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Tomorrow's Mobility…Is Here Today!

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Infrastructure classification scheme to support the circulation of automated vehicles

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Intelligent Transport Systems (ITS)

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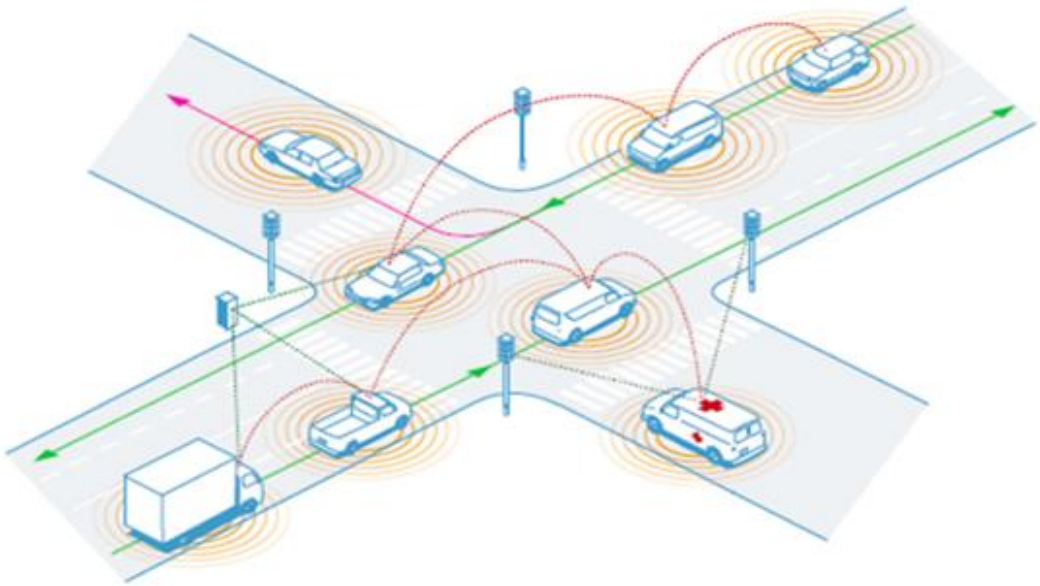
Intelligent Mobility is here

ITS is not a matter of automated vehicles **ONLY**,
it is a matter of effective cooperation of road infrastructure
and **ALL** (AV & conventional) connected **vehicles**

ITS world vision & targets

Vision: Road infrastructure supporting or even fully controlling the coexistence of conventional and automated vehicles, with enhanced traffic flow efficiency, safety, and user appreciation



Targets:

- Increased traffic efficiency by at least 40%
- Increased safety by at least 50%
- Increased user appreciation by at least 70%

All the above just with increased penetration of automated vehicles by at least 30%

Transport Management Center (TMC)

