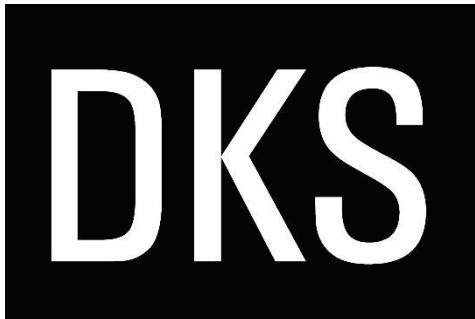


Smart Cities & *Smart Mobility* *Bend & Central Oregon*

Central Oregon ITS Plan Update | December 16, 2019



Adrian Pearmine
National Director for Smart Cities and Connected Vehicles
DKS Associates







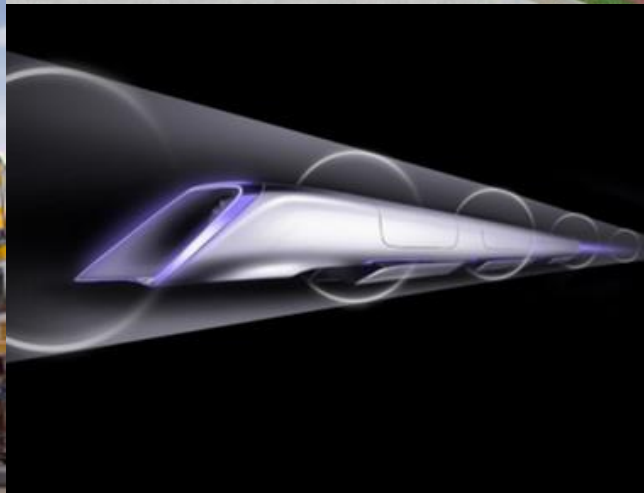
ELECTRICITY MAY BE THE DRIVER! 1950s promotional advertisement for *America's Electric Light and Power Companies*



UBER

N323UX

Future of ~~Transportation~~ Mobility: 3rd Revolution



What is the *Third Revolution*?



Mobility Part 1: Walking



Mobility Part 1: Horse & Buggy

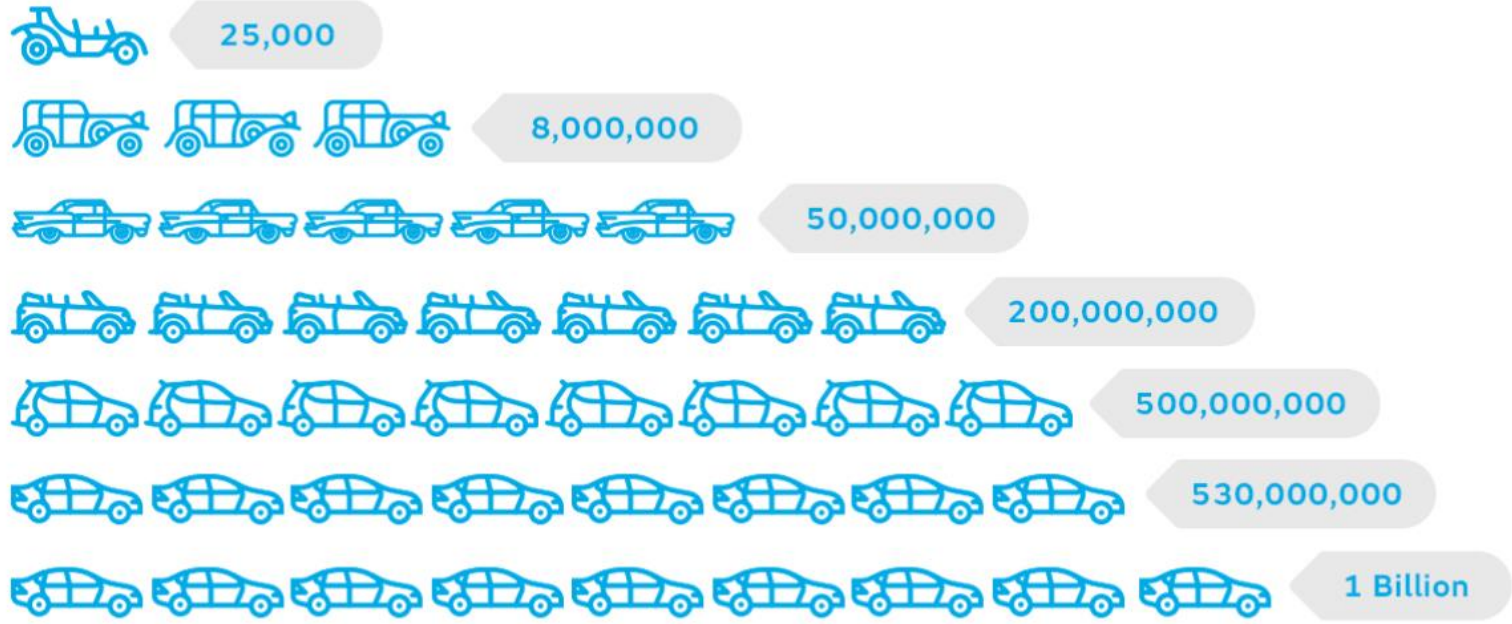




Revolution 1: Cars & Airplanes

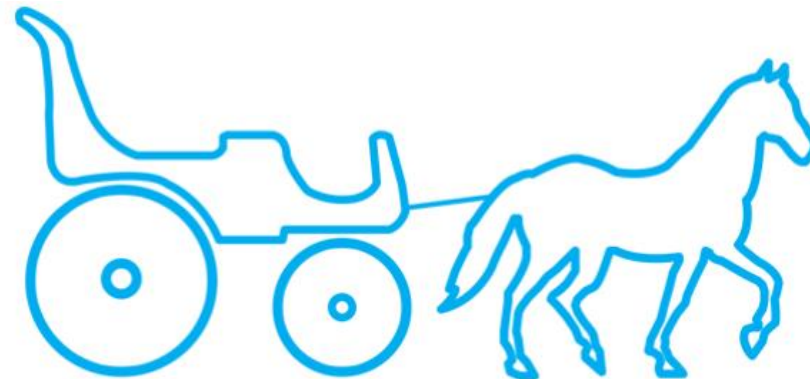


- 1900
- 1920
- 1950
- 1970
- 1990
- 2002
- 2010



11.8mph

Average speed in London 2016

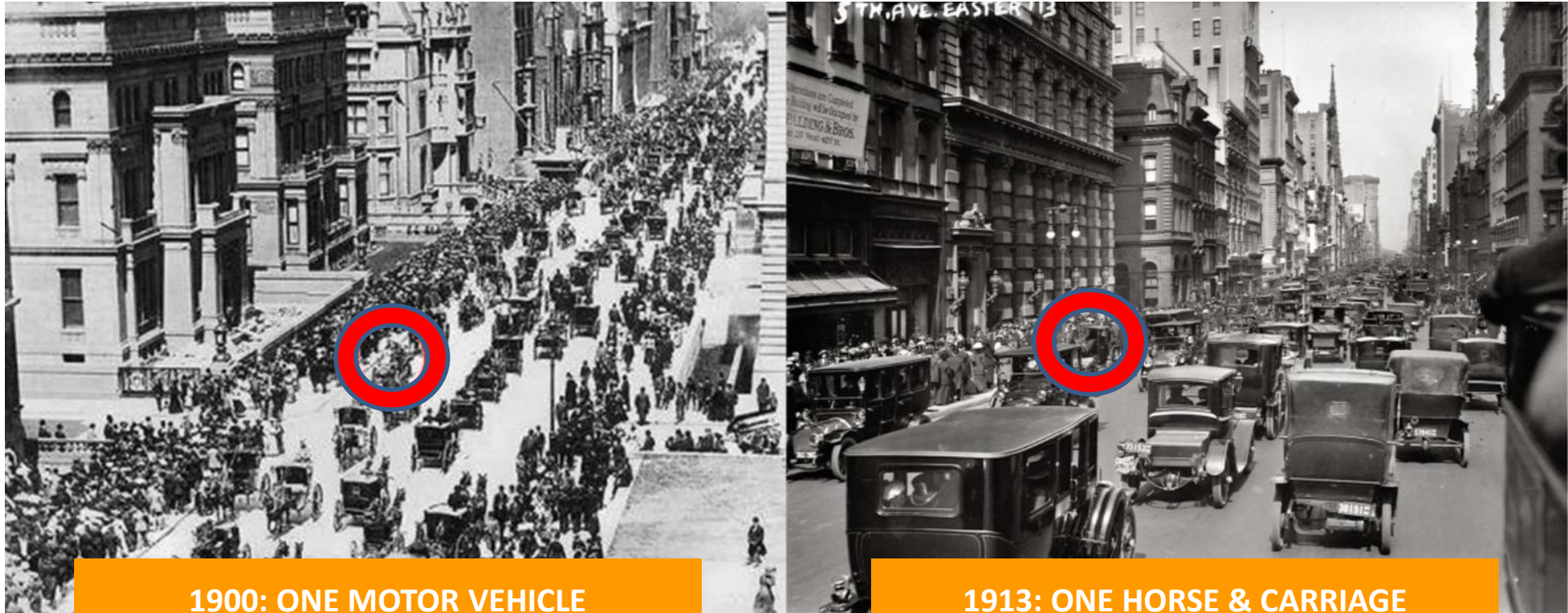


17mph

Average speed in London 1916

First Mobility Revolution: *How Quickly?*

EASTER PARADES IN NEW YORK CITY



1900: ONE MOTOR VEHICLE

1913: ONE HORSE & CARRIAGE



Safety

- 33,561 highway deaths in 2012
- 5.615 million crashes in 2012
- Leading cause of death for ages 4, 11-27



Mobility

- 5.5 billion hours of travel delay
- \$121 billion cost of urban congestion



Environment

- 2.9 billion gallons of wasted fuel
- 56 billion lbs of additional CO₂



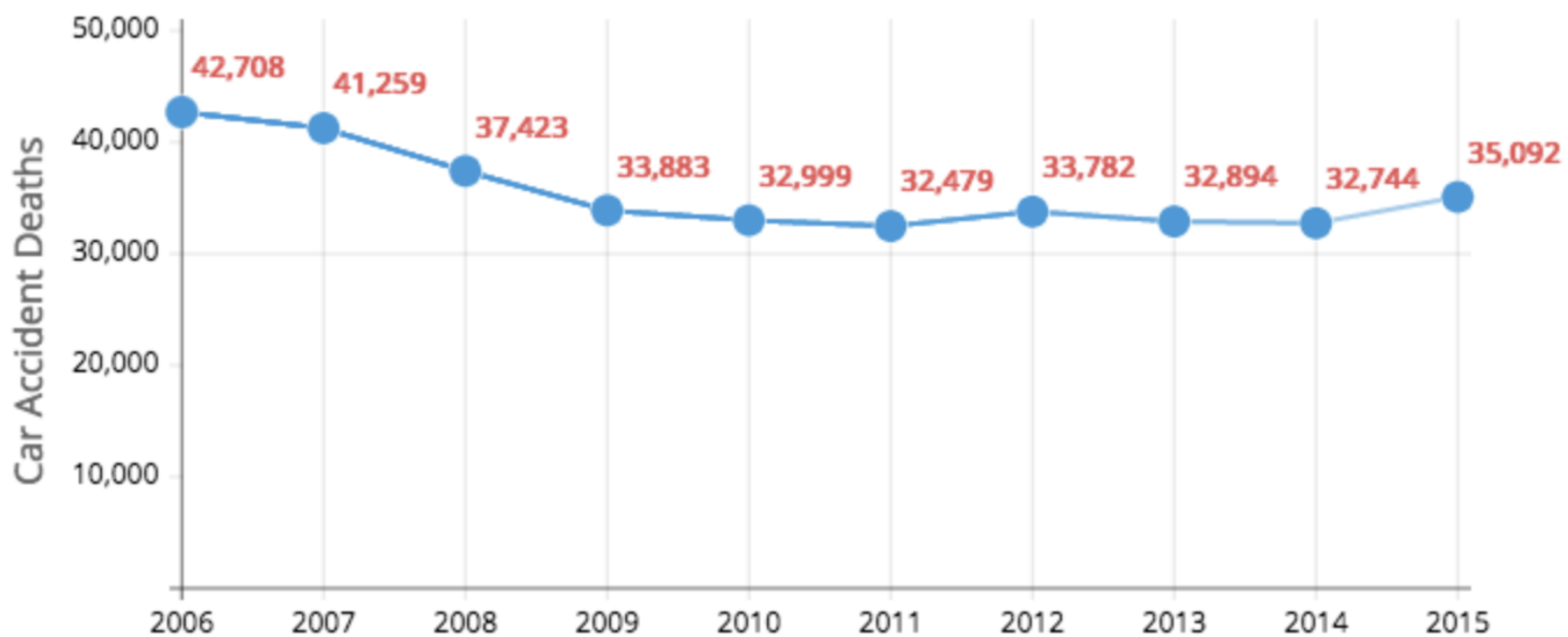
Data Sources:

Traffic Safety Facts: 2012 Data, National Highway Traffic Safety Administration (Nov 2013)

2011 Annual Urban Mobility Report, Texas Transportation Institute (Feb 2013)

Car Accidents Deaths

2006-2015



Source: Insurance Institute for Highway Safety - Fatality Facts

YOUR DRIVING COSTS 2017

AVERAGE COSTS TO OWN AND OPERATE A NEW VEHICLE ANNUALLY*

\$8,469

SMALL SEDAN	SMALL SUV	HYBRID
\$6,354	\$7,606	\$7,687
MEDIUM SEDAN	ELECTRIC VEHICLE	MINIVAN
\$8,171	\$8,439	\$9,146
LARGE SEDAN	MEDIUM SUV	PICKUP TRUCK
\$9,399	\$9,451	\$10,054



NewsRoom.AAA.com

*BASED ON 15,000 MILES ANNUALLY.



