Shared Mobility – What are we facing?

Current and Future Trends

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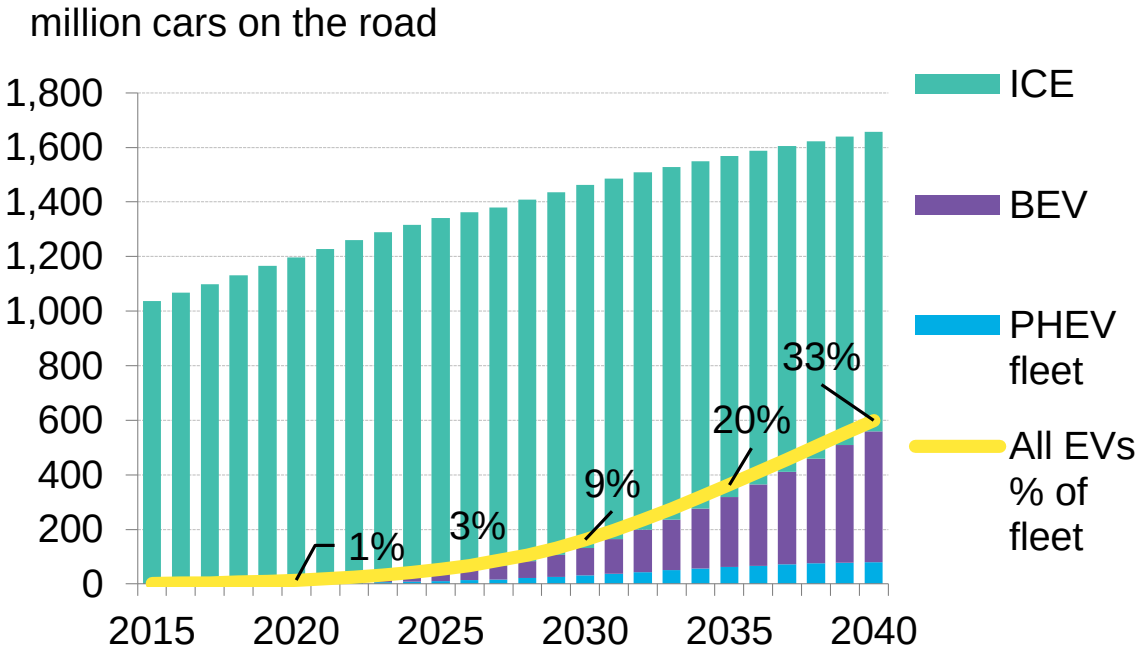
BloombergNEF

Global light duty vehicle fleet



Source: Bloomberg NEF

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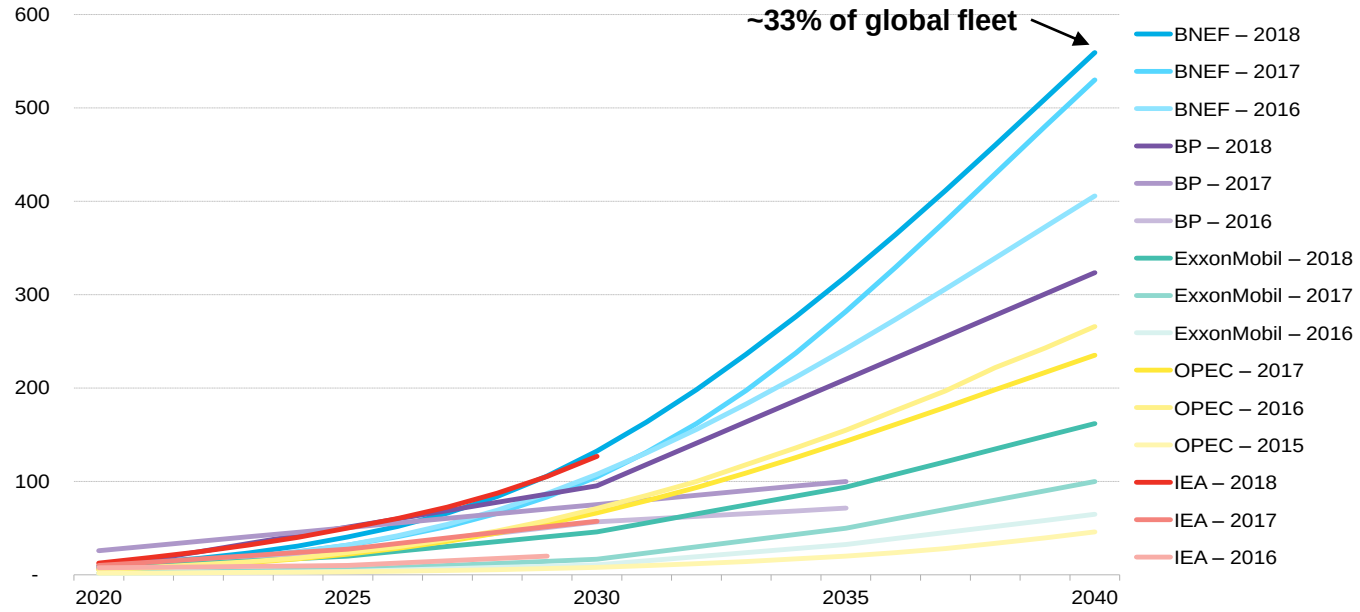
Consensus views on EV adoption are rising – 2018



