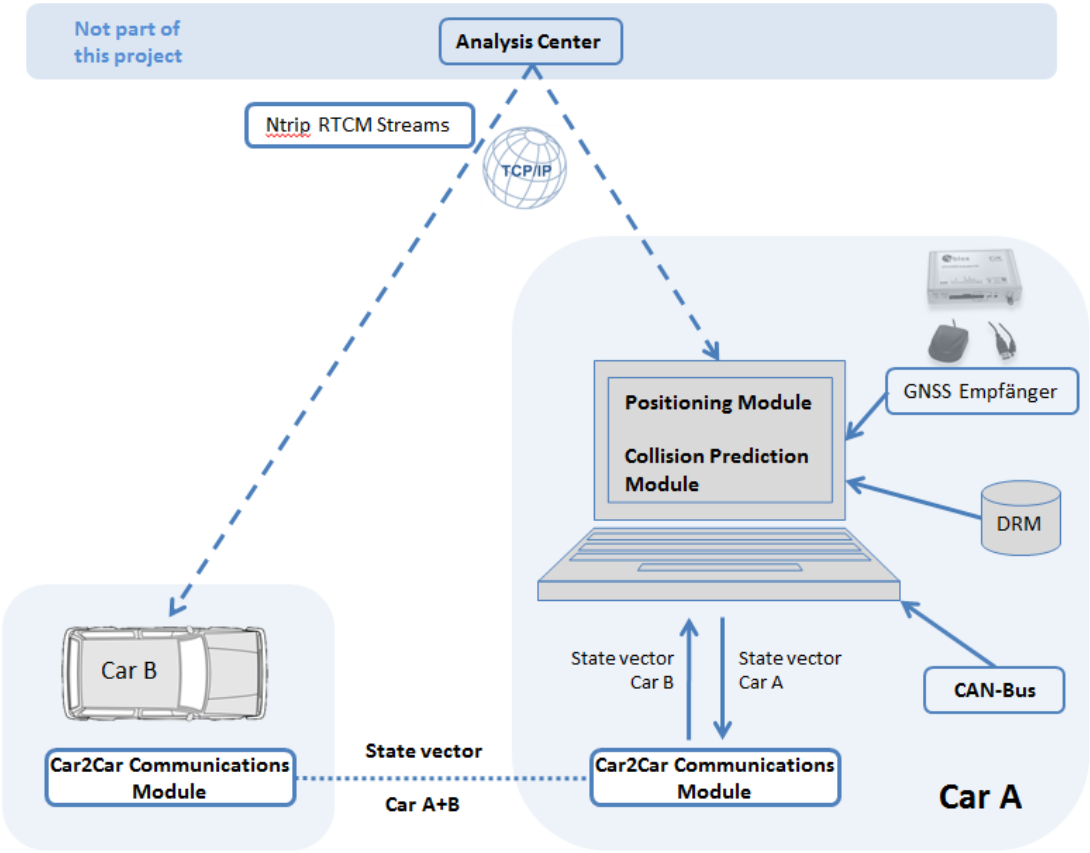
Todays Collision Prediction Systems based on:

- Radar
- Camera

UPIC based on:

- C2X Communications
- Low-Cost GNSS
- Standard Vehicle Sensors
- Lane-level Digital Road Map (DRM)

→ **Cooperative system for collision prediction**



Source: ifG, TU Graz

Thanks for your attention!

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