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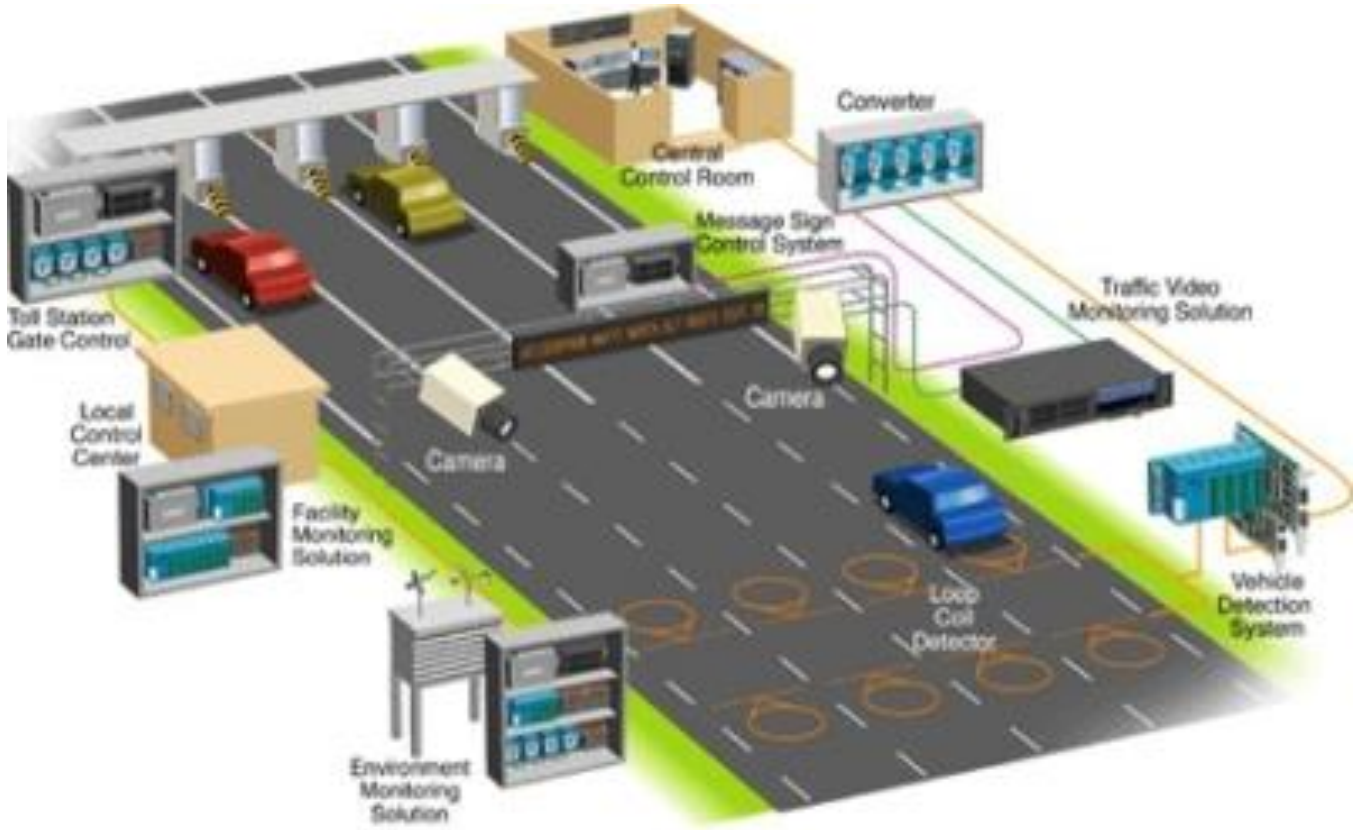