Source: Bloomberg NEF, BP, Exxon, OPEC and IEA

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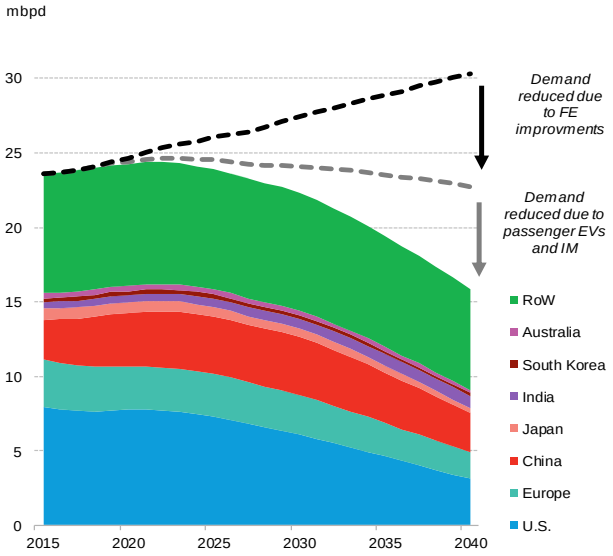
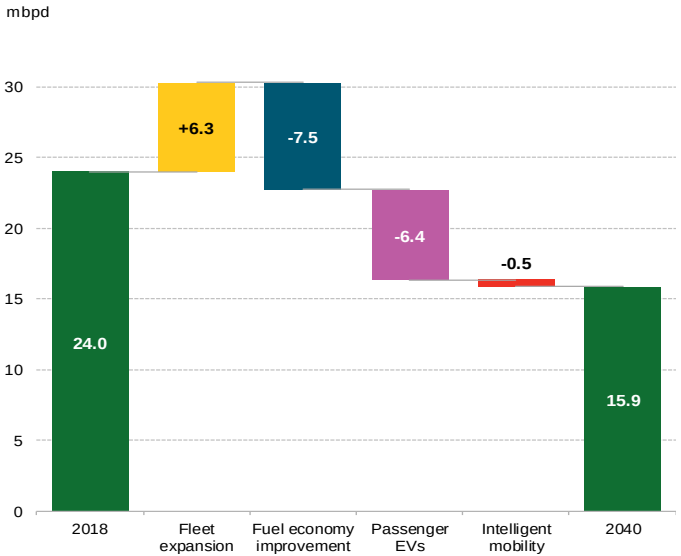
ICE efficiency gains beat EVs in the battle to displace oil