YOUR DRIVING COSTS

2015



DEPRECIATION
\$3,654/year
42%



FUEL
\$1,681.50/year
19.3%



INSURANCE
\$1,115/year
12.8%



TIRES
\$147/year
1.7%



MAINTENANCE
\$766.50/year
8.8%



LICENSE, TAXES & REGISTRATION
\$665/year
7.7%



FINANCE CHARGES
\$669/year
7.7%



NewsRoom.AAA.com

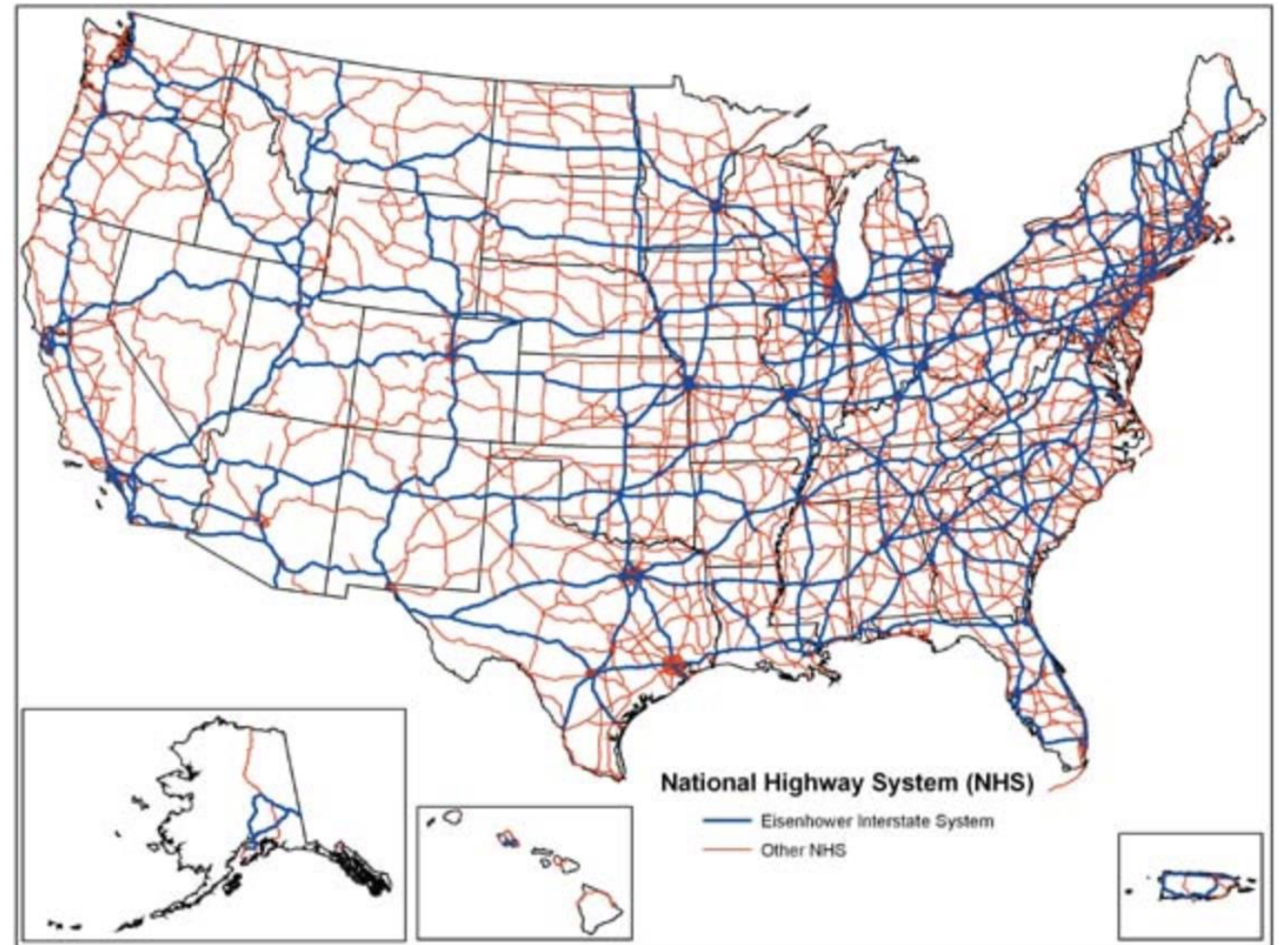
Revolution #2: National Highway & Freeway System

Federal Aid Highway Act of 1956



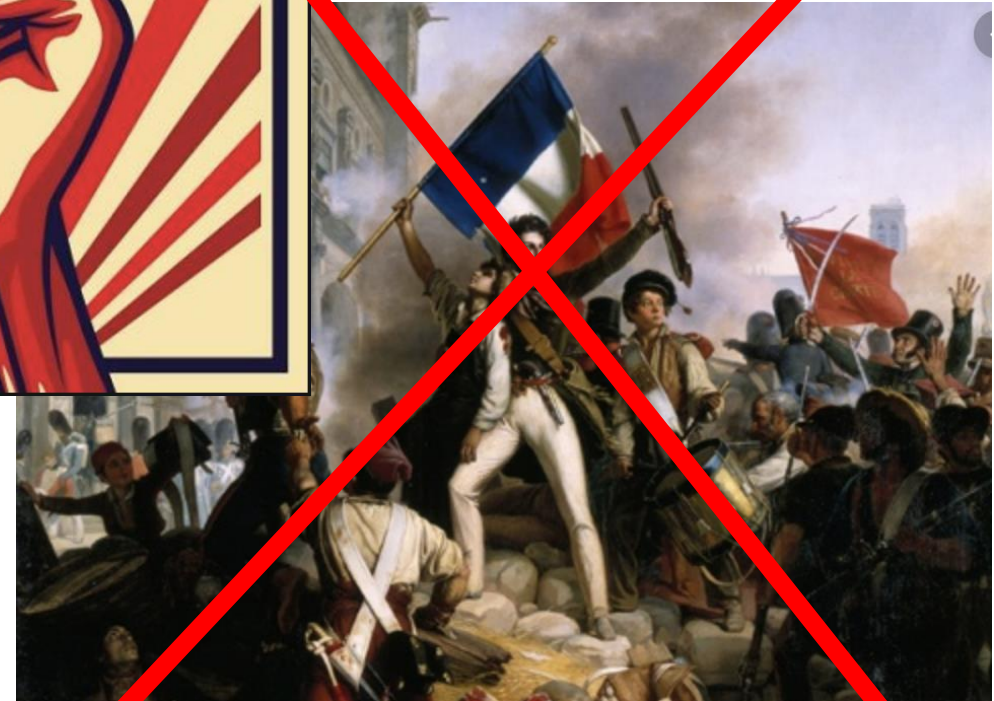
**Other
short titles**

Highway Construction Act
National Interstate and Defense Highways Act





What is the *Third Revolution*? (of Mobility)



