An aerial photograph of a city, likely Oslo, taken at sunset. The sky is filled with orange and yellow clouds. A large red polygon is overlaid on the city, highlighting a central urban area. The polygon is irregular, following the city's layout. The city features a mix of modern and older buildings, green spaces, and a body of water in the foreground.

# Mobility Pricing - Instrument zur Verbesserung des innerstädtischen Verkehrs?

Ralf Grigutsch 22.11.2023







# Agenda

- 01**     **Future Mobility / Mobilität der Zukunft**
- 02**     **Architektur, Infrastrukturen, Komponenten ...**
- 03**     **Datenplattformen / Eco Systeme**
- 04**     **5G-Loginnov, Low Emission Zones and Green Navigation**



# Future Mobility / Mobilität der Zukunft

## Autonom ... Umweltfreundlich ... Flexibel

„Die Mobilität der Zukunft soll **autonom**, **umweltfreundlich** und **flexibel** sein. Dabei ist es egal, ob sich Nutzer für einen eigenen Wagen oder ein Sharing-Konzept entscheiden. Autonomes Fahren soll die Norm werden, damit u. a. der **Verkehrsfluss optimiert** und das Fahren sicherer wird.“

Quelle: [So sieht die Mobilität der Zukunft aus - Energie Digitalisieren \(energie-digitalisieren.de\)](https://www.energie-digitalisieren.de/so-sieht-die-mobilitaet-der-zukunft-aus)

## Vermeiden ... Verlagern ... Verbessern

„Ausgangspunkt des Mobilitätsmasterplans 2030 ist ... von einem sinnvollen Mix aus **Verkehrsvermeidung**, **Verkehrsverlagerung** und **Effizienzverbesserung** bei den einzelnen Verkehrsträgern ... und einen deutlichen Anstieg der Energieeffizienz des gesamten Verkehrssystems innerhalb des zur Verfügung stehenden CO<sub>2</sub> -Budgets ...“

Quelle: [https://www.bmk.gv.at/dam/jcr:6318aa6f-f02b-4eb0-9eb9-1ffabf369432/BMK\\_Mobilitaetsmasterplan2030\\_DE\\_UA.pdf](https://www.bmk.gv.at/dam/jcr:6318aa6f-f02b-4eb0-9eb9-1ffabf369432/BMK_Mobilitaetsmasterplan2030_DE_UA.pdf)

## ... Mobilitätsbedürfnisse befriedigen ... die negativen Auswirkungen des Verkehrs minimieren

„Die verkehrliche Zukunft ... liegt im ausgewogenen Miteinander der verschiedenen Verkehrsarten innerhalb des gesamten Verkehrssystems. Die Gestaltung des Verkehrssystems wirkt dabei in alle Lebensbereiche hinein und beeinflusst die Verkehrsmittelwahl der Bevölkerung. **Verkehr ist kein Selbstzweck, sondern hat eine dienende Funktion, ...**“

Quelle: [VEP\\_Teil\\_2\\_web.pdf \(karlsruhe.de\)](https://www.karlsruhe.de/vep-teil-2-web.pdf)