Fuel demand outlook, passenger cars



Source: IEA, Bloomberg NEF

Passenger vehicle oil demand 2018-40



Source: Bloomberg NEF

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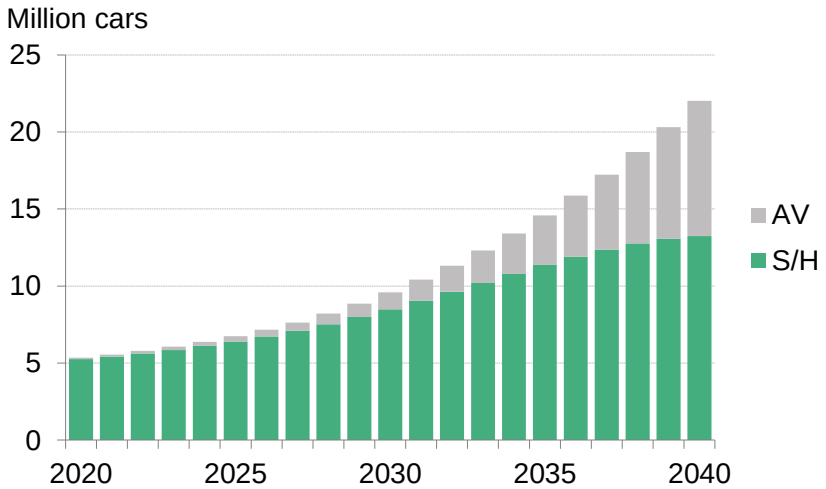
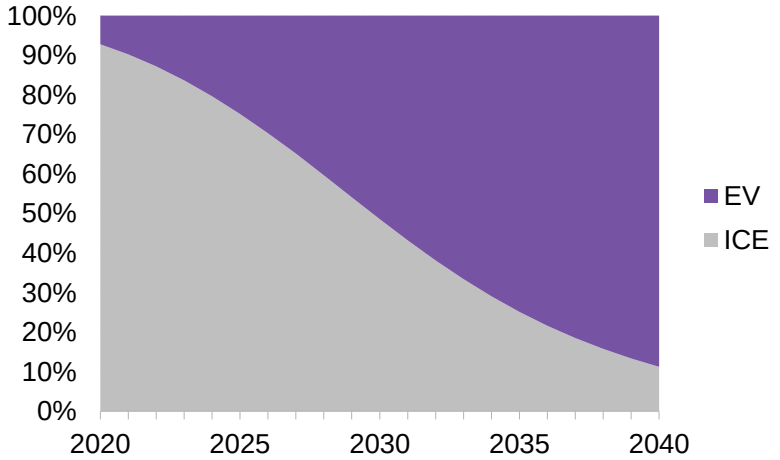
Intelligent Mobility's Role

Global fleet of intelligent mobility by type



Drivetrain of the intelligent mobility fleet



Source: Bloomberg NEF Note: AV stands for autonomous vehicles. S/H denotes non-autonomous share and hailed vehicles.

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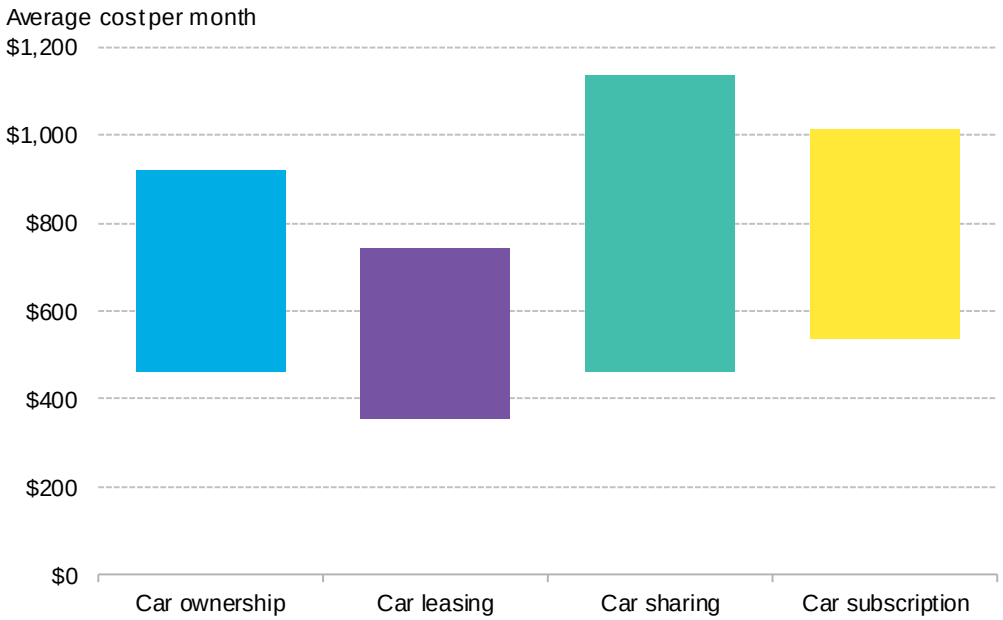
U.S. cost range for new car ownership, leasing, sharing and subscribing (monthly figures)



- Economics alone will not drive adoption of mobility services, but cost parity makes displacement of car sales and leases more likely
- In the short term, we expect the expansion of mobility services to complement, rather than displace, new car sales and leases.
- Over the long term, we expect car subscriptions to replace some car leases and purchases

Source: Bloomberg NEF. Notes: Cost ranges approximate. Costs assumes base level service options.