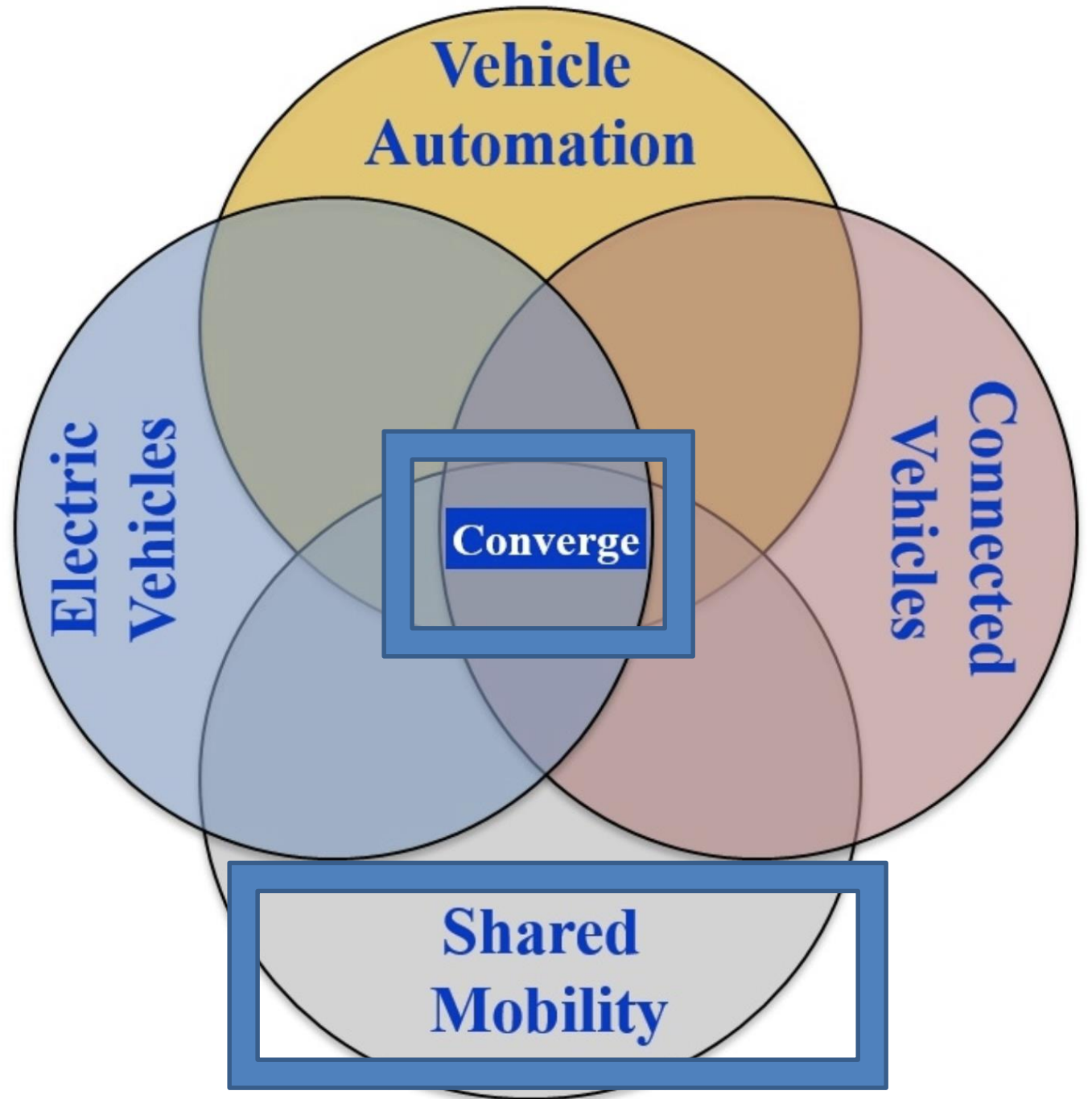
ACES

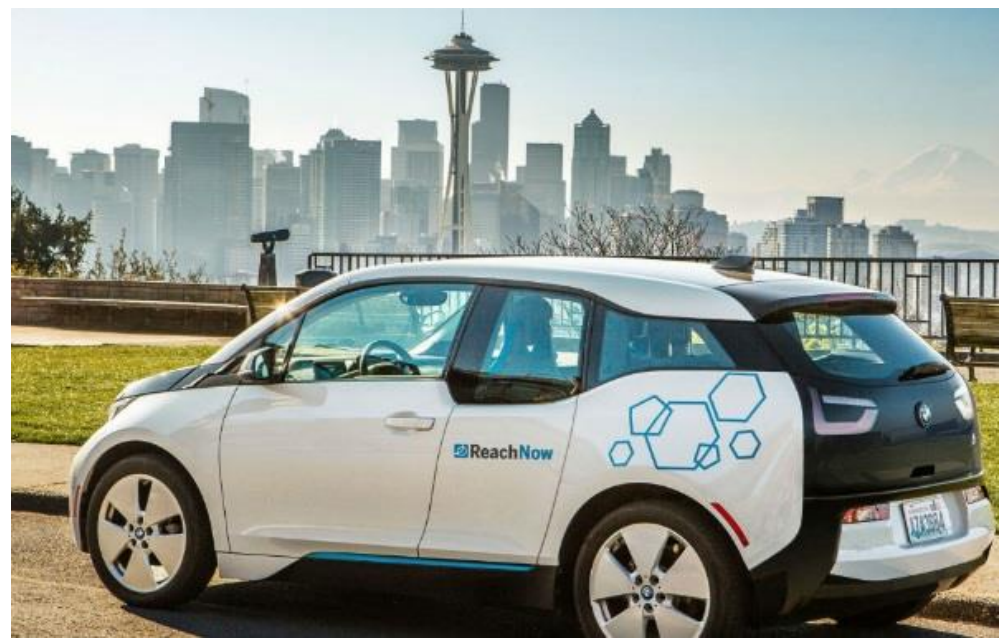
Automated

Connected

Electric

Shared

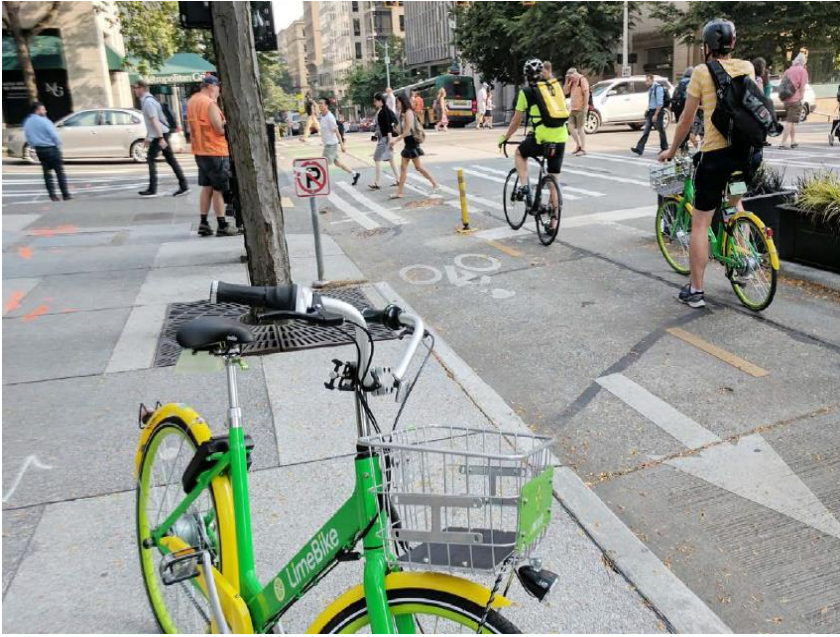




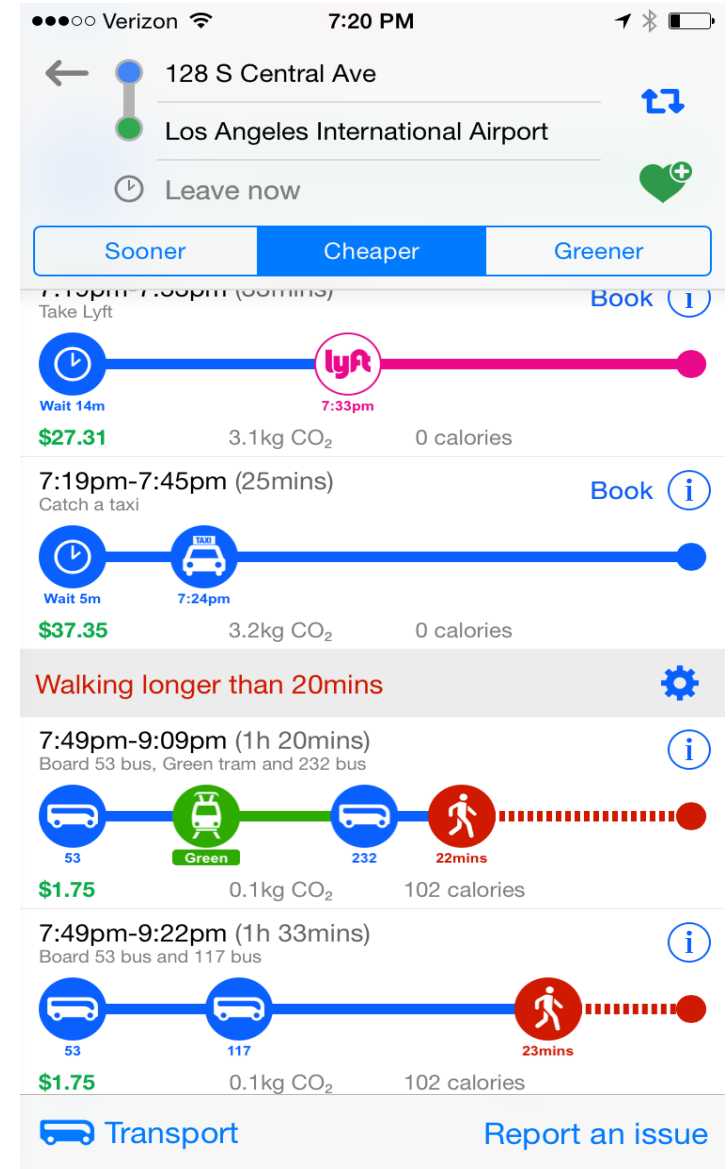
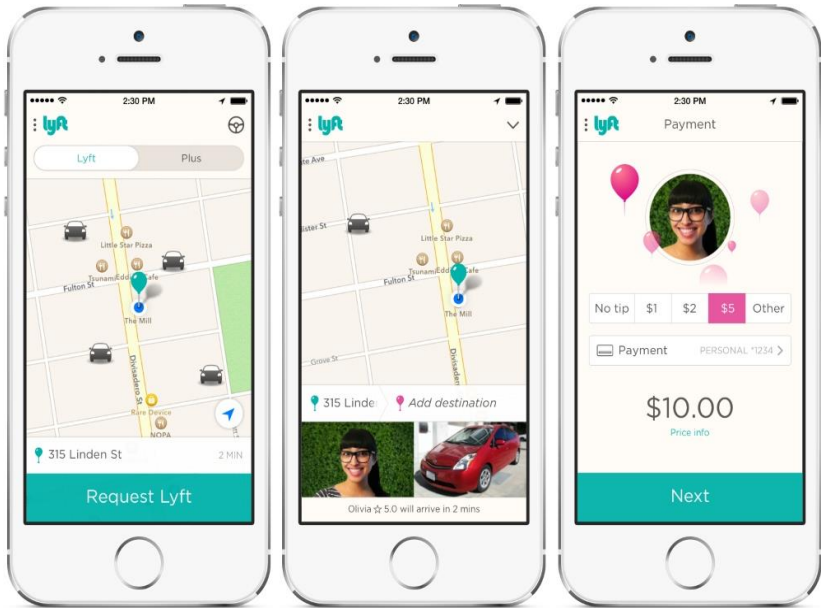
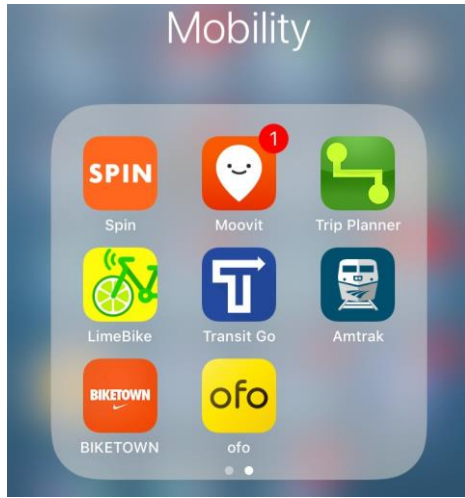
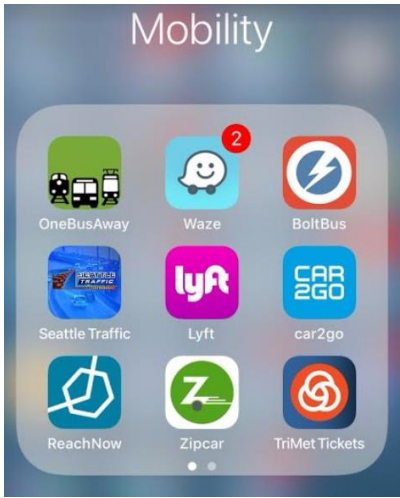


Uber Lyft

RIDESHARE



MaaS



» Speed of TaaS adoption

TaaS (same thing)