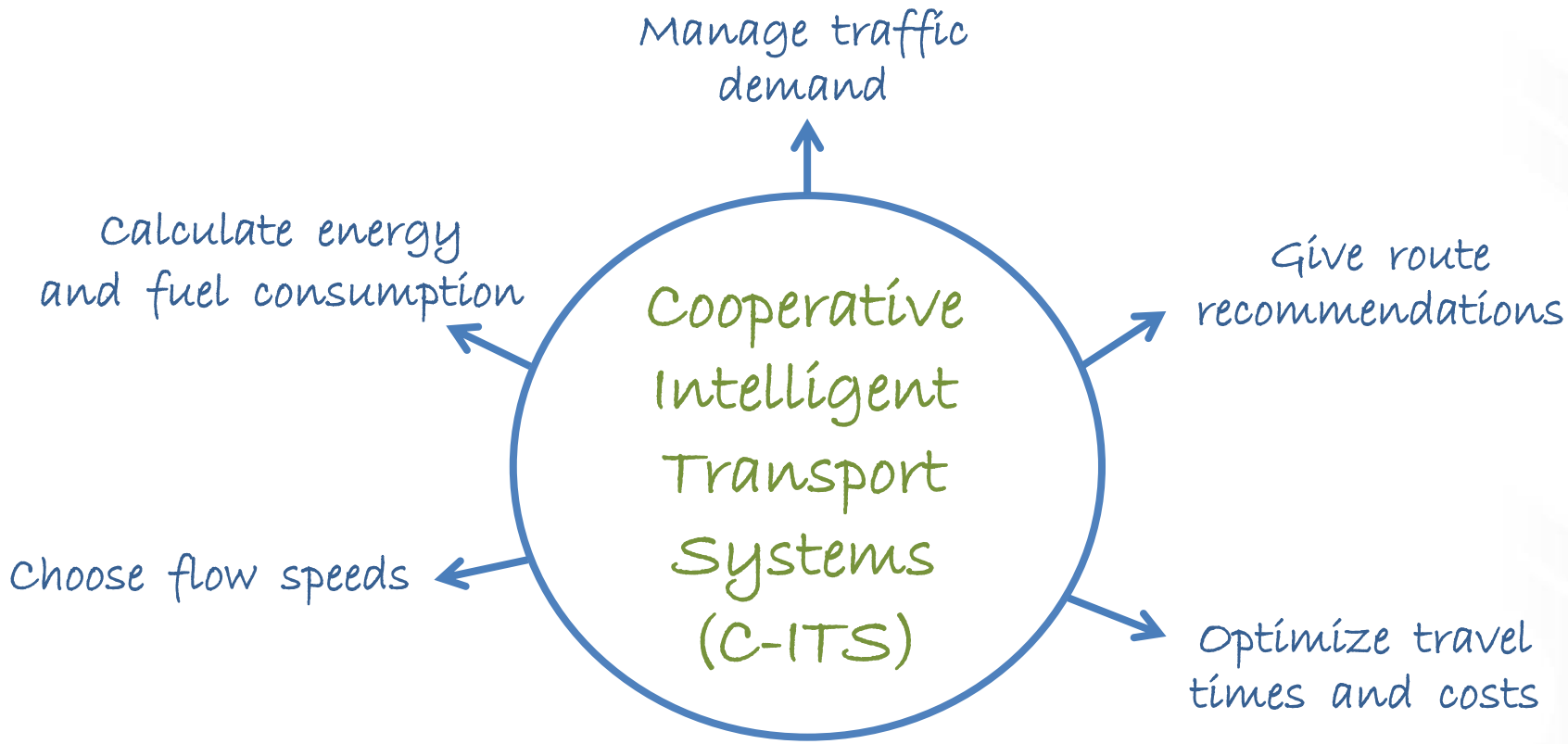
Only a central player (TMC) can achieve the **full** potential of automated driving