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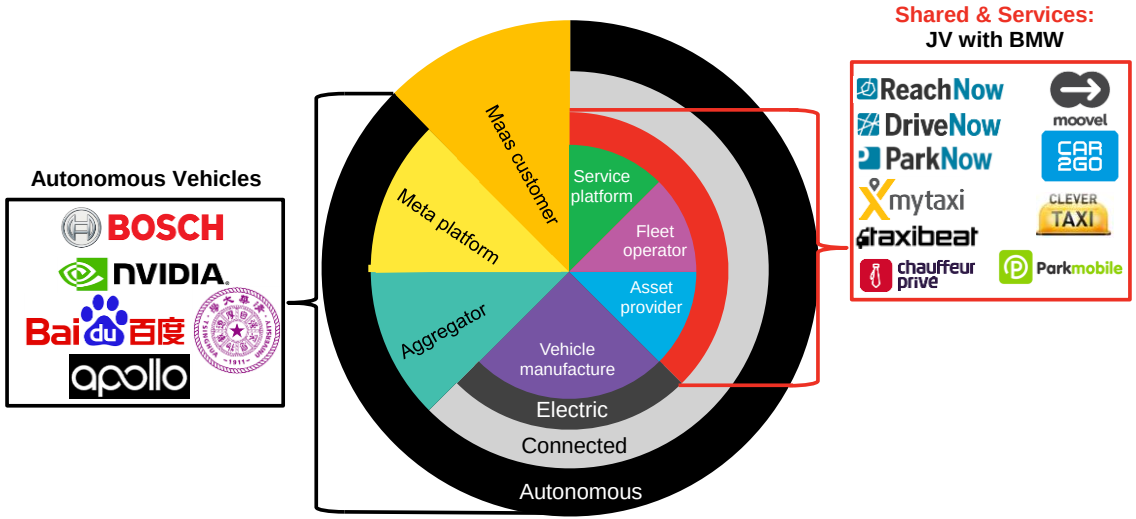
Automakers' autonomous vehicle strategy based on public disclosures

Automaker	Level 4 launch date	AVs using EVs?	Shared AVs?
GM	2019	✓	✓
RNM Alliance	2020	✓	✓
Toyota	2020	HEV	✓
Tesla	2020	✓	✓
Daimler	2020s	✓	✓
VW	2021	✓	✓
BMW	2021	✓	✓
Ford	2021	HEV	✓
PSA	2021	✓	✓
Hyundai-Kia	2021	FCV & BEV	✓
SAIC	2021-25	✓	ND
Honda	2025	✓	✓
Legend	*Early*	Average	Late

- There is consensus among the top 12 listed automakers (and Tesla) that commercial deployment of vehicles with highly autonomous capabilities (Level 4) will start around 2020 and fully autonomous capability (Level 5) around 2025.
- Some are already planning to reposition themselves as mobility service providers

Source: Bloomberg NEF based on public announcements as of May 2018. Note: Tesla included as a leader in EVs and AVs. FCA is not included because as of May 2018 it had not publicly disclosed its own AV launch plan. ND: 'not disclosed'. FCV: 'fuel-cell electric vehicle'; BEV: 'battery electric vehicle'; HEV: 'hybrid electric vehicle'.

Bloomberg NEF's interpretation of Daimler's CASE strategy



- The CASE strategy was unveiled in 2016, marking the first commitment by an automaker to a future dominated by connected, autonomous, shared and electric vehicles.
- CASE, Bosch and Daimler announced on July 11 that they will offer a shuttle service using Mercedes-Benz S-Class sedans and V-Class vans in the San Francisco Bay Area by mid-2019. The cars will be capable of high and full automation (Similar to SAE International Levels 4 and 5)

Source: Bloomberg NEF, Daimler. Notes: not an exhaustive list of companies and services. MaaS is short for 'mobility-as-a-service'.