# Architektur, Infrastrukturen, Komponenten ...

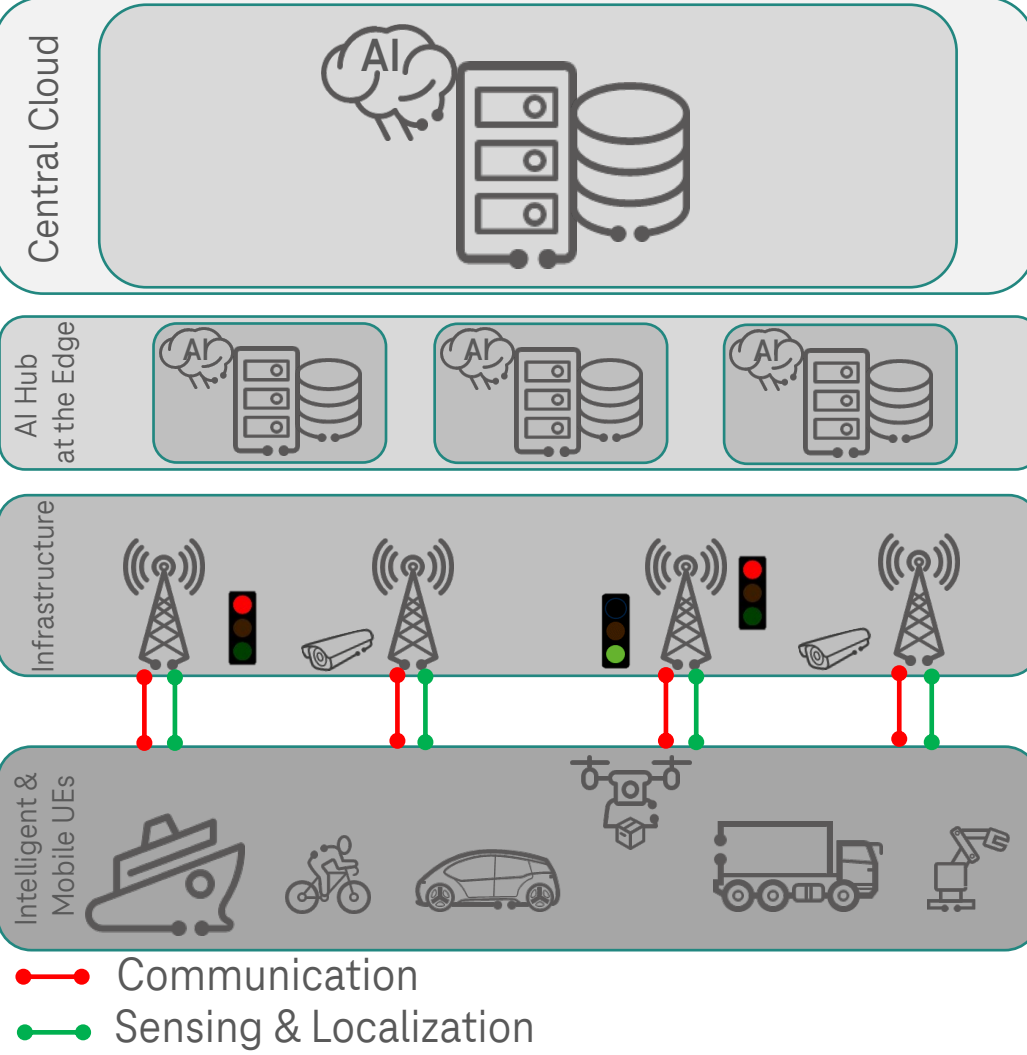
Pricing

Dynamic service management

Artificial Intelligence

Sensor fusion, HD maps

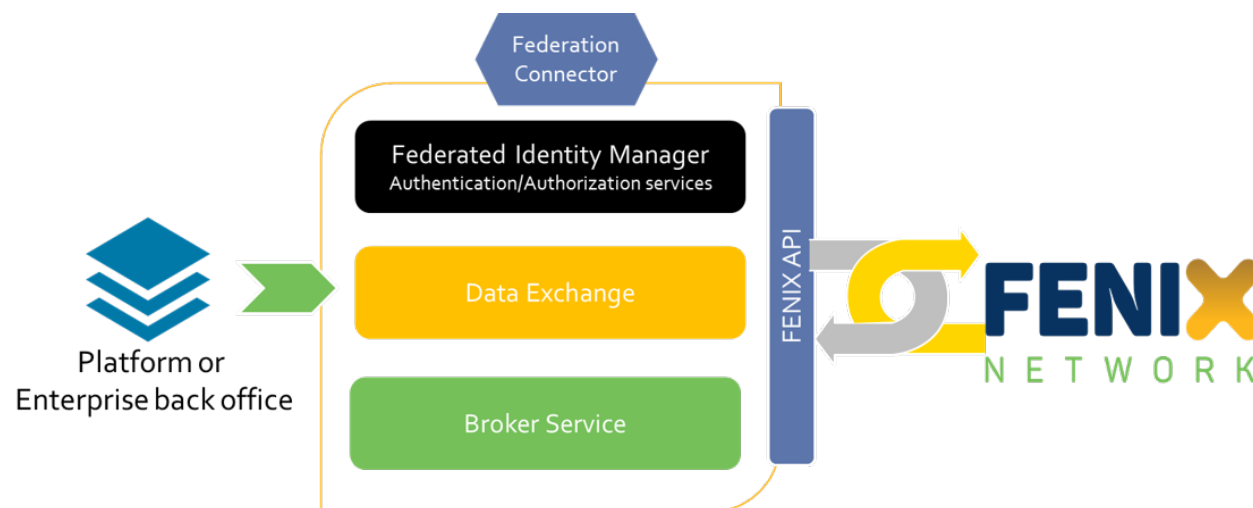
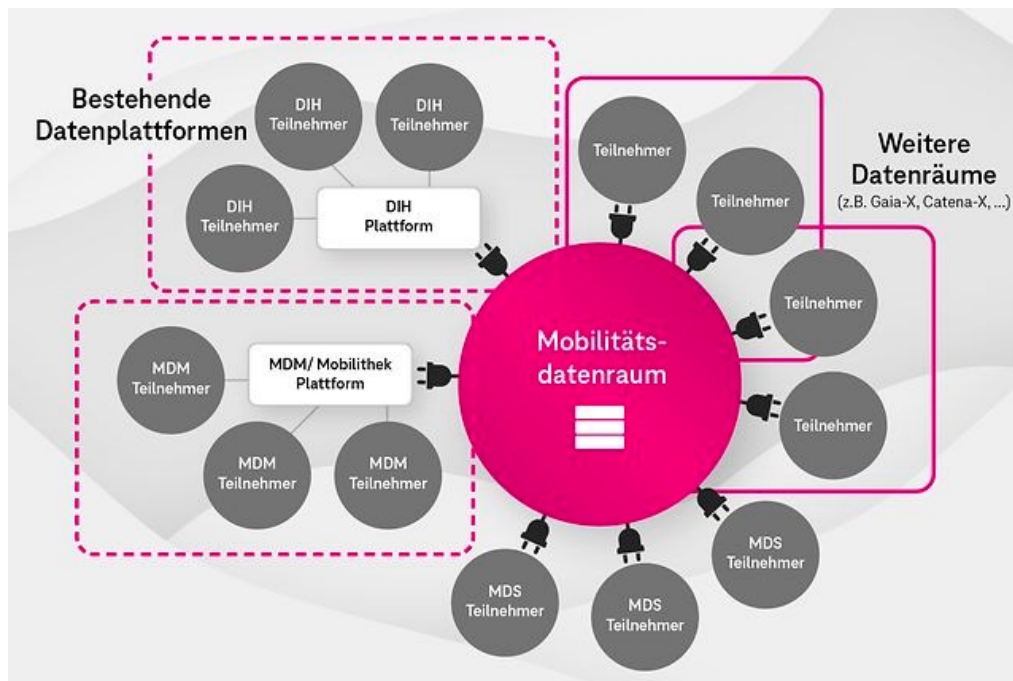
Safety, Assisted,  
Automated driving Support



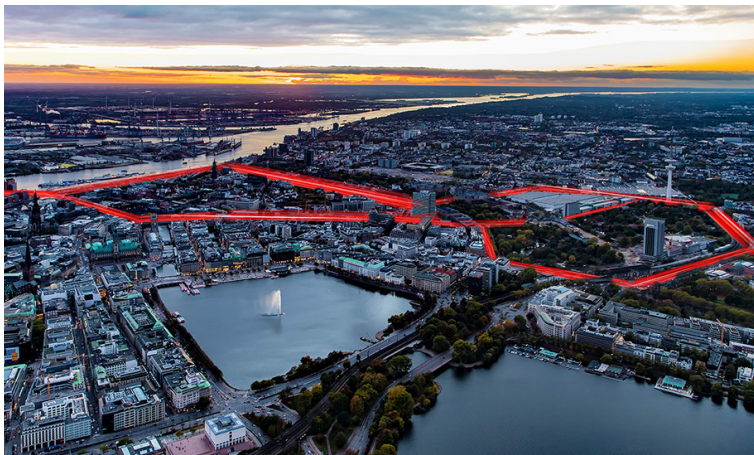
Cyber-security and privacy



# Datenplattformen / Eco Systeme







## Floating Truck and Emission Data

### GLOSA and Automated Truck Platooning (GTP)

- under 5G-LOGINNOV Green initiative

### Dynamic control loop

- for environment sensitive traffic management actions (DCET)