Individual ownership miles
TaaS miles

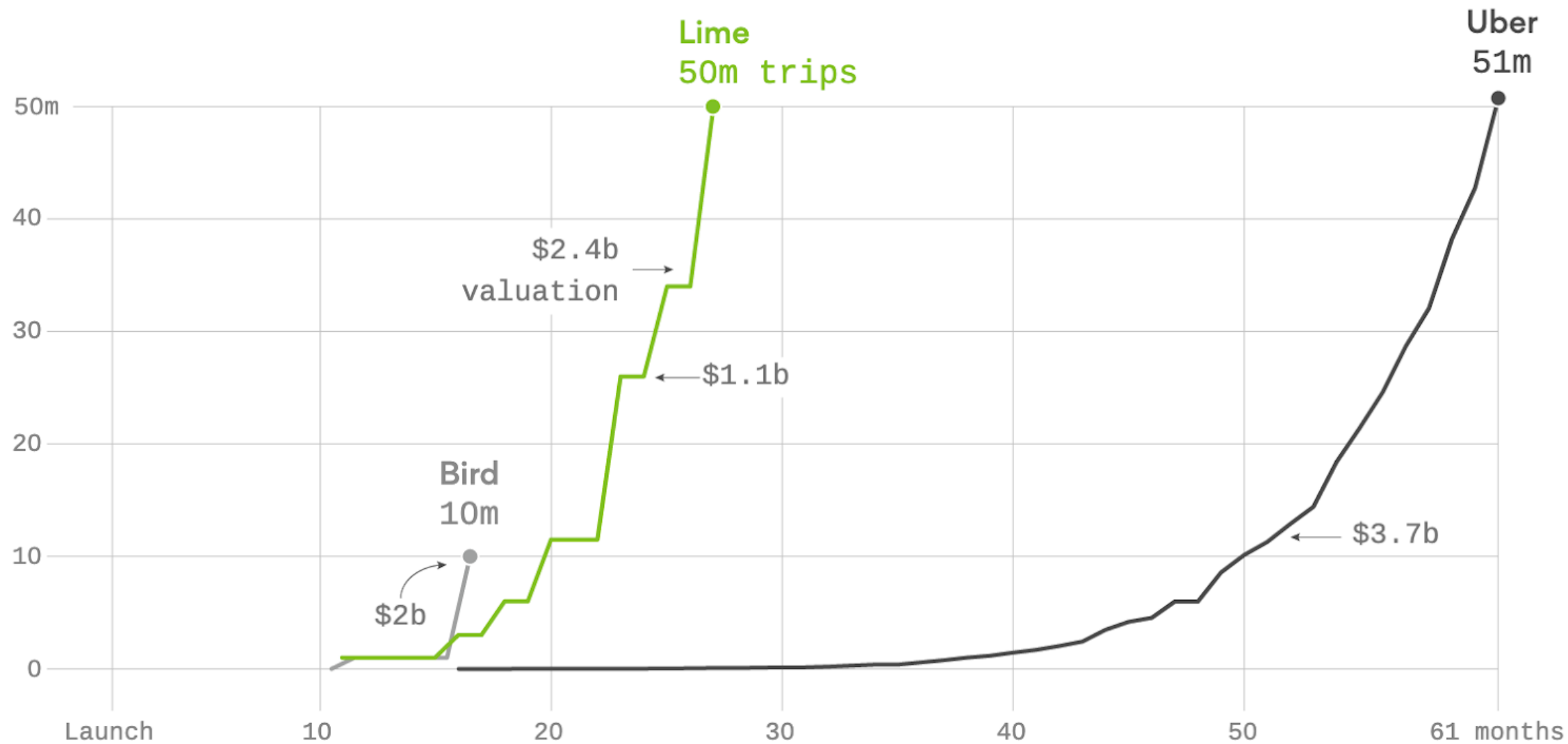


Individual owri
TaaS miles

Micromobility: particularly scooters

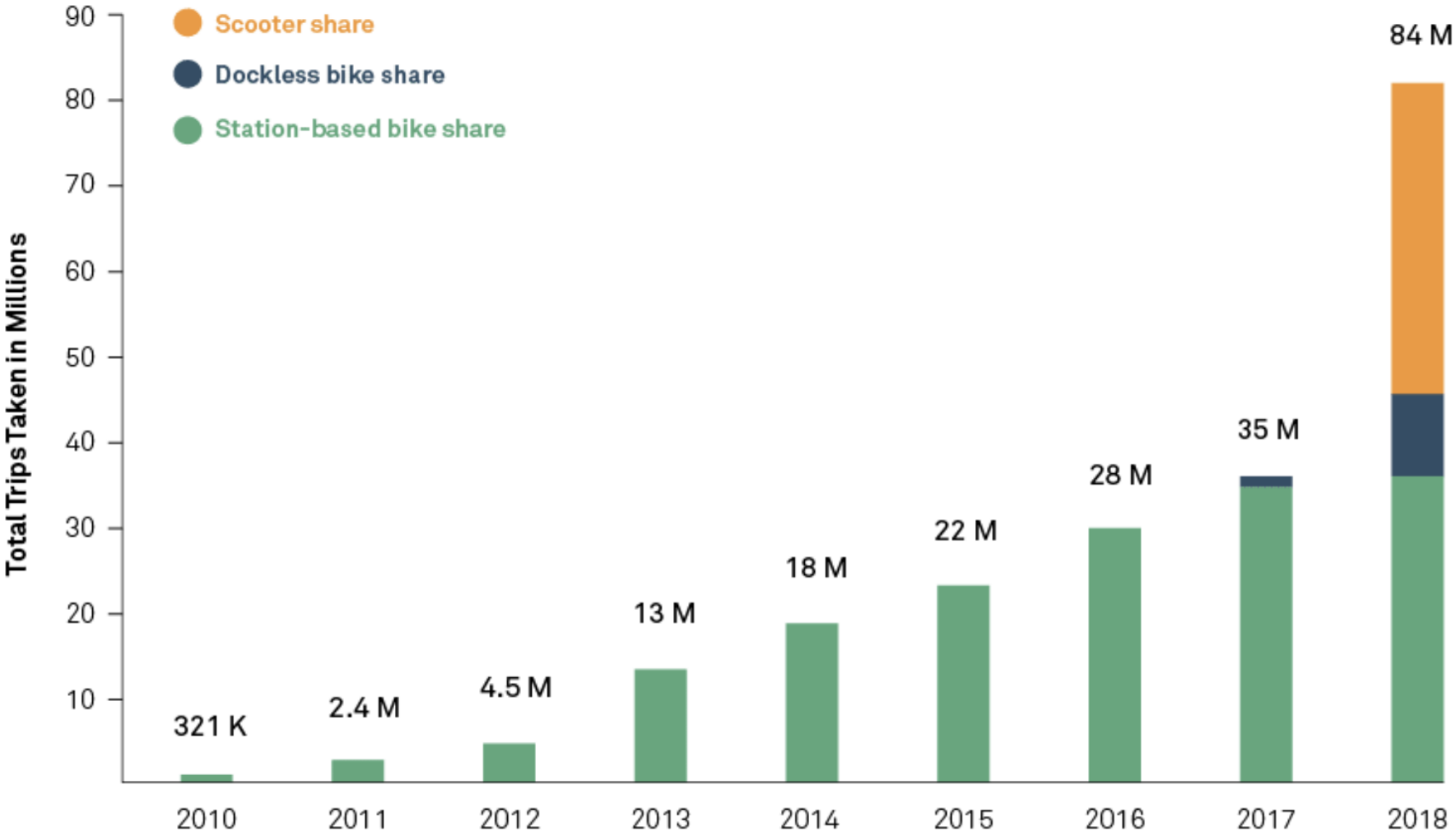


Total trips since launch for Uber, Lime and Bird



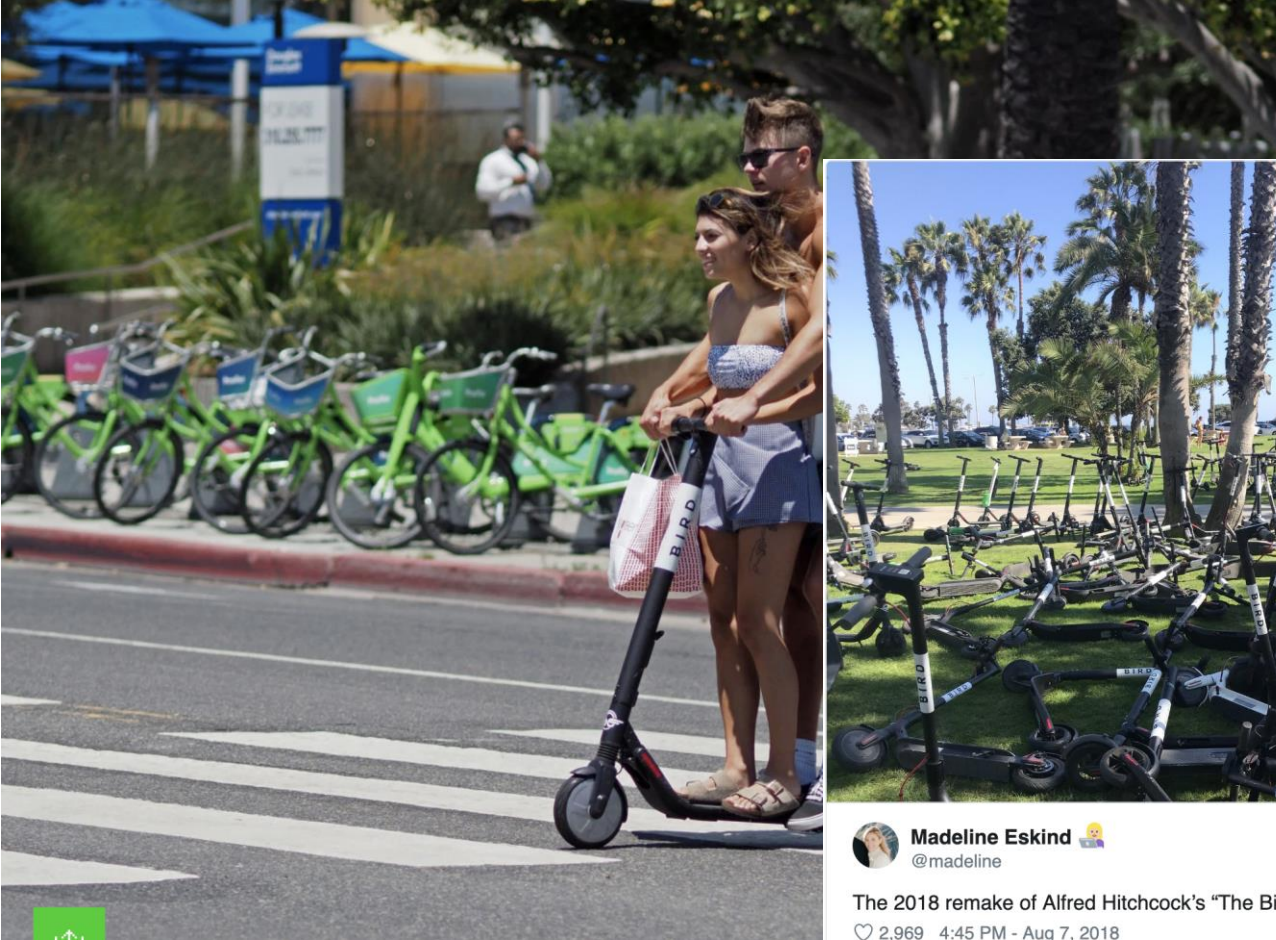
Data: Axios research; Chart: Naema Ahmed/Axios

84 Million Trips on Shared Micromobility in 2018



Source: NACTO

Scooters: What we want / what we don't



 **Madeline Eskind** 🧑
@madeline

The 2018 remake of Alfred Hitchcock's "The Birds"
❤️ 2,969 4:45 PM - Aug 7, 2018

🗨️ 914 people are talking about this

Policy, Engineering & Investment



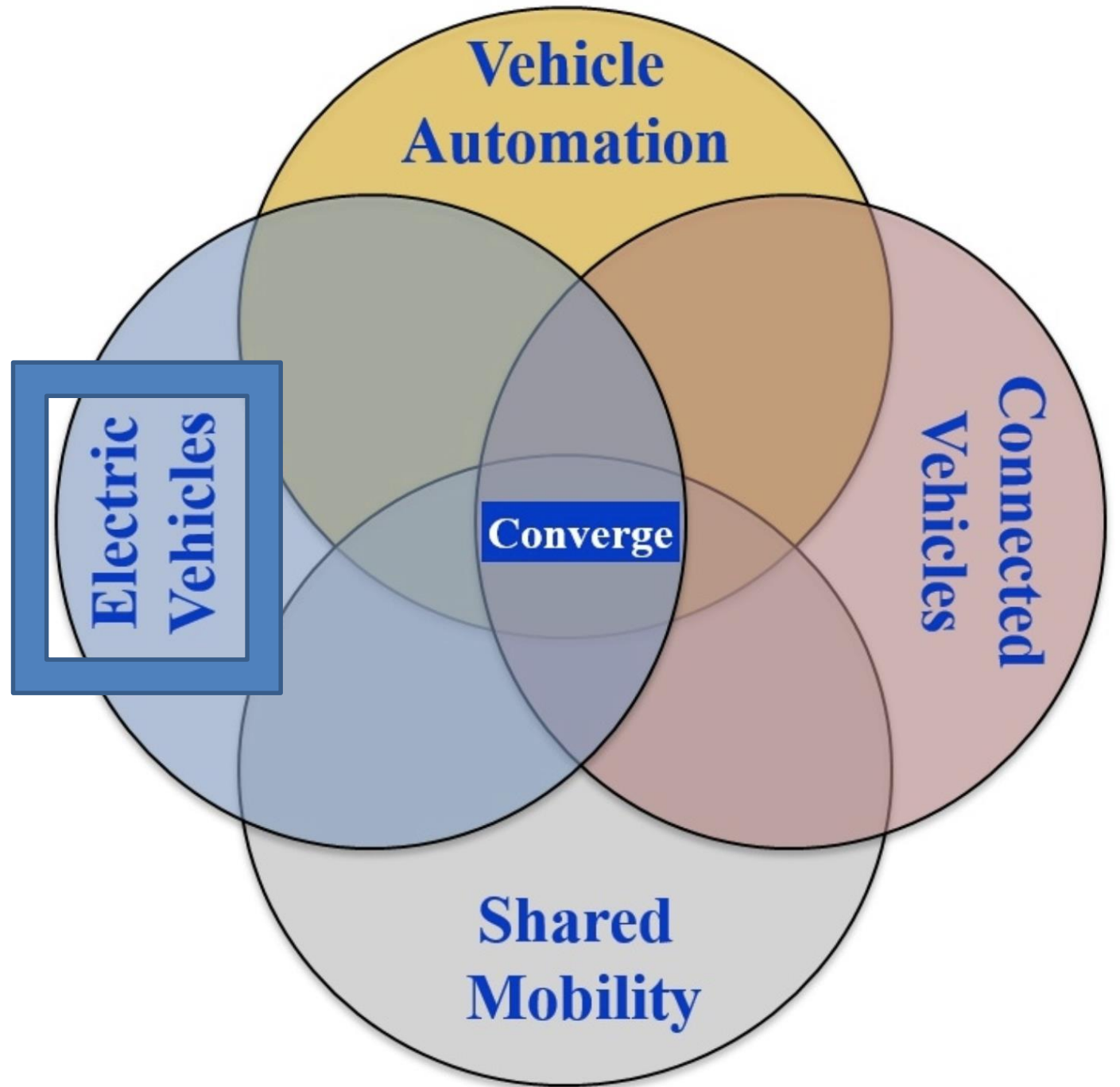
ACES

Automated

Connected

Electric

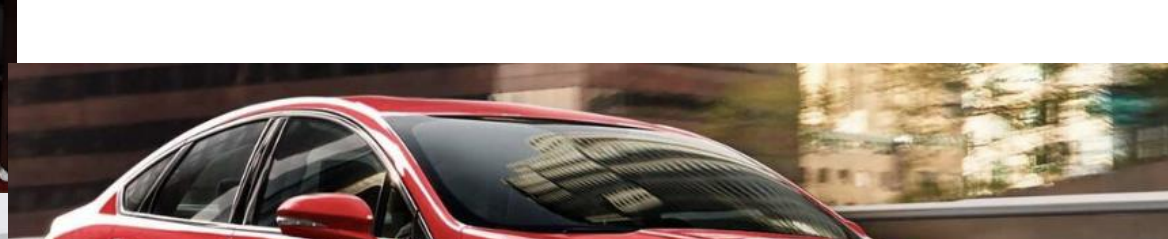
Shared





SUNOCO





JAGUAR



PEUGEOT







PRODUCT	BRAND/MODEL	RANGE	TOP SPEED	WEIGHT	PRICE
Segway	Segway miniPRO	14 miles	10 mph	28 lbs.	\$ 600
E-Unicycle	Uno Bolt	25 miles	22 mph	45 lbs.	\$ 1,500
Scooterboard	InMotion Technology	7.5 miles	15.5 mph	22 lbs.	\$ 700
E-Unicycle	Onewheel+	7 miles	19 mph	24.5 lbs.	\$ 1,500
E-Skateboard	Boostedboard (2nd Gen.) Dual+	7 miles	22 mph	15 lbs.	\$ 1,500
Hoverboard	EpikGo Classic	12.5 miles	12 mph	20 lbs.	\$ 600
E-Unicycle	Solowheel Xtreme	10 miles	14 mph	26 lbs.	\$ 1,800