Cooperative Intelligent Transport Systems (C-ITS)



Amazon's coordination system of AVs (2017) **"Lane assignments for autonomous vehicles"** generates lane configurations and assignments depending on roadway data

Vehicle-to-Infrastructure (V2I)

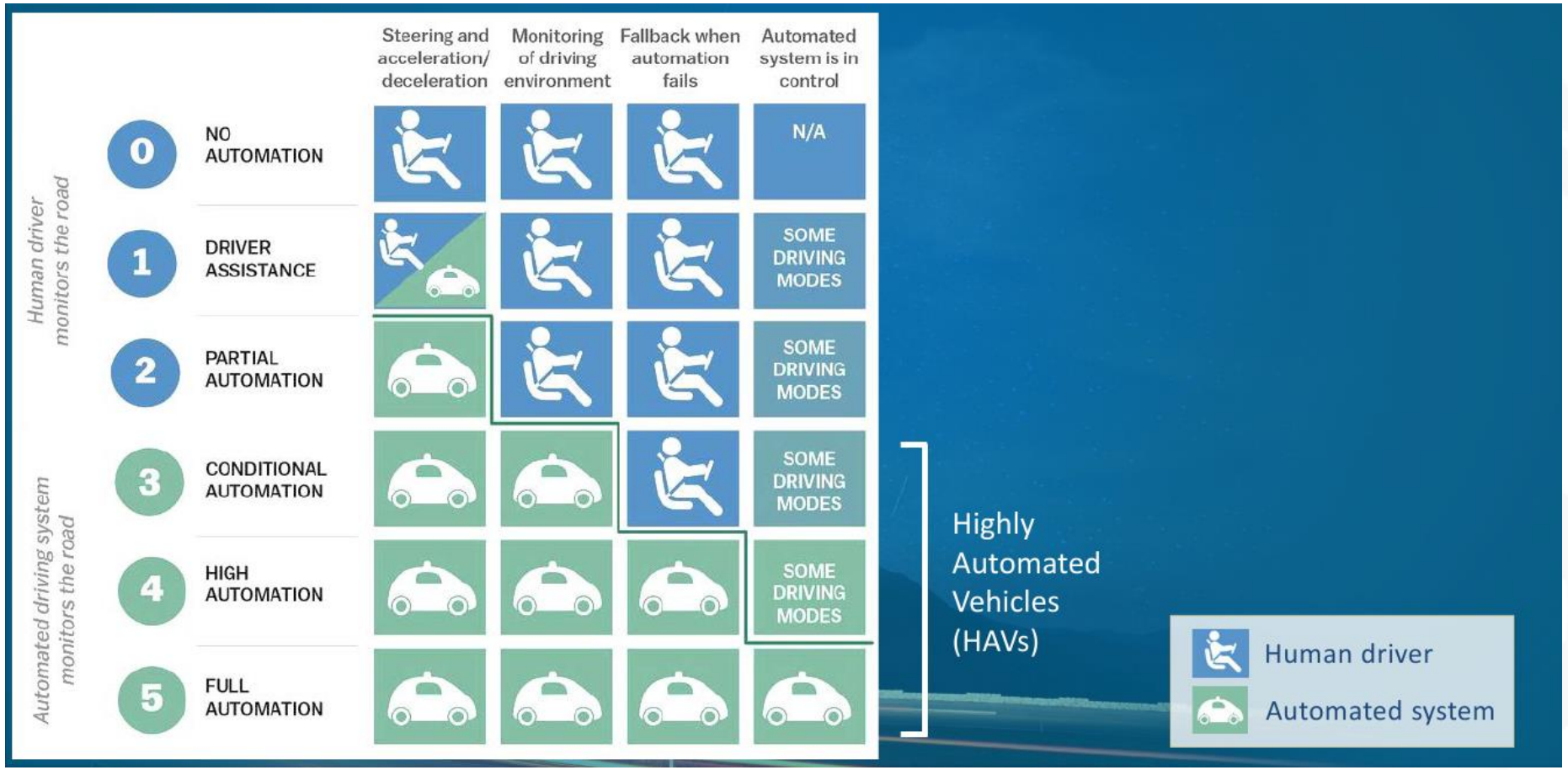
V2I cooperation - interoperability will help drivers receive accurate travel alerts such as:

traffic congestion

bad weather conditions

crashes

Five levels of driving automation



Our approach

ISAD levels mapped to digital, physical, and operational elements

Level / Name	Digital infrastructure	Physical infrastructure	Operational infrastructure
A / Cooperative driving	HD maps (cloud based dig. maps incl. accurate position of signs, dynamic update of lane topology, location of emergency stop zones)	Elements to ensure continuous connectivity (enabling V2X) along the segment (e.g. RSUs)	Dynamic Guidance for Individual & group of vehicles: speed, gap, lane advice
		High precision meteorological stations; in-pavement sensors to detect moisture, temperature, strain	Detailed weather info
		+ level B	+ level B
B/ Cooperative perception	HD maps (cloud based dig. maps incl. accurate position of signs, dynamic update of lane topology, location of emergency stop zones)	Elements to ensure continuous connectivity (enabling V2X) along the segment (e.g. RSUs)	Microscopic traffic situation
		+level C	Data exchange with cloud services
			+ level C
C / Dynamic Digital information	HD maps (incl. accurate position of signs, dynamic update of lane topology)	Dense location referencing points	Automated update of digital infrastructure
		+ level D	Automated data processing
			+ level D

Level / Name	Digital infrastructure	Physical infrastructure	Operational infrastructure
D / Static digital information	Digital map with static road signs (incl. accurate position of signs)	VMS	Handling information related to: Warnings
		+ level E	Incidents
			Weather
E / Conventional infrastructure	-	Vehicle-recognizable road traffic signs; colours, position	-
		Signs with speed limits, road curvature and inclination	
		Good lane markings in both sides	
		Lane width based on standards	
		Working zone signalization	
		Video cameras for real-time vehicle detection	

Road infrastructure is not just a supporting asset for automated driving

Vehicles and road infrastructure are cooperating components

Important requirements/critical factors

Coherent regulatory framework

Public acceptance improvement

Future challenges

Road infrastructure should serve automated vehicles of different SAE levels, as well as connected conventional vehicles

Decision on the level of TMC coordination across different functionalities and ISAD levels