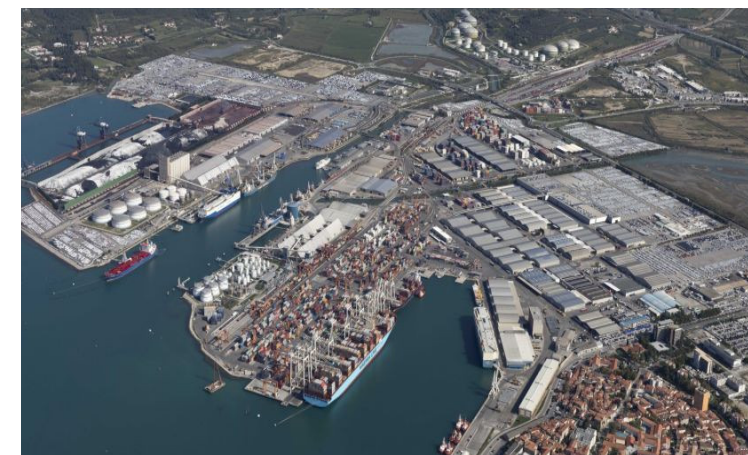


## Optimal selection of yard trucks

- Installation of a 5G access point on yard trucks
- 5G latency, precise localization services, etc.

## Surveillance cameras / video analytics

- Installation of connected 4K surveillance cameras
- AI/ML solution for container seal presence, human presence detection, social distancing etc.



## Predictive Maintenance

- 5G access point installed on yard vehicles
- AP will collect and forward in real time with low latency telemetry data over the 5G network

## Port control, logistics and remote automation

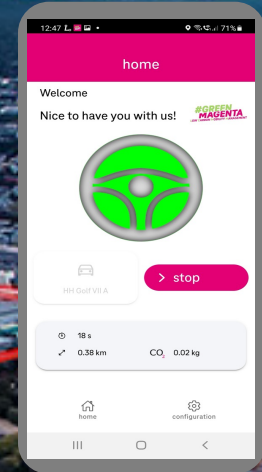
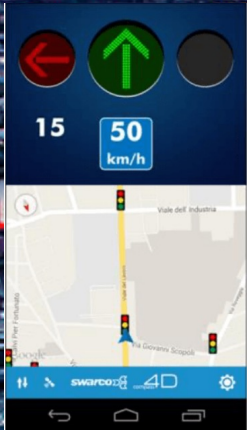
## Business critical and mission critical communications