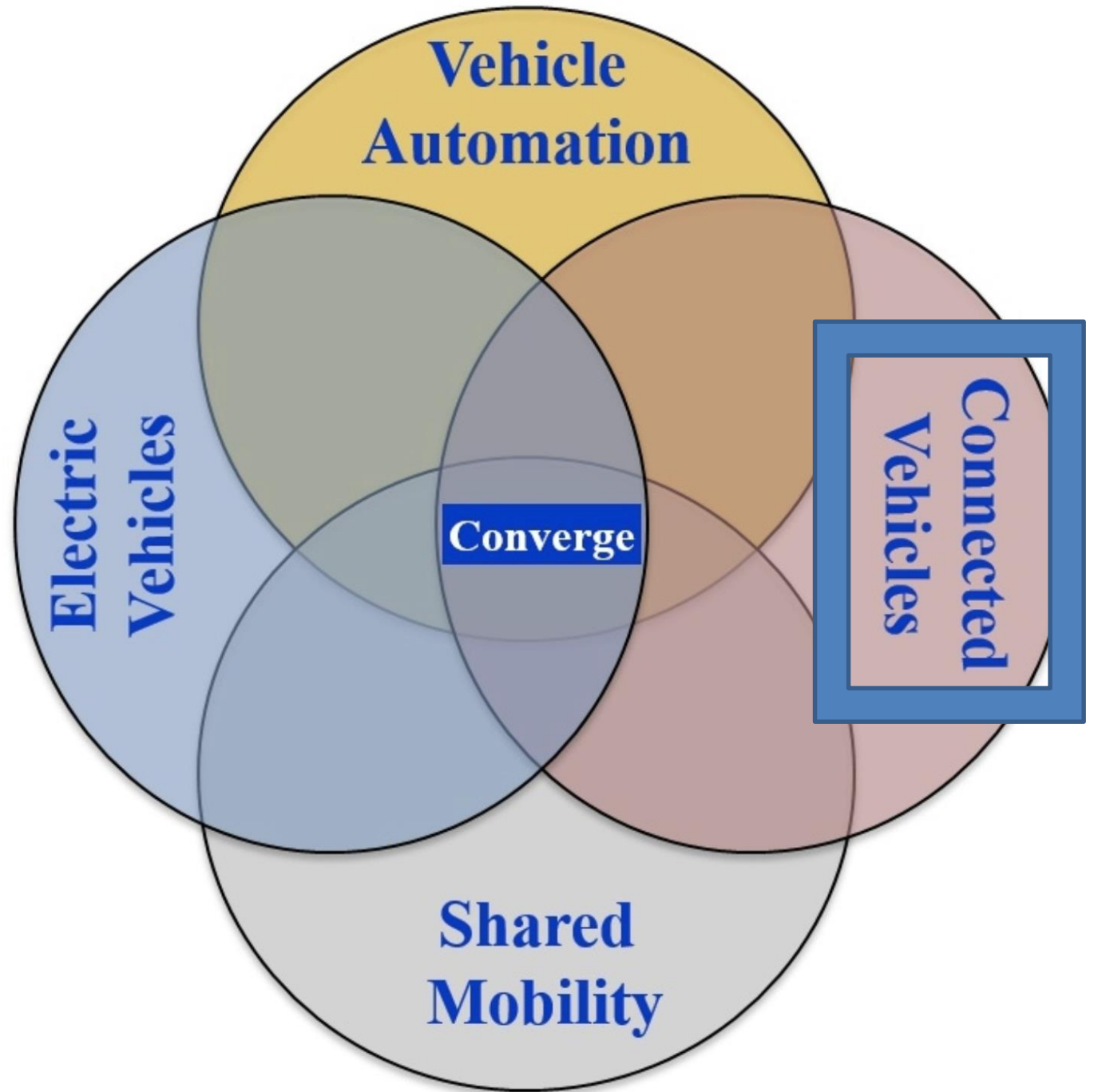
ACES

Automated

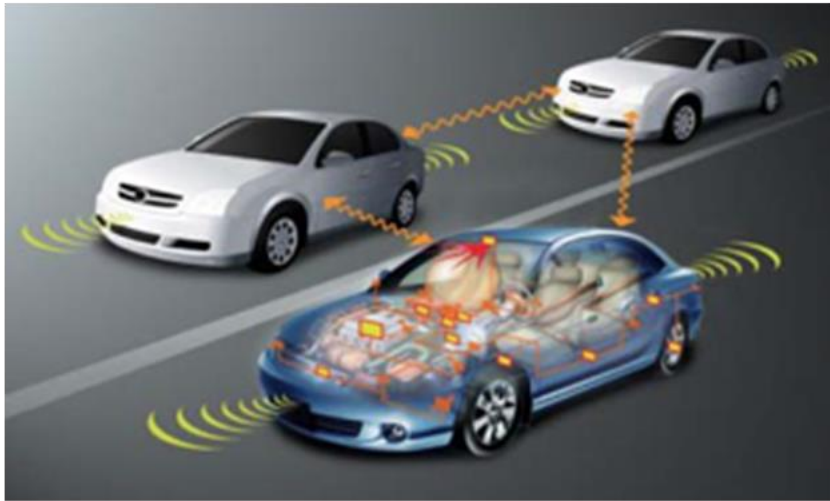
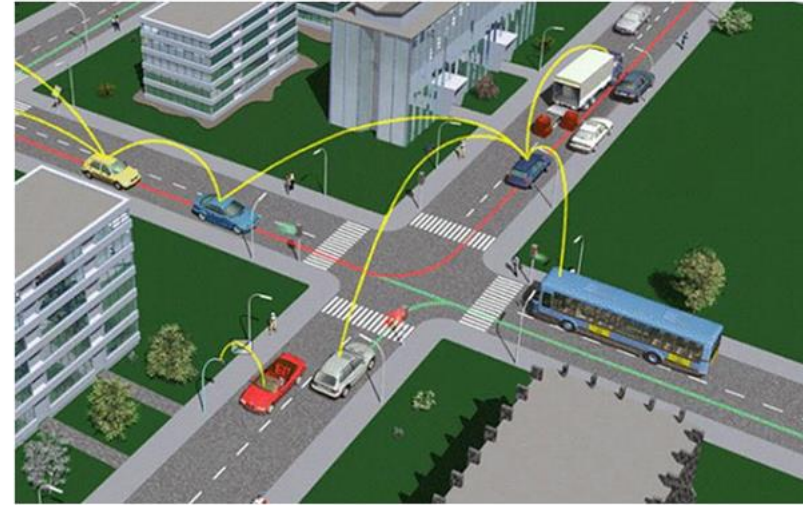
Connected

Electric

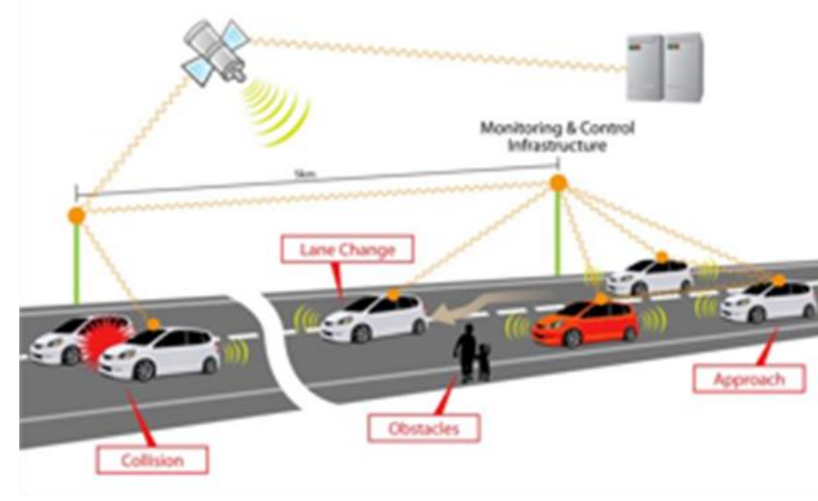
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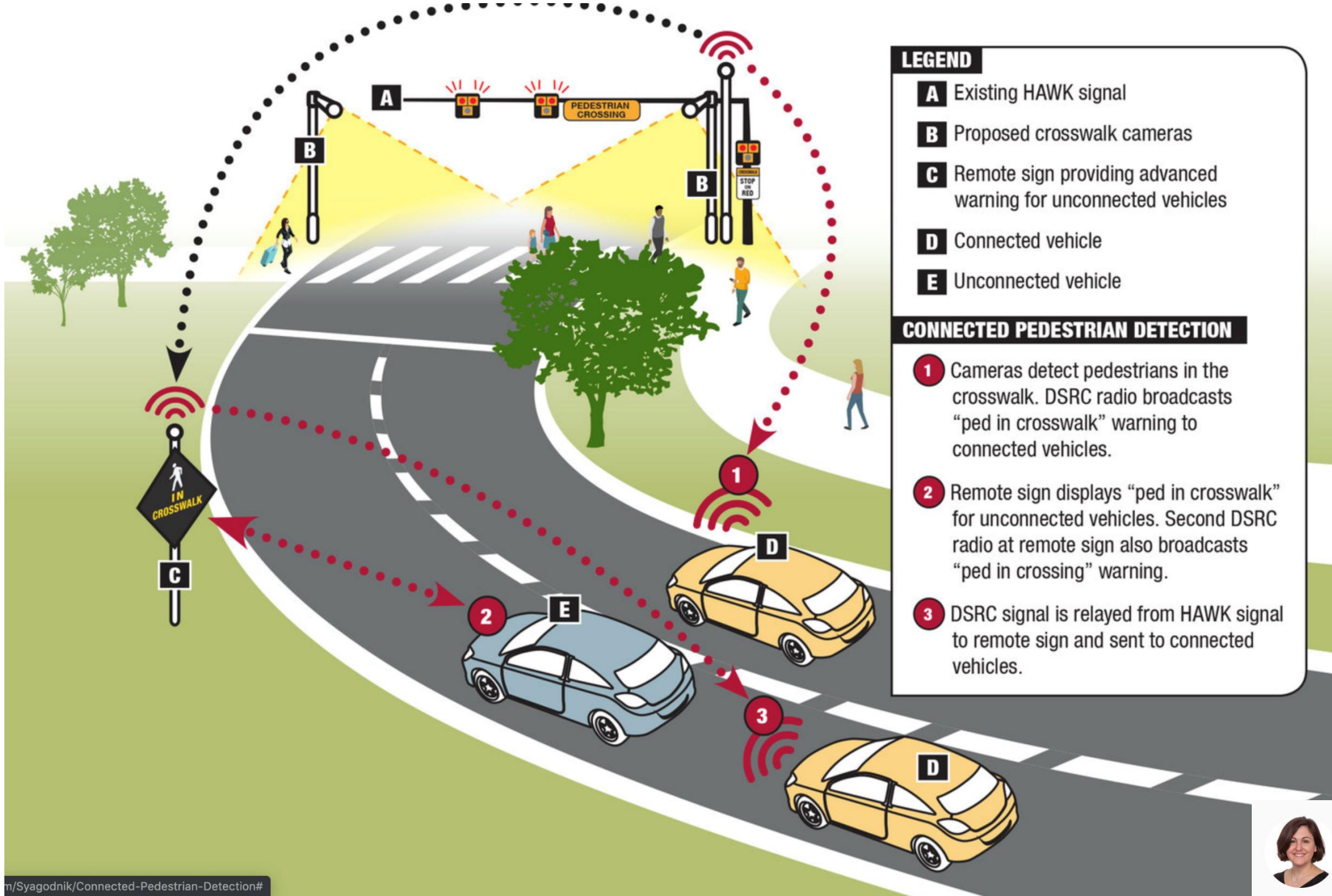
WHAT ARE CONNECTED VEHICLES CONNECTED TO?



V2V: Vehicle-to-Vehicle



V2I: Vehicle-to-Infrastructure



LEGEND

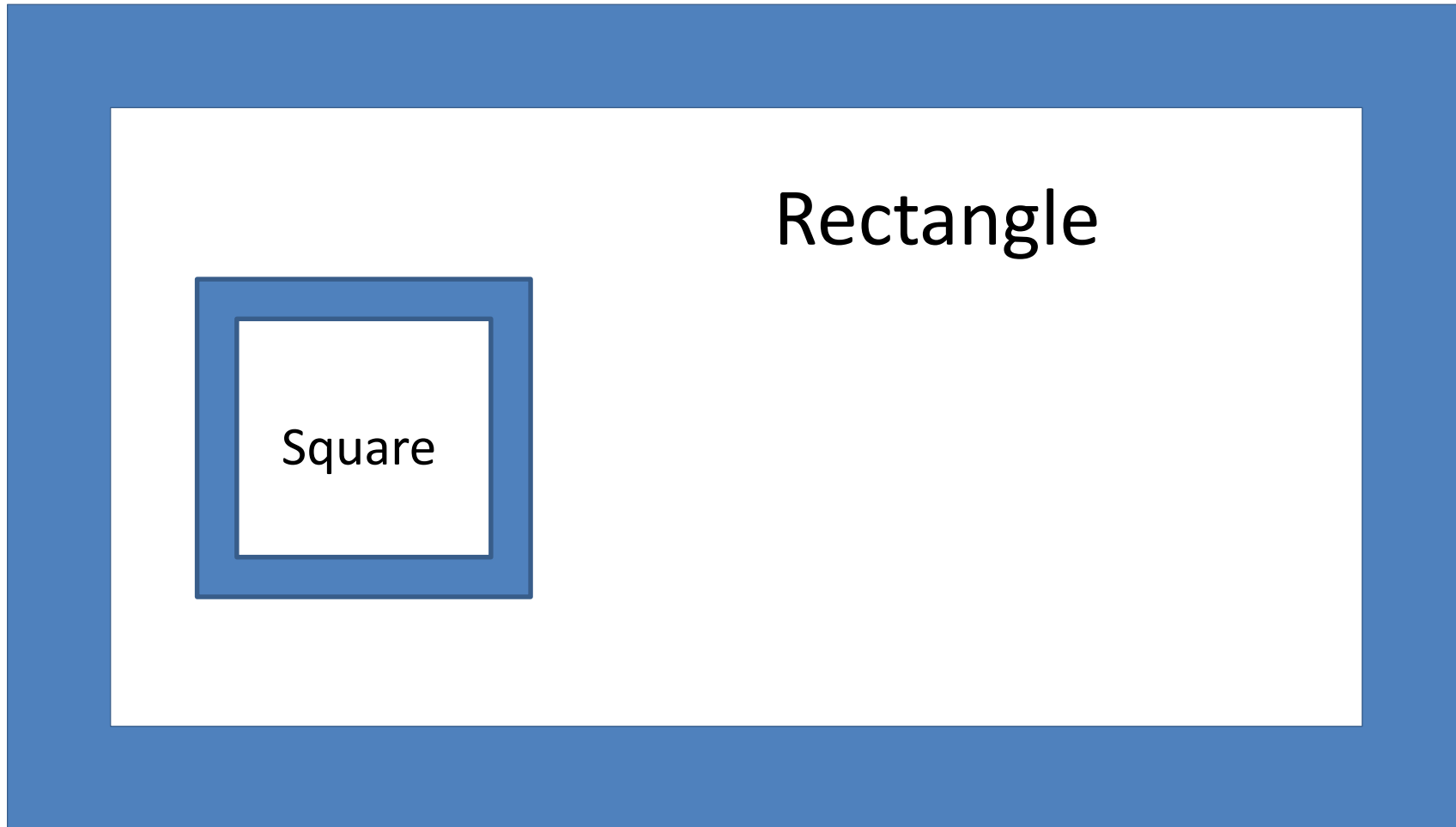
- A** Existing HAWK signal
- B** Proposed crosswalk cameras
- C** Remote sign providing advanced warning for unconnected vehicles
- D** Connected vehicle
- E** Unconnected vehicle