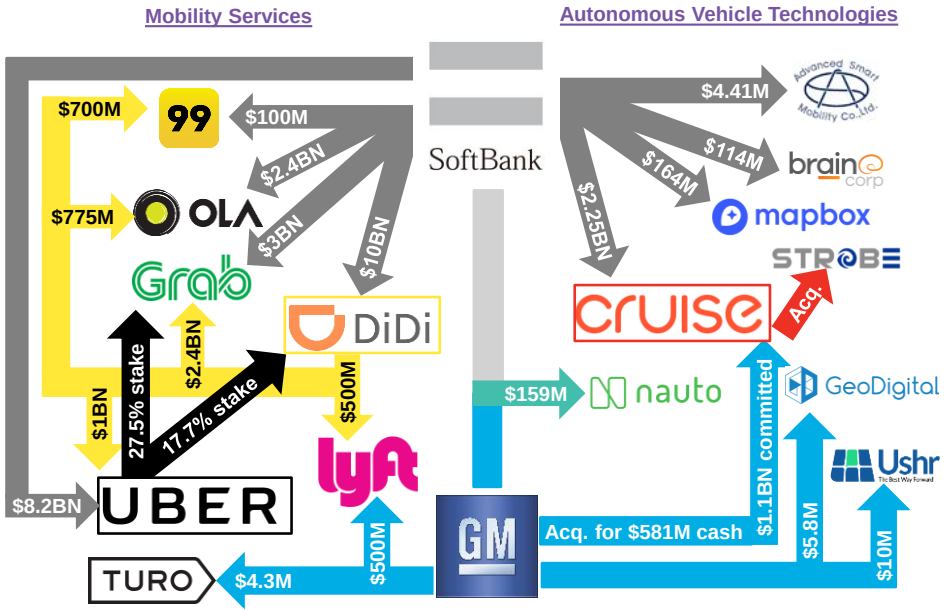
Toyota's notable investments in future of mobility, 2017-2018

Date	Investment*	Recipient	Segment(s)
27 August 2018	$500 million	Uber	Ride-hailing, autonomous vehicles
21 August 2018	$300 million (includes other investors)	Getaround	Car-sharing
12 June 2018	$1 billion	Grab	Ride-hailing/sharing
8 February 2018	$68.56 million	JapanTaxi	Taxi-hailing
4 August 2017	$95.4 million	Preferred Networks	Autonomous vehicles, connected cars
2 August 2017	$16.8 million (includes other investors)	Maas Global	Multimodal transport
24 July 2017	$2 billion (includes other investors)	Grab	Ride-hailing/sharing
15 May 2017	$0.35 million	Cartivator	Flying cars
20 April 2017	$45 million (includes other investors)	Getaround	Car-sharing

- Toyota is applying its production philosophy of Kaizen - continuous improvement - to its strategy for AVs and shared mobility.
- Since 2001, Toyota and its affiliates have step by step developed new intellectual property on AVs. This has enabled Toyota to achieve number one ranking in U.S. patents related to AVs.
- For mobility services, over the last two years, Toyota has made several strategic external investments while also expanding its own activities, for example, launching a car-sharing service in Hawaii.

*Source: Bloomberg NEF, CB Insights. Note: *the invested amount shows Toyota's contribution, except for entries where it is stated "includes other investors".*

Notable investments by Softbank and GM in intelligent mobility companies



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Summary of new business structures of split Tier-1 auto part suppliers

Original	DELPHI		Autoliv		Continental		
New	APTIV	Delphi Technologies	veoneer	Autoliv	New 'Continental Group'		
					Rubber	Automotive	Powertrain
Functions	• $12.8 billion in revenues in 2017 • Active safety products for autonomous driving, enhanced user experiences and connected services	• $4.5 billion in revenues in 2017 • Vehicle propulsion, software, controls and electrification.	• $2.3 billion in revenues in 2017 since IPO June 11 • Active safety products such as radars, cameras and other sensors and software for ADAS and AVs	• $10.4 billion in revenues in 2017 • Passive Safety segment, mainly airbag systems, steering wheels and seatbelts	• Develop products based on rubber and plastics under new 'Tire Technologies' unit and existing 'ContiTech' • Potential partial share sale in future	• Autonomous driving products and chassis functions • Vehicle connectivity including V2X • Integrate R&D functions	• Hybrid and electric drive systems, all battery activities and combustion engine business • IPO mid-2019.

- Over the past year, Delphi Automotive and Autoliv spun off their combustion propulsion systems, seat belts and airbags units from their sensors and software divisions.
- On July 18, Continental announced plans to reorganize its business units. The new 'Continental Automotive' company will oversee the largest business units today and will host advanced driver-assistance systems (ADAS) and autonomous driving technologies.
- ZF Friedrichshafen AG announced September 19 it will invest $14 billion over the next five years in development of new technologies for electric and autonomous vehicles.

Source: Bloomberg NEF, press releases. Notes: AV stands for autonomous vehicles. Stock prices in US dollars as of July 23, 2018. Revenues for Continental units exclude intercompany sales.