# Testfield autonomous and connected driving (TAVF)

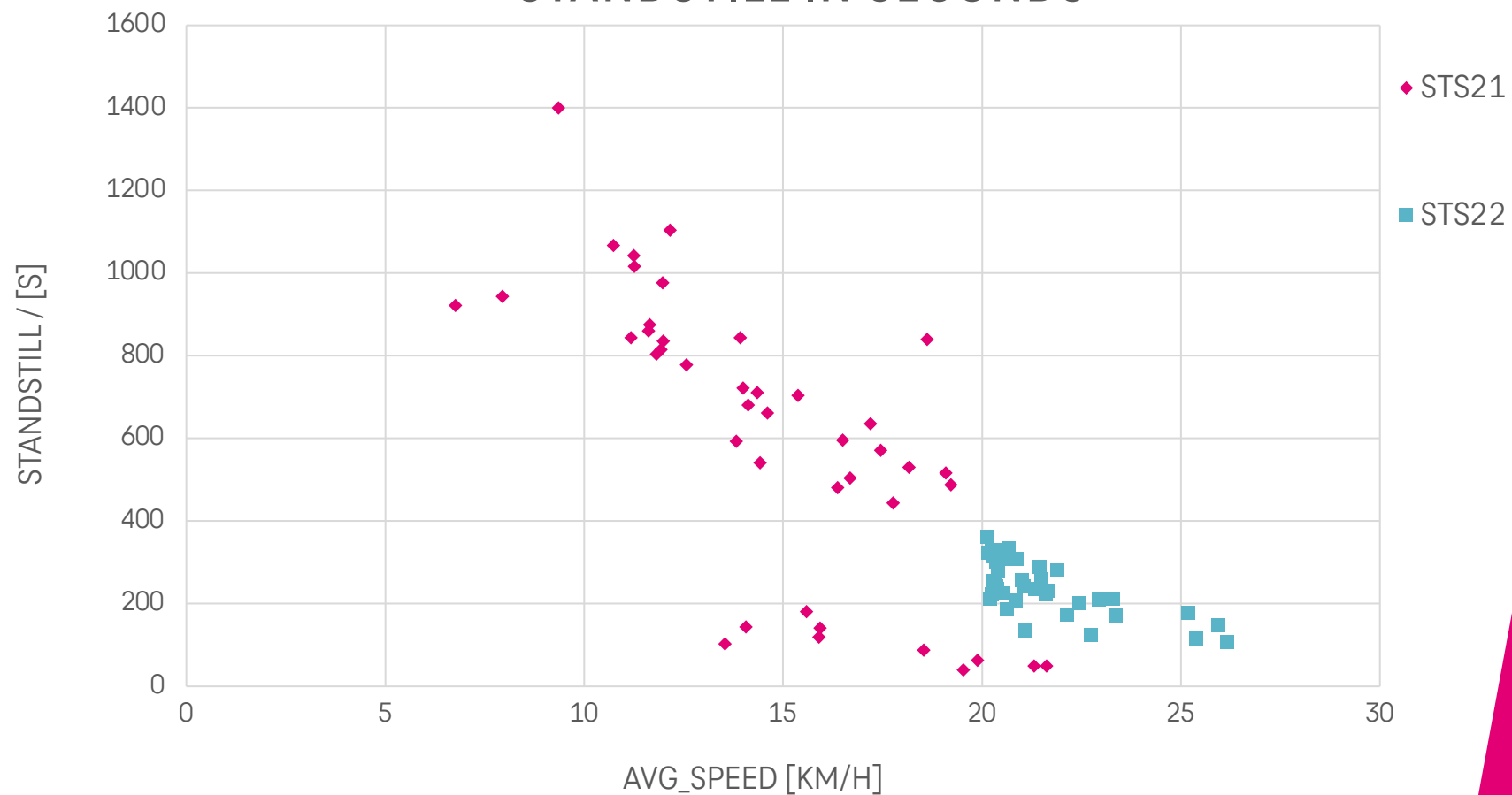


ISO-  
23795-1





## STANDSTILL IN SECONDS



## Results

### No GLOSA - Tests 2021

- 15 km/h
- 613s

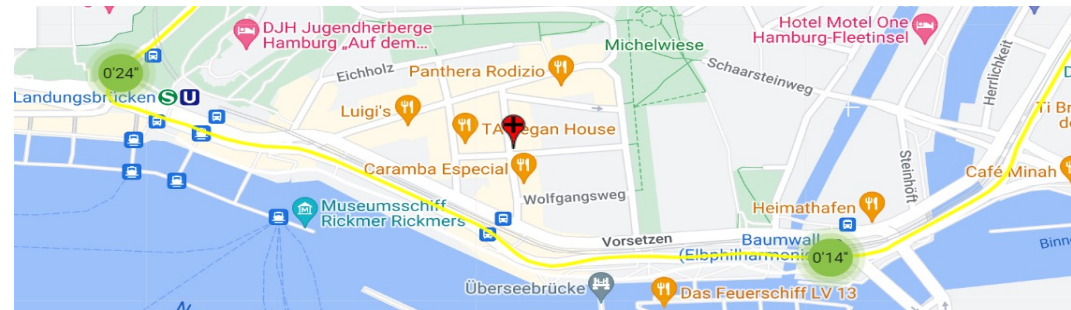
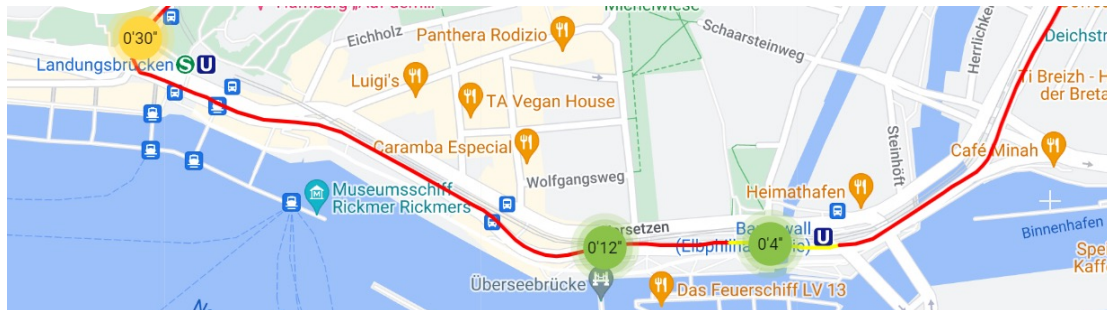
### GLOSA - Tests 2022