CONNECTED PEDESTRIAN DETECTION

- 1** Cameras detect pedestrians in the crosswalk. DSRC radio broadcasts “ped in crosswalk” warning to connected vehicles.
- 2** Remote sign displays “ped in crosswalk” for unconnected vehicles. Second DSRC radio at remote sign also broadcasts “ped in crossing” warning.
- 3** DSRC signal is relayed from HAWK signal to remote sign and sent to connected vehicles.



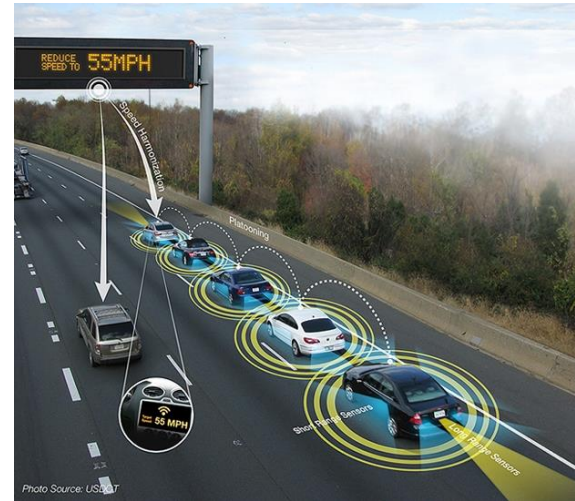
Relationship of Connected to Autonomous



Eventually Autonomous Vehicles will be Connected

Connected Vehicles

Autonomous
Vehicles



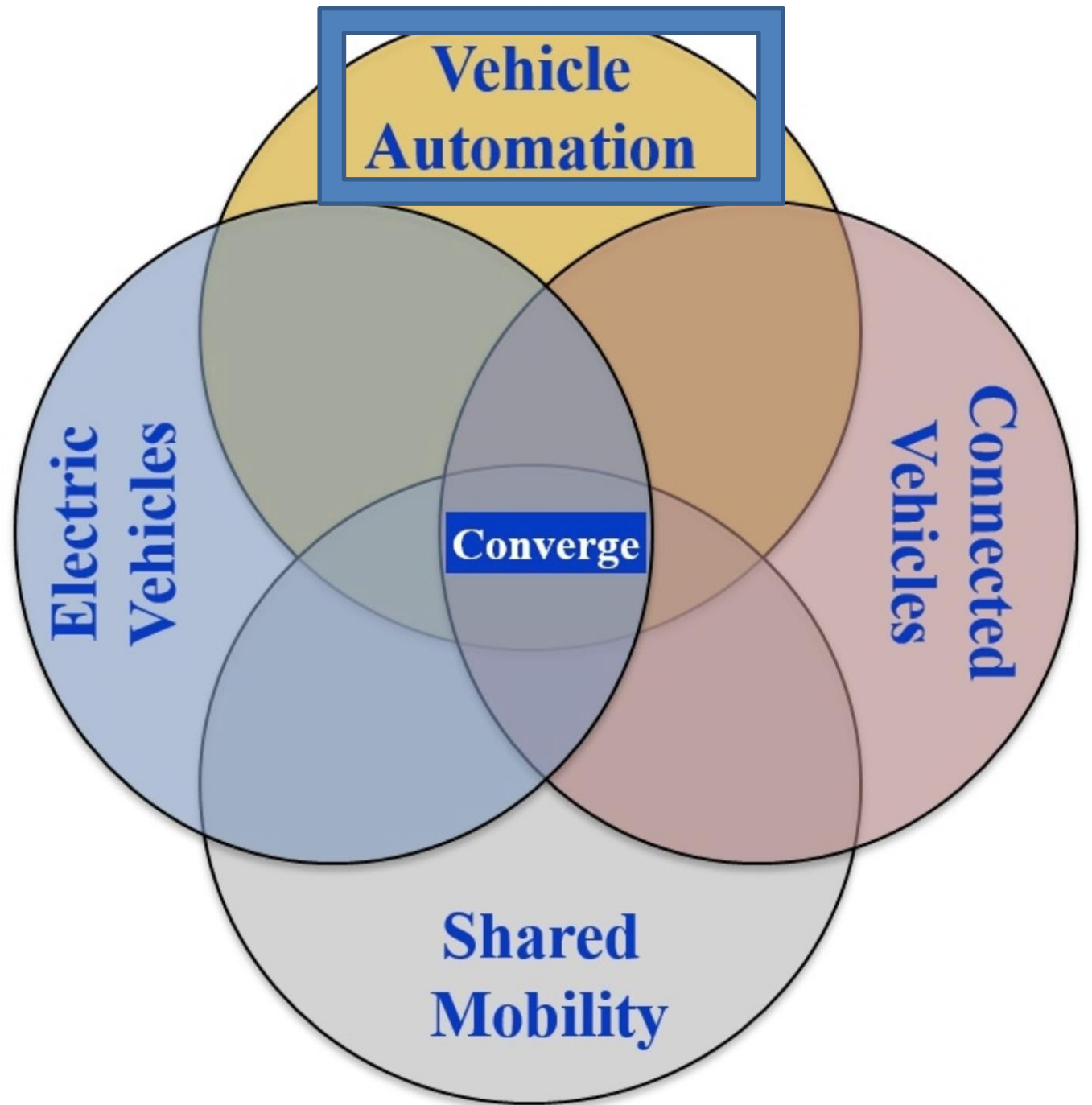
ACES

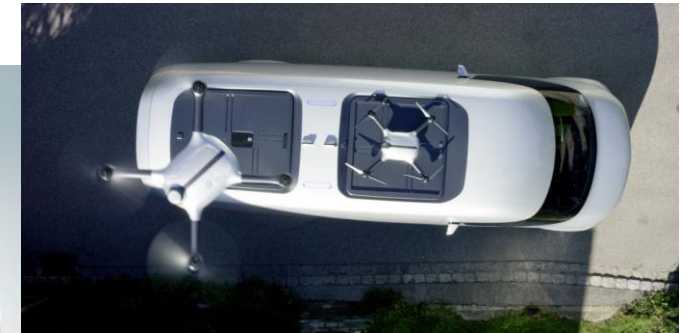
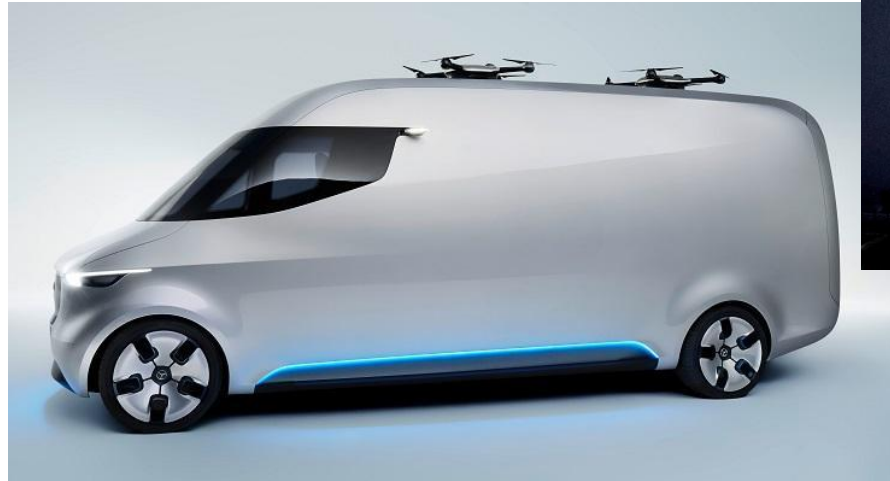
Automated