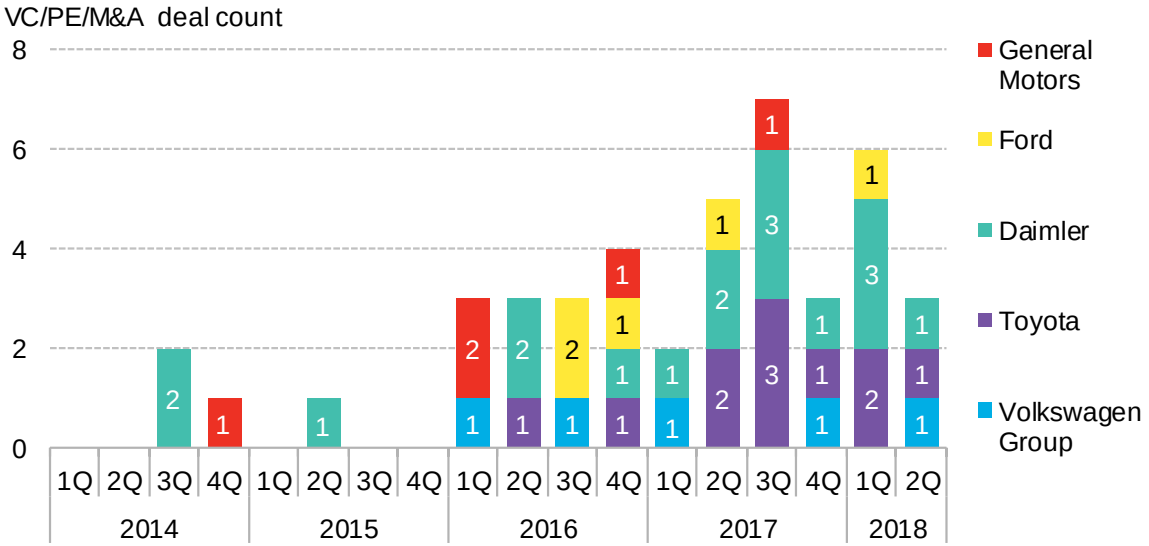
Samsung and Baidu are the most active technology companies investing in lidar companies

Target company	Tech. Investor	Disclosed value $M	Date	Other notable participants in round
Velodyne LiDAR	Baidu Ventures	150	Aug 2016	Ford Motor Company
Hesai Photonics	Baidu Ventures	39.3	May 2018	Lightspeed China
	Microsoft ScaleUp	NA	Mar 2016	ND
Aeye	Intel Capital	16	Jun 2017	Airbus Ventures
Innoviz Technologies	Samsung Catalyst Fund	8	Dec 2017	Softbank Ventures Korea
Quanergy	Samsung Ventures	90	Aug 2016	Aptiv, Sensata Technologies
		30	Dec 2014	Daimler
TetraVue	Samsung Catalyst Fund	NA	Nov 2017	Robert Bosch Ventures
	Foxconn Technology	10	Feb 2017	
LeddarTech	Integrated Device Technology	101	Sep 2017	Aptiv, Magneti Marelli
	Osram	NA	July 2017	None

Source: Bloomberg NEF, Aptiv 2Q 2018 earnings report. Note: list of investors and target companies not comprehensive.

Macro-mechanical | Mechanical other | MEMS | Optical phased array | modulated continuous | Flash

Count of investments and acquisitions in mobility-as-a-service by selected automakers



- Toyota's $1 billion investment in Grab and $500 million in Uber
- Volkswagen also made a repeat investment in ride-hailing company Gett, as part of an$80 million funding round
- Daimler invested an undisclosed amount in Taxify, which is also backed by Didi.

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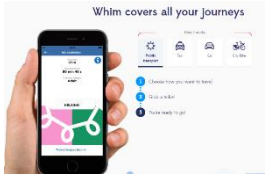
More important is to ask what is the future role of passenger vehicles?

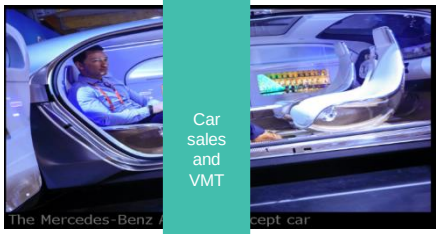
On-demand mult[illegible]odal transport by a combination of s[illegible]ng and autonomy



Car sales and VMT

Cars as a form of personal expression and art

Autono[illegible]us cars as living [illegible]ns on wheels



Car sales and VMT

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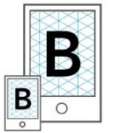

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