- 22 km/h
- 214s
- No GLOSA has 3-times the standstill

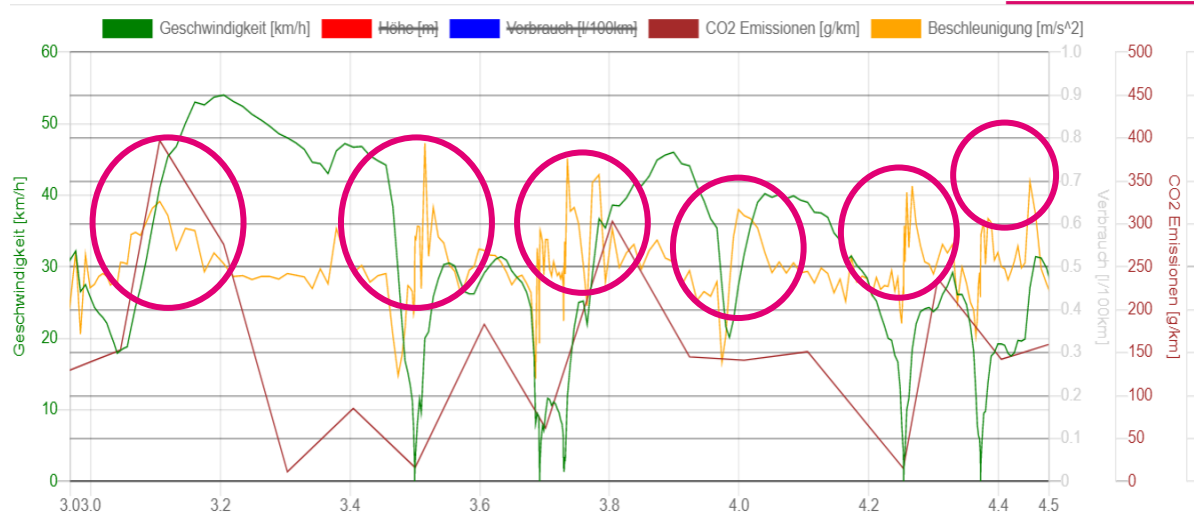




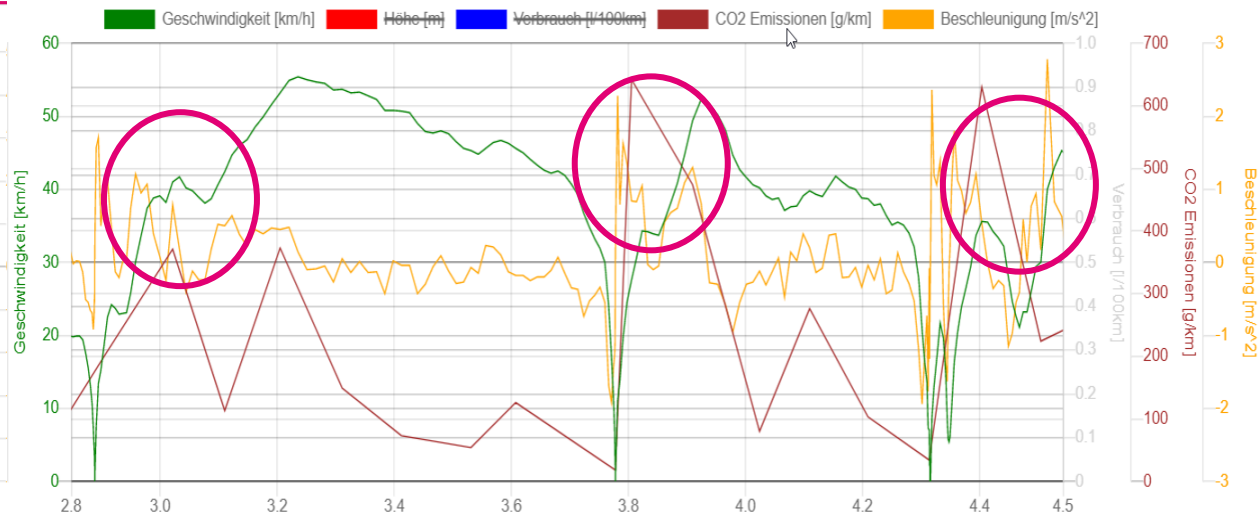
# 5G LOGINNOV



Karte Geschwindigkeitsprofil Höhenprofil Emissionsprofil Wegprofil Info



Karte Geschwindigkeitsprofil Höhenprofil Emissionsprofil Wegprofil Info



Funded by the Horizon 2020  
Framework Programme of the  
European Union



5GLOGINNOV

# Measurable reduction of carbon emission

**For saving 1 ton of CO<sub>2</sub>**

You would have to plant 80 trees...



...or equip 80 taxis in Hamburg with 5G GLOSA

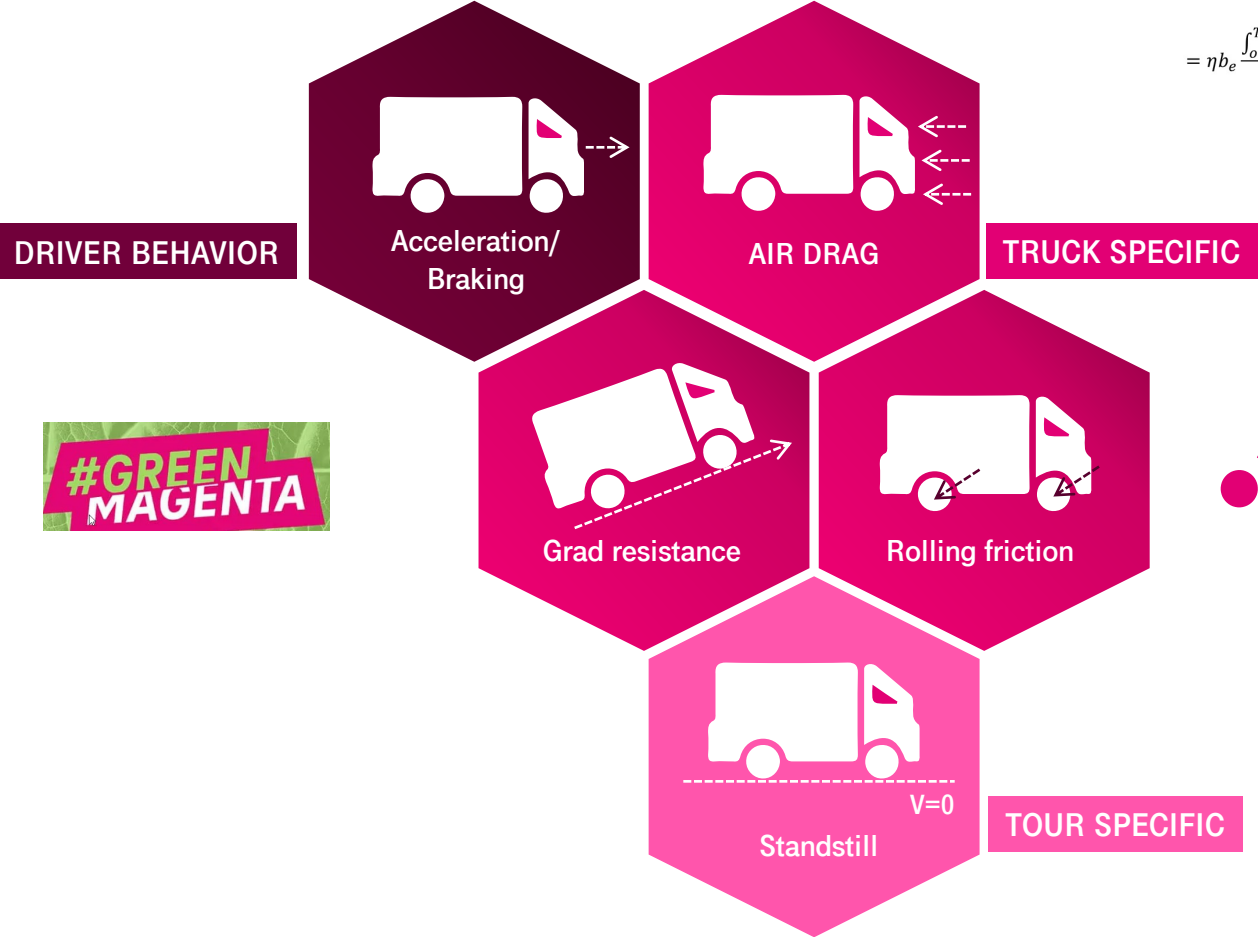




**Back-up**

# ISO-23795-1: Nomadic Devices for Carbon Monitoring

Just take a smartphone and Newtonian physics ...