Connected

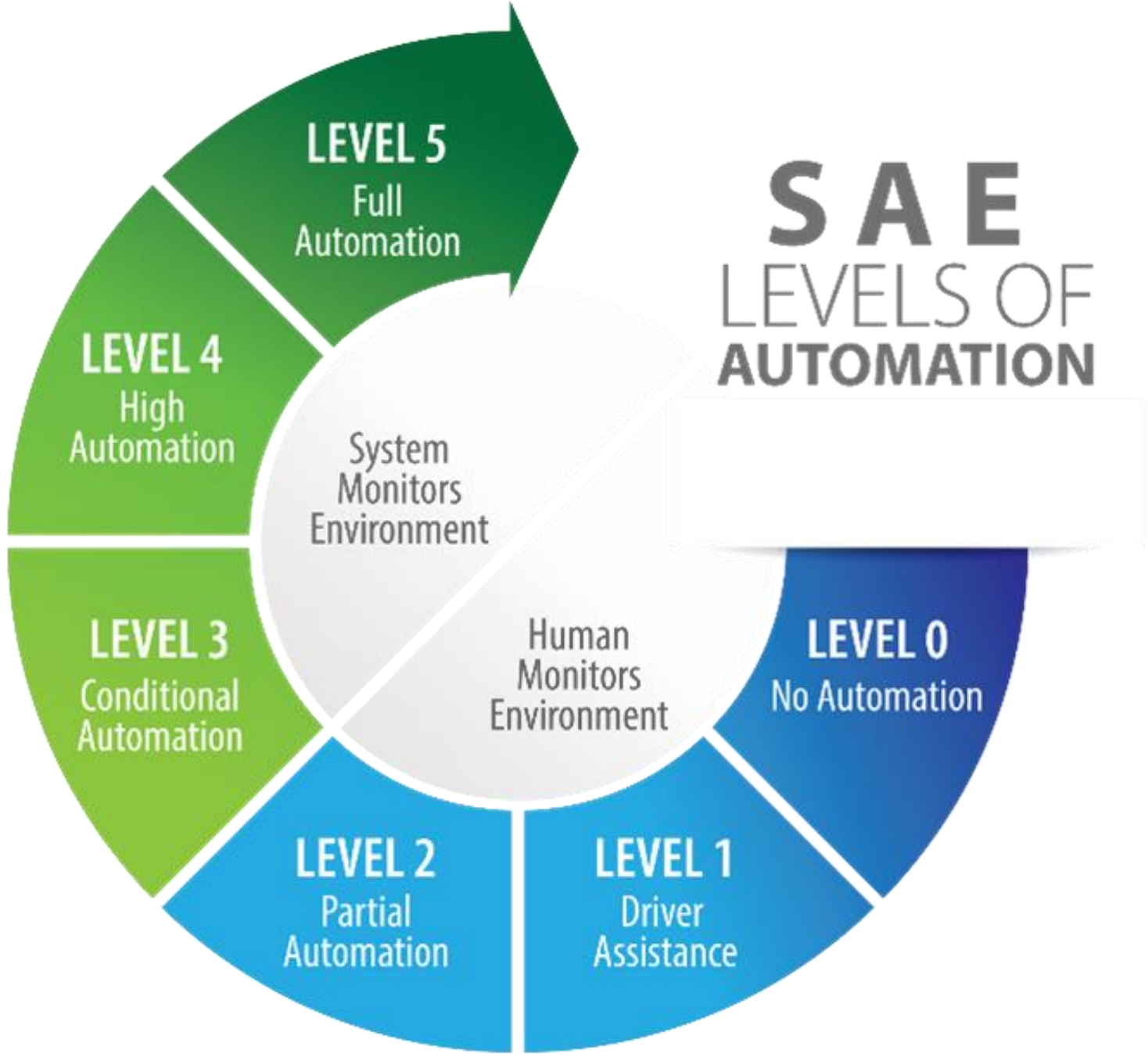
Electric

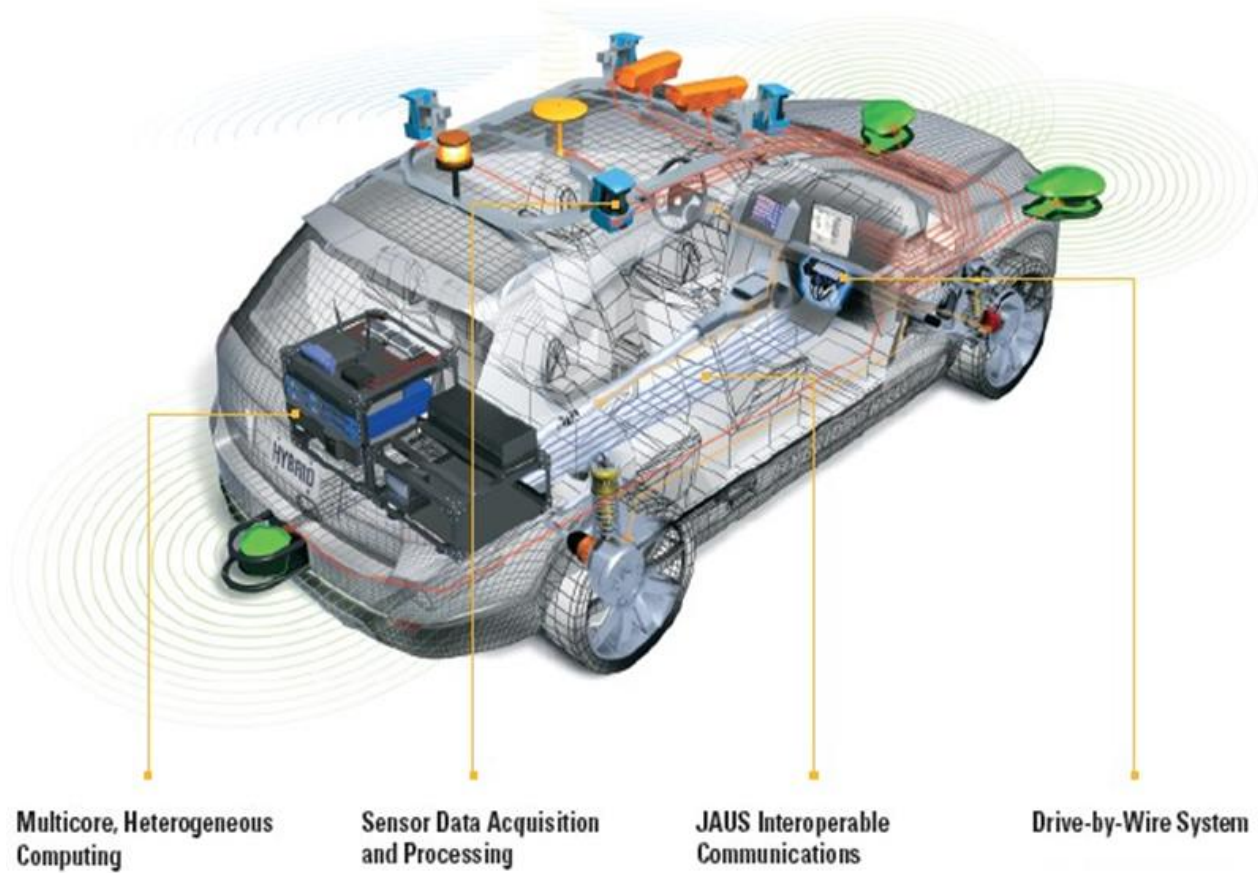
Shared



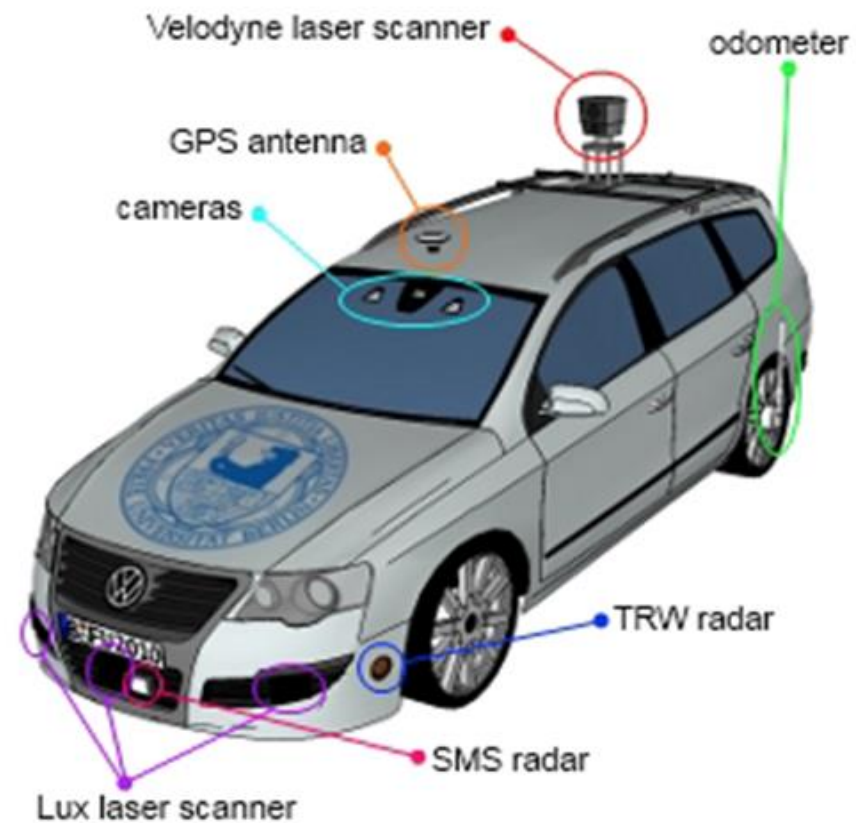


SAE LEVELS OF AUTOMATION

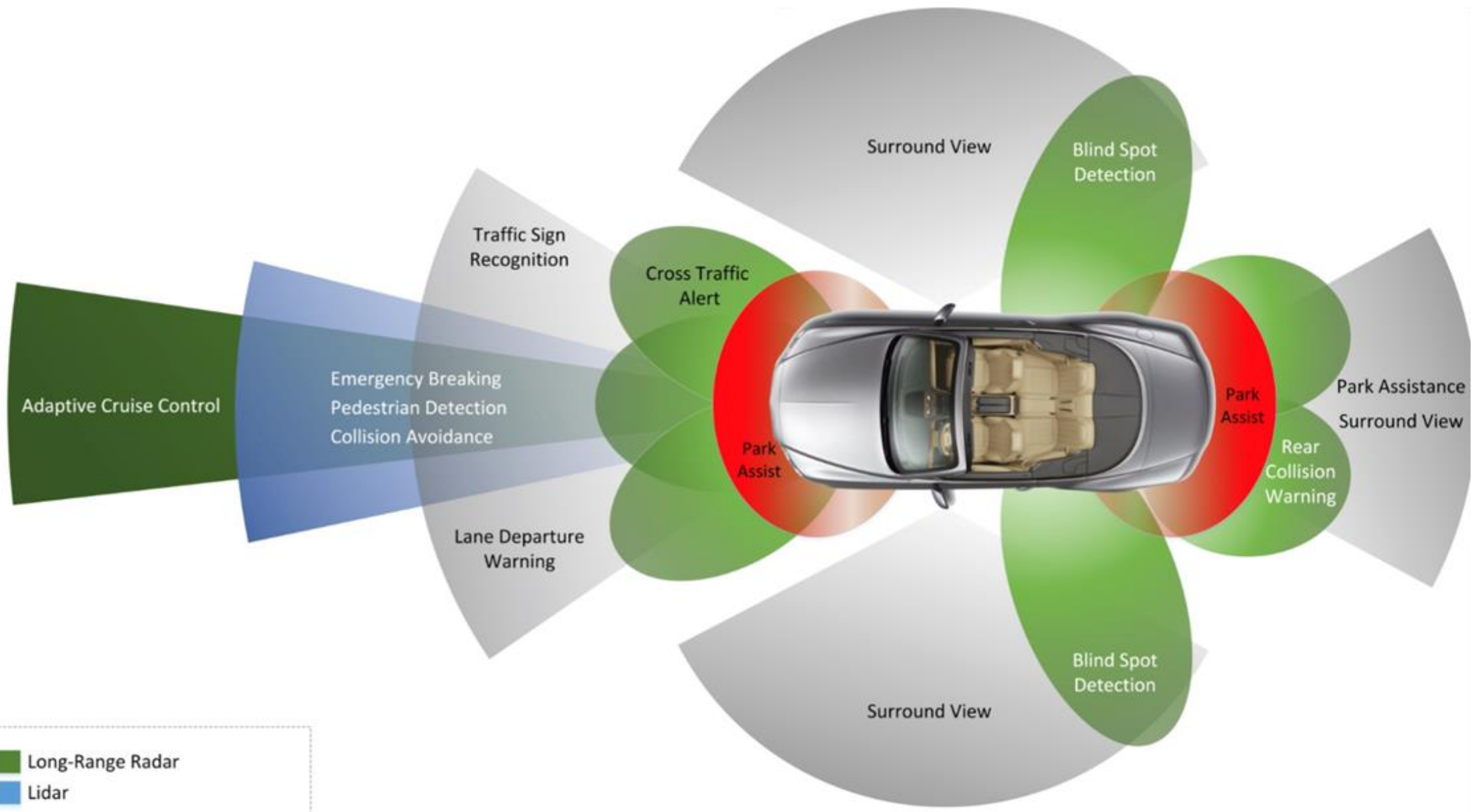




GPS & GIS/High Resolution Mapping provide location



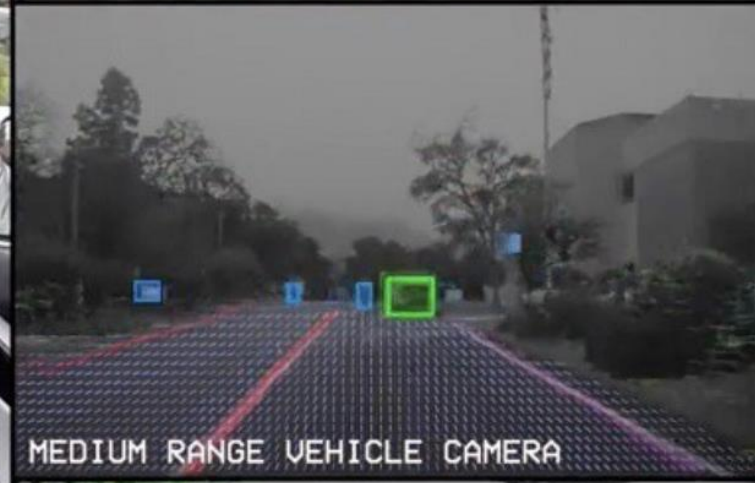
Suite of sensors provide "Situational Awareness"



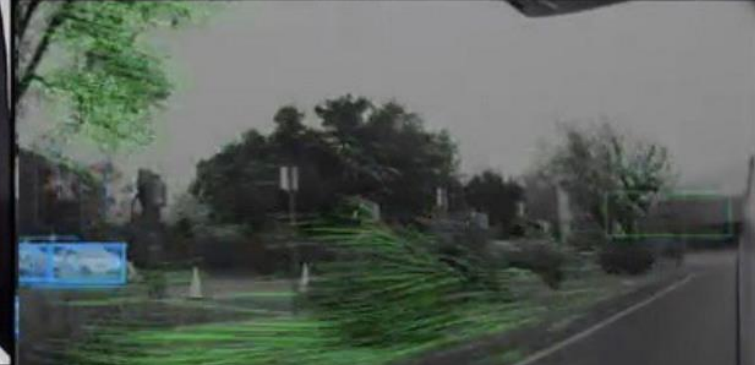
- Long-Range Radar
- Lidar
- Camera
- Short/Medium Range Radar
- Ultrasound