Requirements definition for the transition from manual to control mode (e.g. minimum risk maneuver by TMC after failure of manual take over control)

More specific challenges

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01 Downgrade or upgrade of ISAD level under specific conditions (e.g. weather, traffic incidents, road conditions, technical failures)

02 TMC speed, gap and lane change advice based on individual driving style

03 V2V communication

04 TMC decision on formation or break-up of platooning

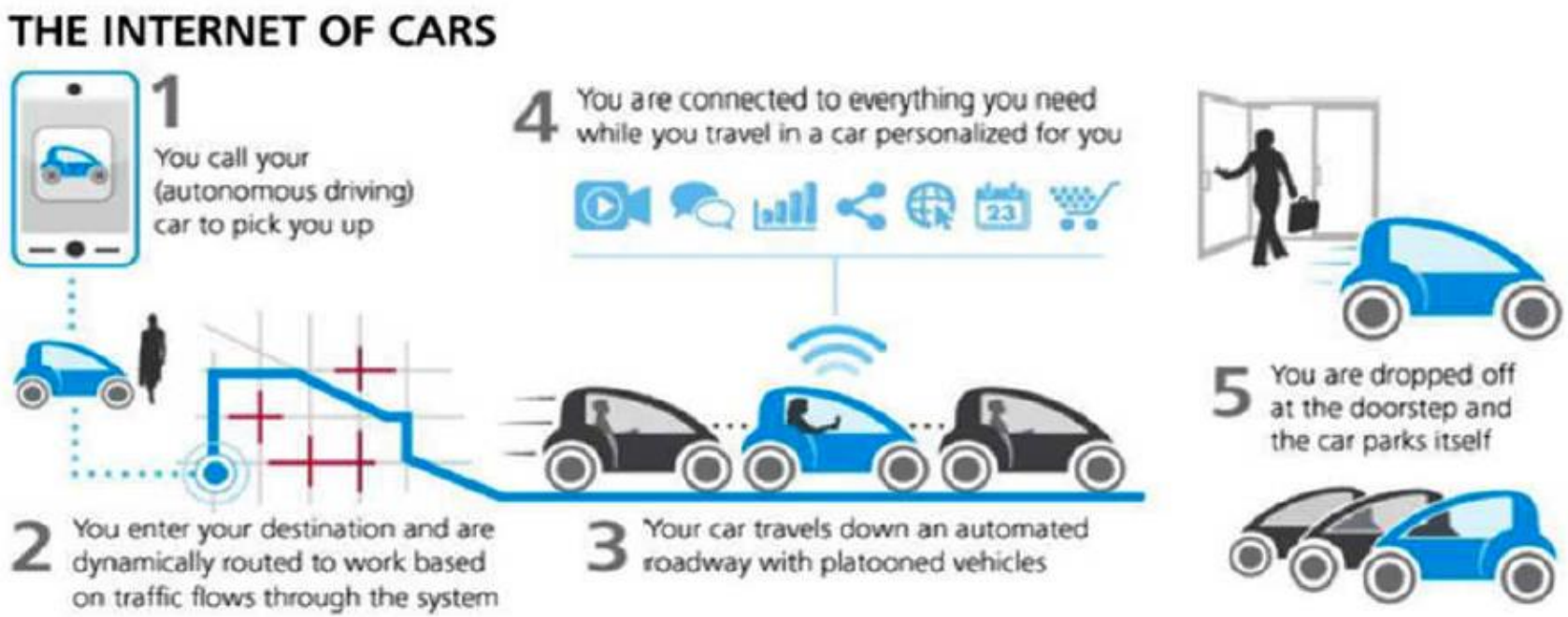
05 Information drivers want to get from TMC to make driving safer and more comfortable

06 Road infrastructure requirements for Pay-as-You Go insurance and Pay-as-You Go toll services

07 V2I simultaneous speech and screen interaction

08 Liability for an accident (driver, car manufacturer or the infrastructure authority?)

C-ITS



Source: Sessa et al., 2013.

C-ITS → Enabler for the transition to the concept of **mobility as a pure service**

Keep track on INFRAMIX

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- **Website:** https://www.inframix.eu/
- **Twitter:** @inframix
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