$$= \eta b_e \frac{\int_0^T (F_{acc} + F_{brake} + F_{roll} + F_{air} + F_G) v(1s) dt}{\int_0^T v(1s) dt}$$

$$(2) \Phi \left[ \frac{Liter}{100km} \right] = \Phi(v > 0) + \Phi(v = 0)$$

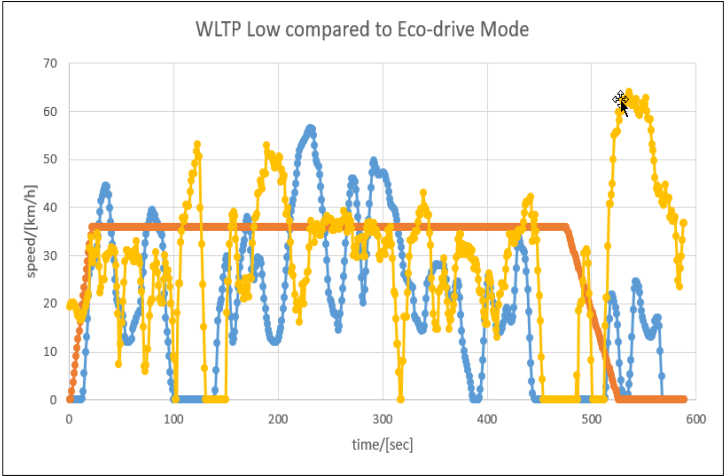
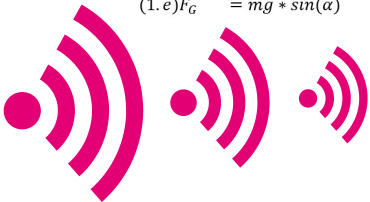
$$(1.a) F_{acc} = m * \frac{dv}{dt}, dv > 0$$

$$(1.b) F_{brake} = \beta m * \frac{dv}{dt}, dv < 0$$

$$(1.c) F_{air} = \frac{\rho}{2} * A * c_w v^2$$

$$(1.d) F_{roll} = mg \mu$$

$$(1.e) F_G = mg * \sin(\alpha)$$



EPI for different speed cycles and profiles: half-loaded truck

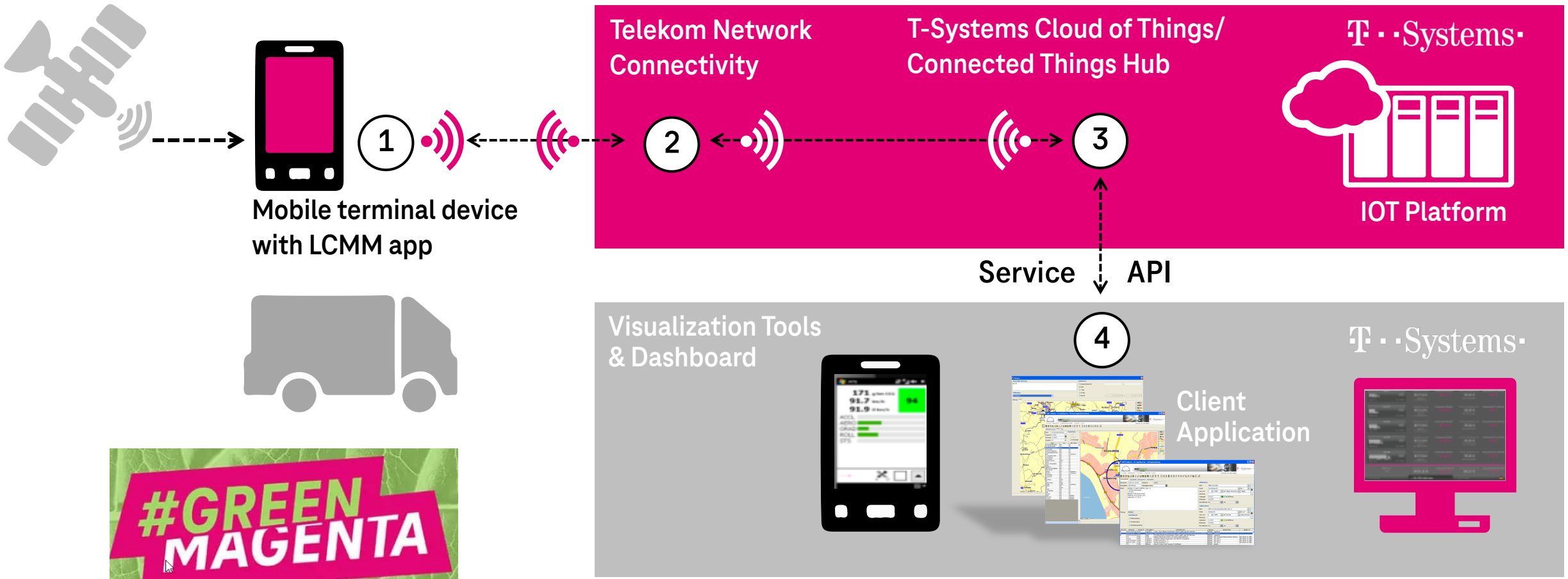
	Avg. Speed/[km/h]	Dist./[km]	EPI / [Centilitre/tkm]	STS/[sec]
WLTP	18,9	3,09	3,15	150
REAL	28,5	4,66	125%	46%
36kph	29,9	4,89	34%	43%