LEFT REARWARD VEHICLE CAMERA



MEDIUM RANGE VEHICLE CAMERA



Self-driving mode
Program: oncoming drive
Front camera
Real time scan



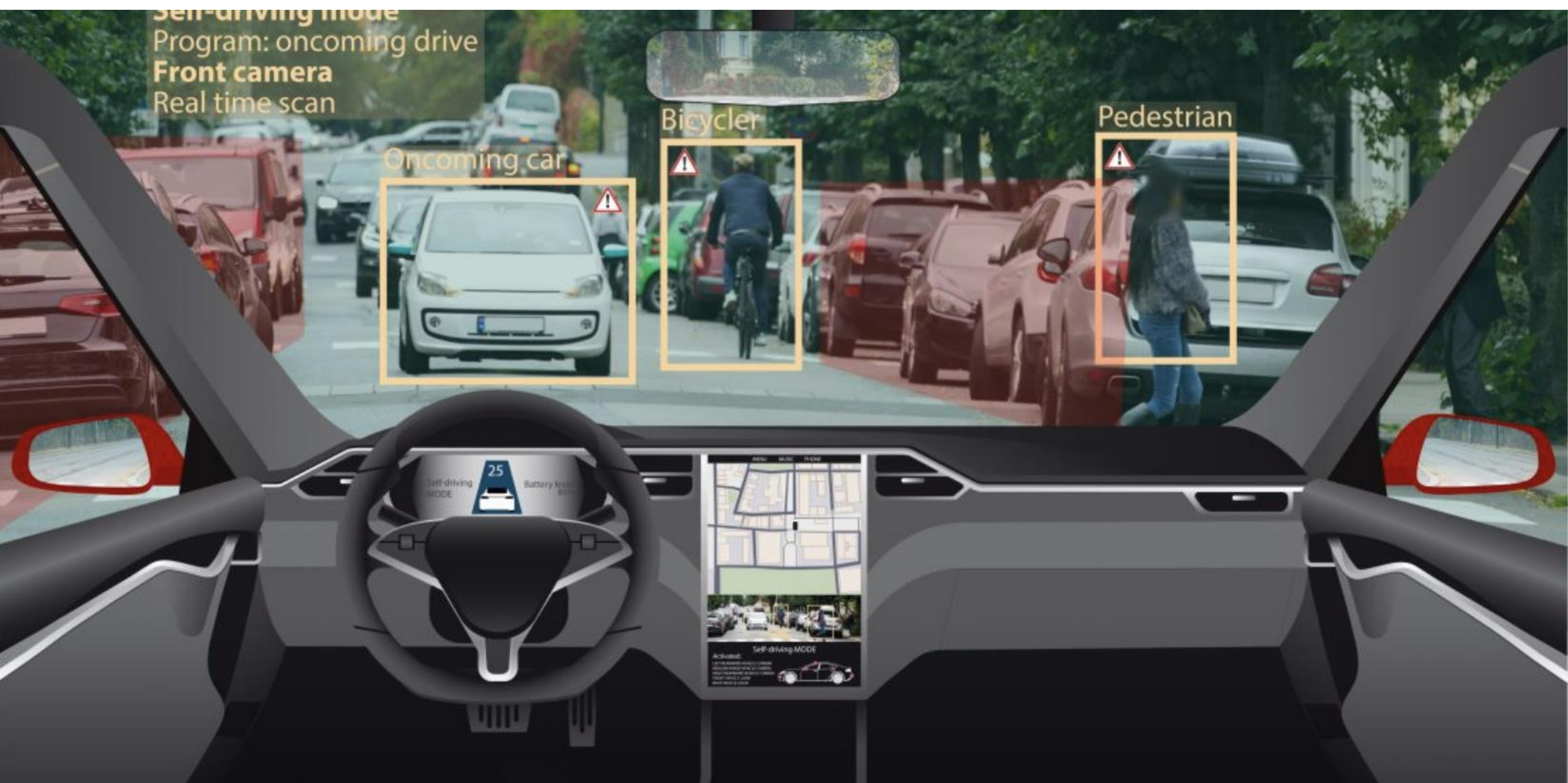
Oncoming car

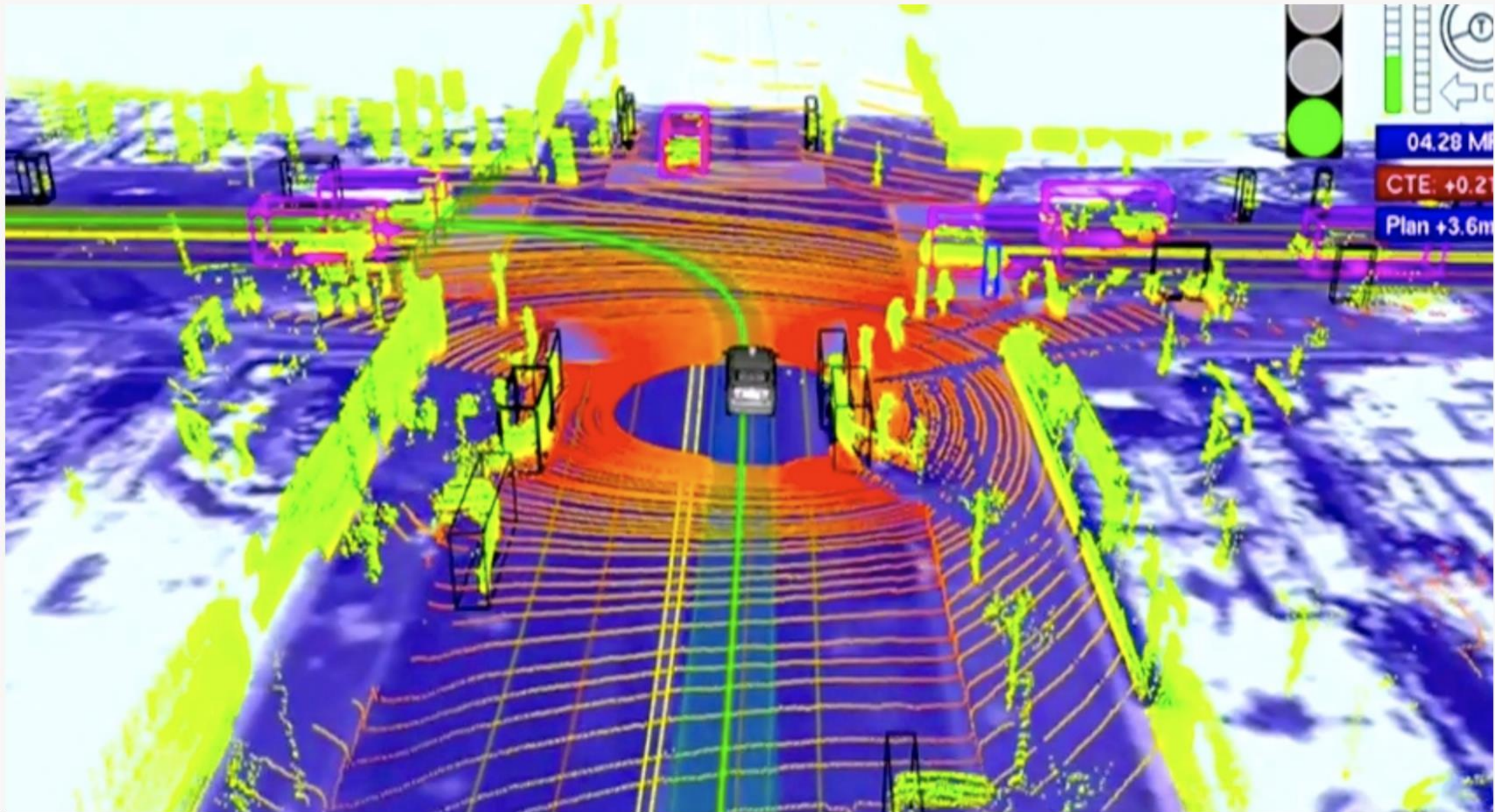


Bicycler



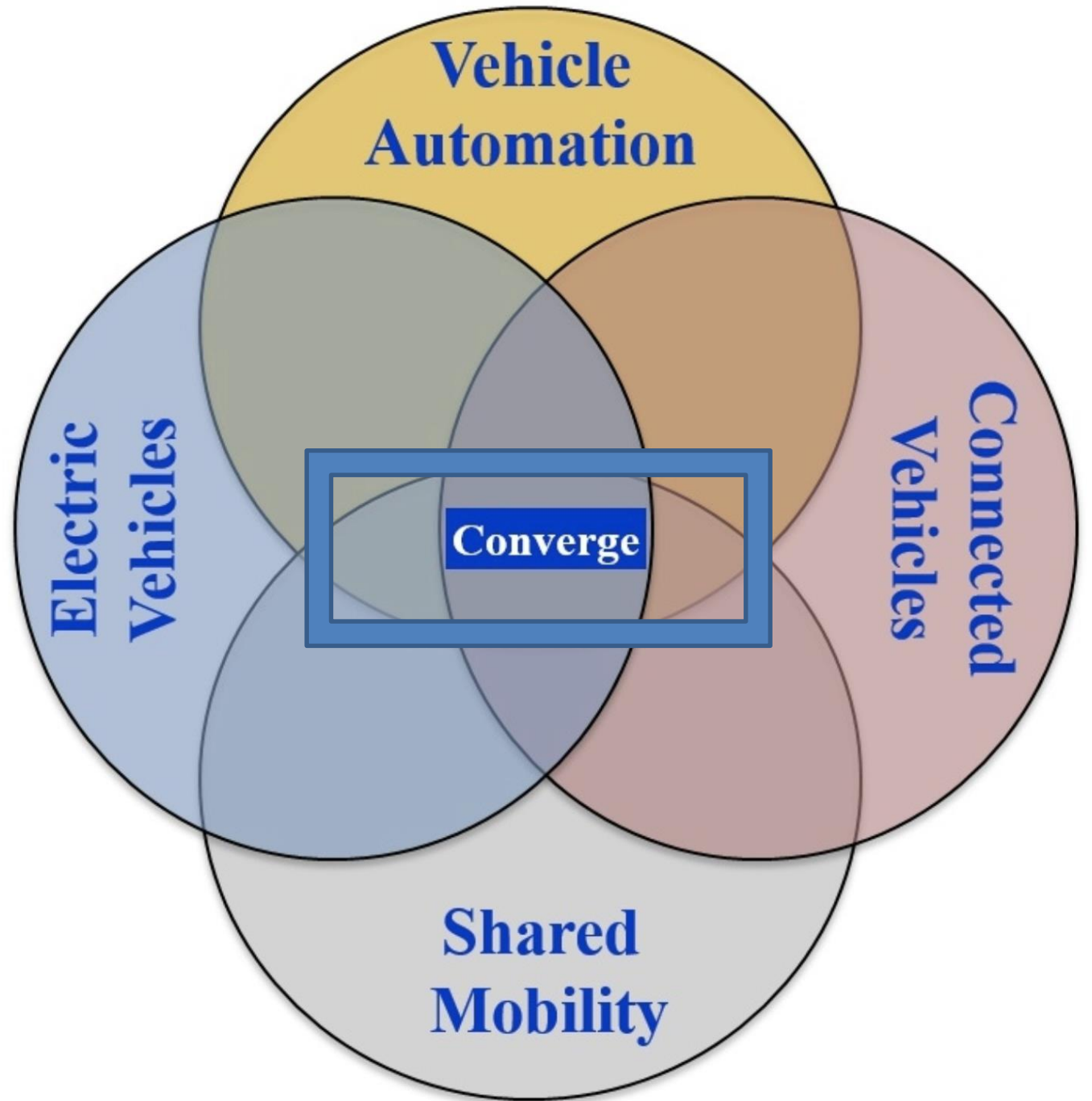
Pedestrian



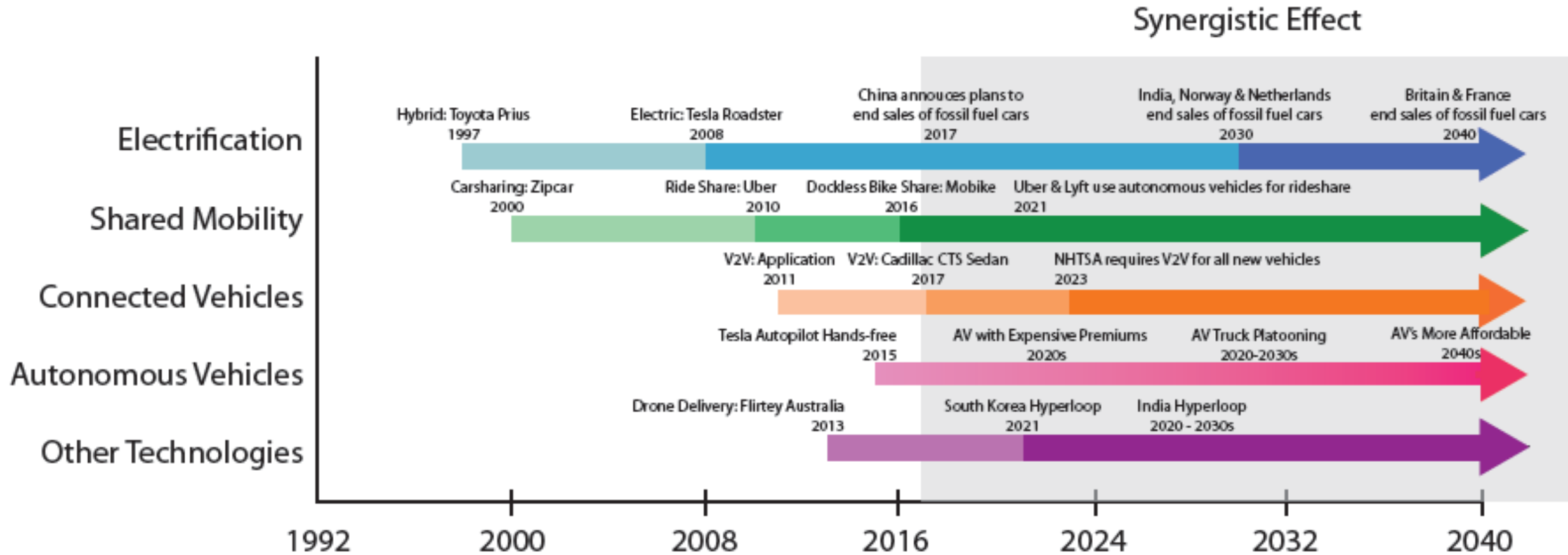


ACES

Connected
Automated
Shared
Electric



When is all this craziness going to happen?



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