ISO 23795-1:2022

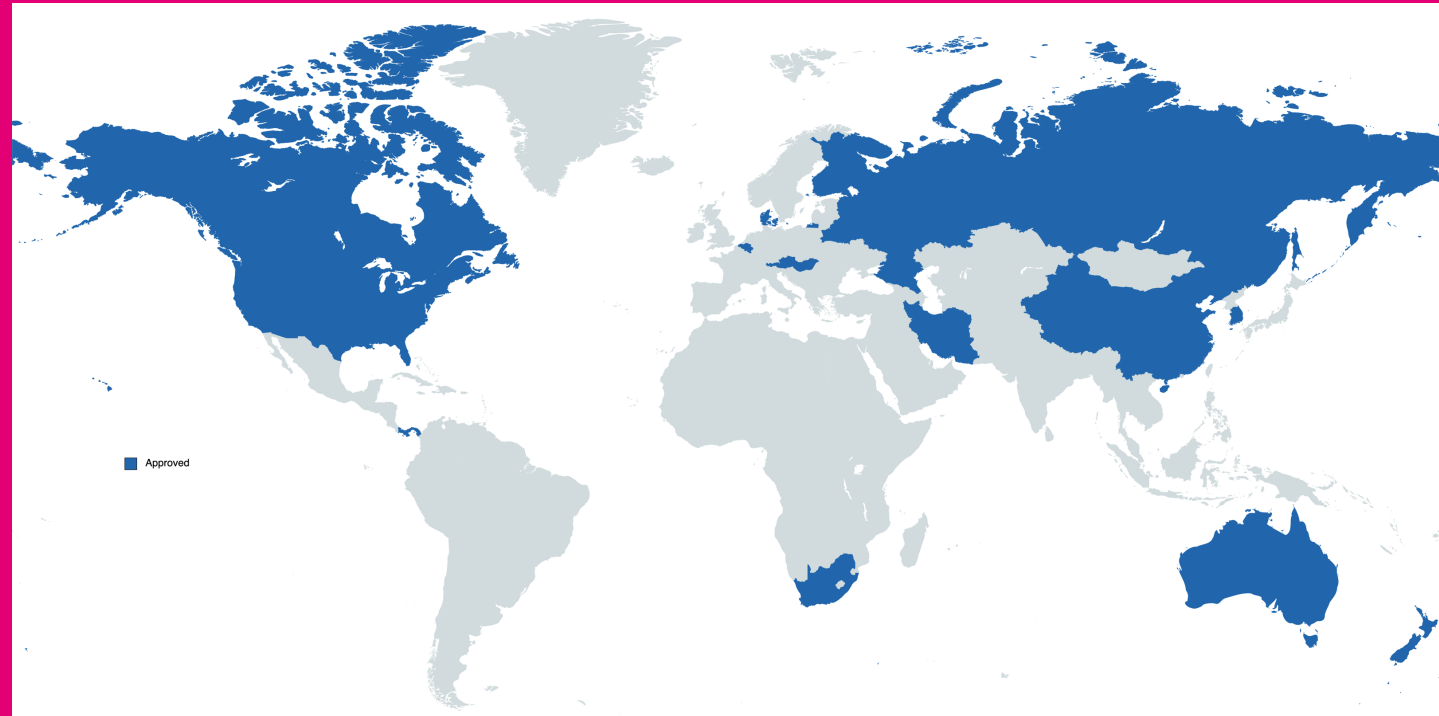
Intelligent transport systems — Extracting trip data using nomadic and mobile devices for estimating CO2 emissions — Part 1: Fuel consumption determination for fleet management



# ISO-conform LCMM – Solution components



# National Standardization Committees – 14 out of 16 approvals



## General information

Status :  Published

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Edition : 1

Number of pages : 31

Technical Committee : **ISO/TC 204** Intelligent transport systems

ICS : **13.020.40** Pollution, pollution control and conservation | **13.040.50** Transport exhaust emissions | **35.240.60** IT applications in transport | **43.040.15** Car informatics. On board computer systems



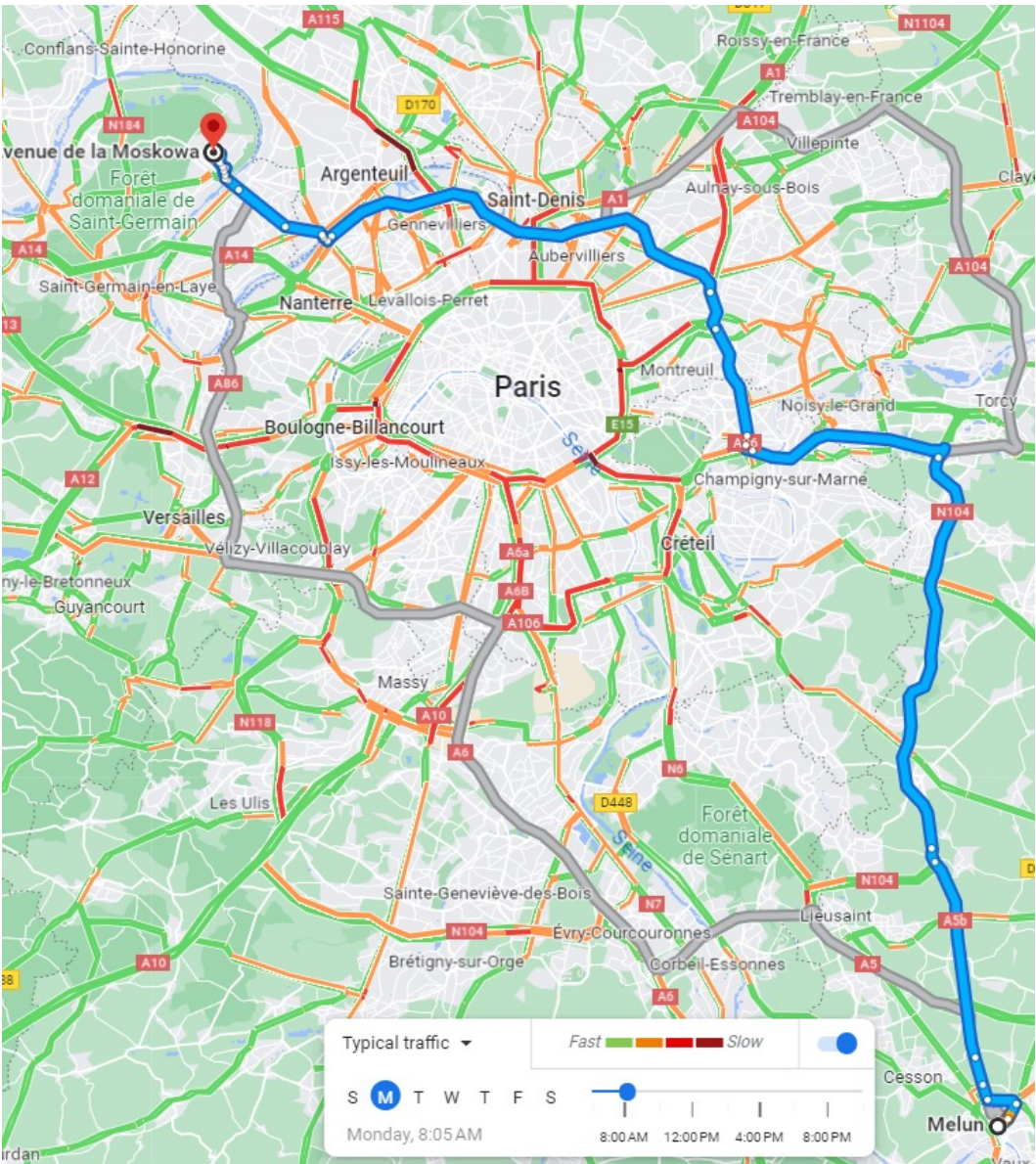
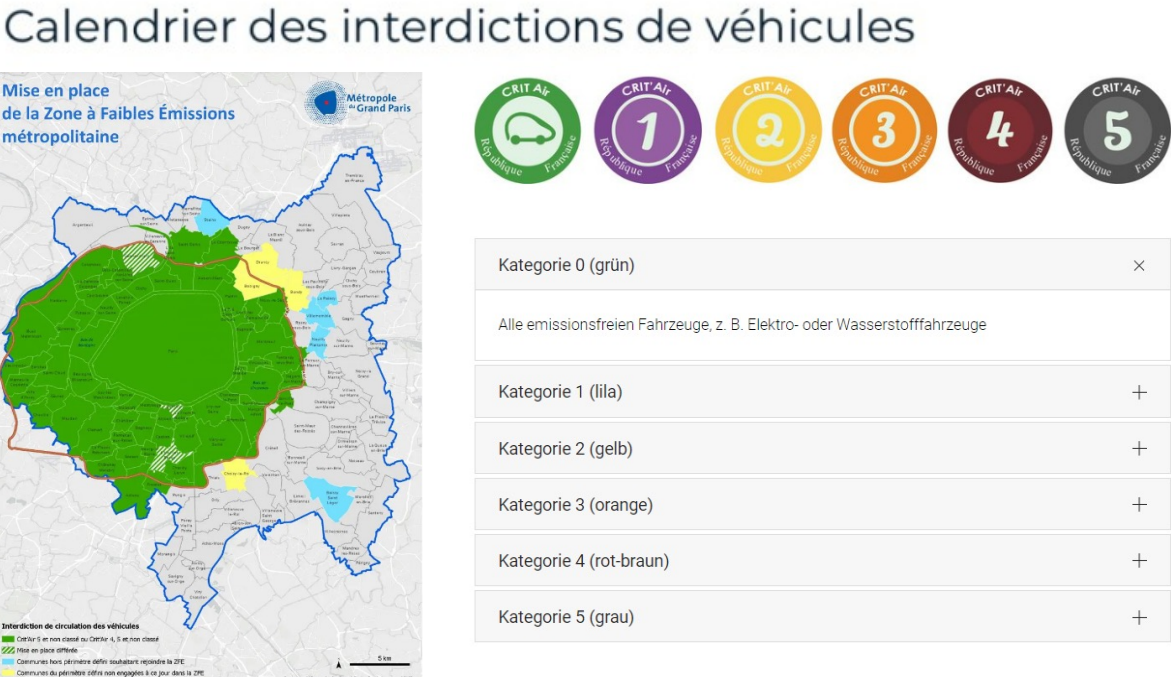
This standard contributes to the following **Sustainable Development Goals**:



Co-financed by the European Union  
Connecting Europe Facility

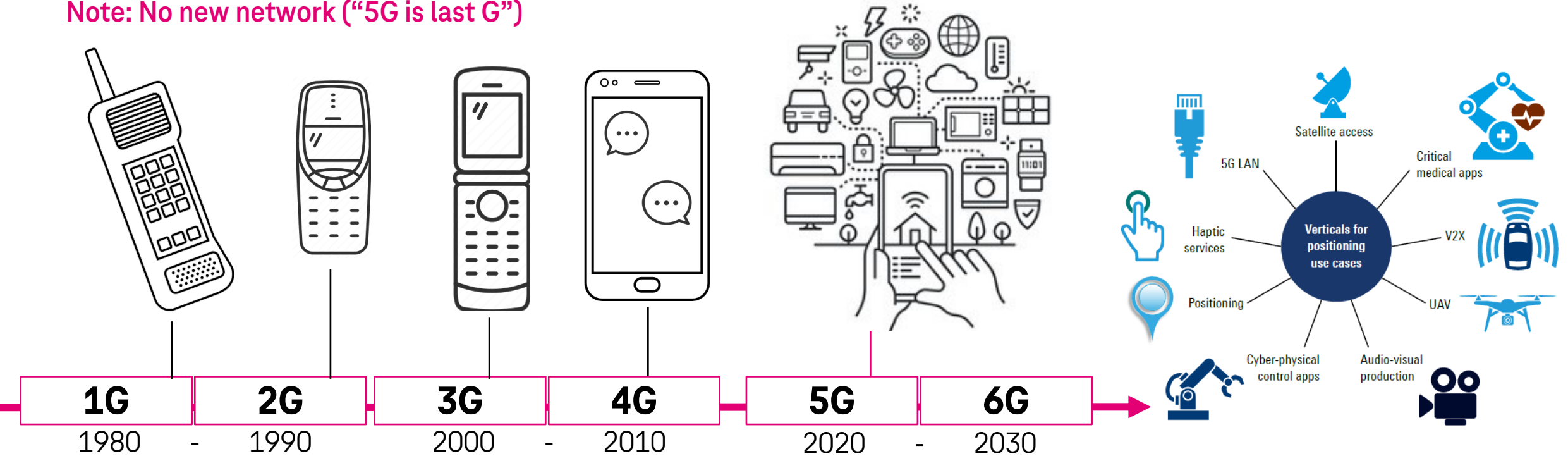


# LEZ Policy Regulation, e.g., Ile-de-France, Grand Paris



# Roadmap towards 6G

Note: No new network ("5G is last G")



Establishing cell phones for everyone → Always connected with a variety of applications → **One integrated network**

**5G is the starting point of Industrial IOT**

**3GPP specifies the evolution path beyond R15**

- 6G is not a new 'G', 5G was last
- 6G NTN to close white spots
- 6G-enabled Precise Positioning
- Network sensing due to >60 GHz bands
- Enables Seamless Container Tracking
- GNSS Tracking: Long-Life Battery Supply
- No Reverse Tracking Device Management



# Beyond 5G Benefits & ISO-23795-1 Carbon Credits



## Vulnerable road users, Public Transportation

Low Latency Collision Alerts (multi-modal)  
Intersection Object Detection (NaaS, CCAM)



## Industry, Logistics, Fleets

Green Navigation via real Space-Time  
relevant trip data  
Iso conform energy monitoring, reliable fuel  
and CO2 reporting, Carbon Certificates



## Traffic managers, Authorities

Cloud based Online Traffic Information (Bn p.m.)  
Impact assessment for corridor management



## Mobility service provider

B2B Marketplaces for data and advertisement  
Seamless and multimodal mobility services  
CO2 certificates to promote low carbon modes