Agenda

- One Page Strategy Analytics Overview

- What is happening in ADAS and Autonomous Driving?

- Sensors: ADAS and Autonomous Driving Trends

- Automotive Architectures

- Q&A

Strategy Analytics Overview

STRATEGY ANALYTICS

Strategy Analytics Overview

Data and Analysis. Business Consulting. Custom Research.
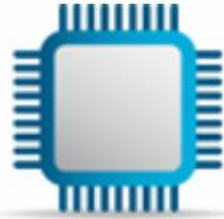
Devices

Automotive

Service Providers

Intelligent Home

Media & Services

IoT Ecosystem

Components

UX Innovation

- 12-month syndicated **subscription services** on specific industries and/or technologies

- **Custom Consulting** on Companies, Brands, Products, and Technologies

- Market Intelligence on **Buyer Behaviors**, Consumer Attitudes, Brand Preferences, and Emerging Behaviors

- Design Guidance and Competitive Intelligence on **User Experiences** and Opportunities for Innovation

- Intelligence on Consumer Activities, Behavioral Patterns, and Usage Profiles through **Big Data Analytics**

STRATEGY ANALYTICS

# What is Happening in ADAS and Autonomous Driving?

STRATEGY ANALYTICS

Strong signs of **"reality"** breaking out at many companies; COVID-19 not helping…

Expect **many more** JVs / mergers / acquisitions and re-focusings – especially when it comes to **monetizing AV development** for ADAS

- E.g. Volvo / Zenuity / Veoneer

A falling car market and static ADAS market will put **severe pressure on investment** levels in 2020 and beyond

Big infrastructure investment (e.g. V2X) also now potentially **even more problematic**

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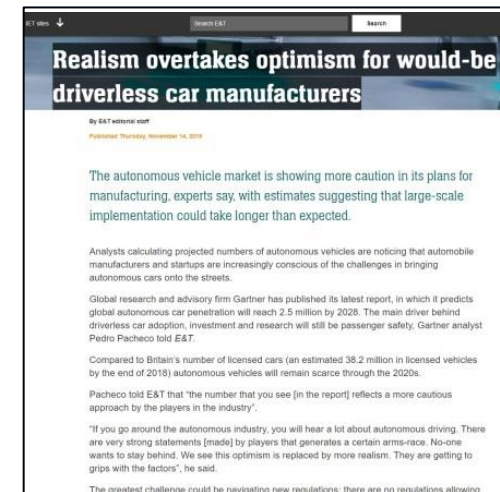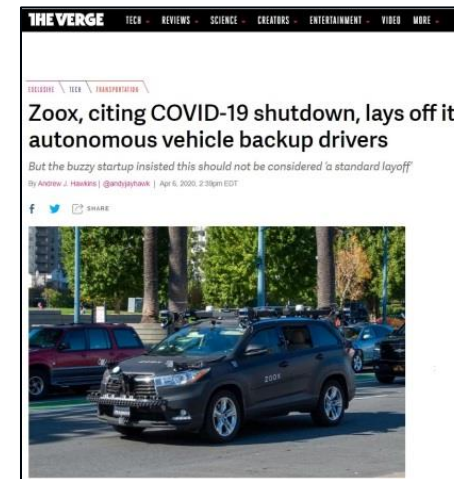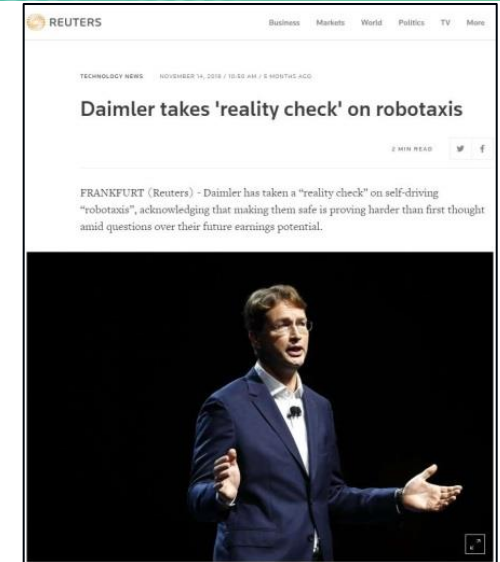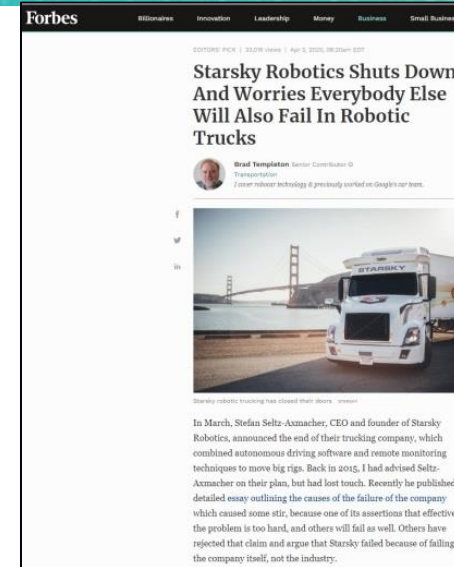
What about L2+ ?

So-called **L2+** now seen as a path-to-market by many:

- **Optimist's view:** Let's make cars as safe and automated as possible under current legal frameworks

- **Cynic's view:** We've spent all this money, how on earth are we going to get a return this side of 2030?

Remember:

- L2+ and now L2++ have no formal definition – marketed as a consumer convenience – consumers are not familiar with SAE levels of autonomy

- In many cases it appears to be L3/L4-style technology (**and hence cost**), but with the driver still required to supervise on a continuous basis

- Audi abandoned L3 Traffic Jam Pilot on its current A8 model.

- How many consumers will pay for this functionality? Subscription

- Older drivers are the least enthusiastic

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Global adas demand $54B by 2026

Source: AVS Strategy Analytics Apr 2020

Legend:
- V2V / V2X
- Parking (With Camera)
- Parking (Ultrasonic Only)
- Parking (Surround View)
- Night Vision
- LDWS
- Head-Up-Display
- Front Corner Alert
- Drowsiness Monitor
- Distance Warning
- ADAS Domain Controller
- Camera Mirror Repl.
- Blindspot
- AFL (Matrix)
- AFL (Dyn.)
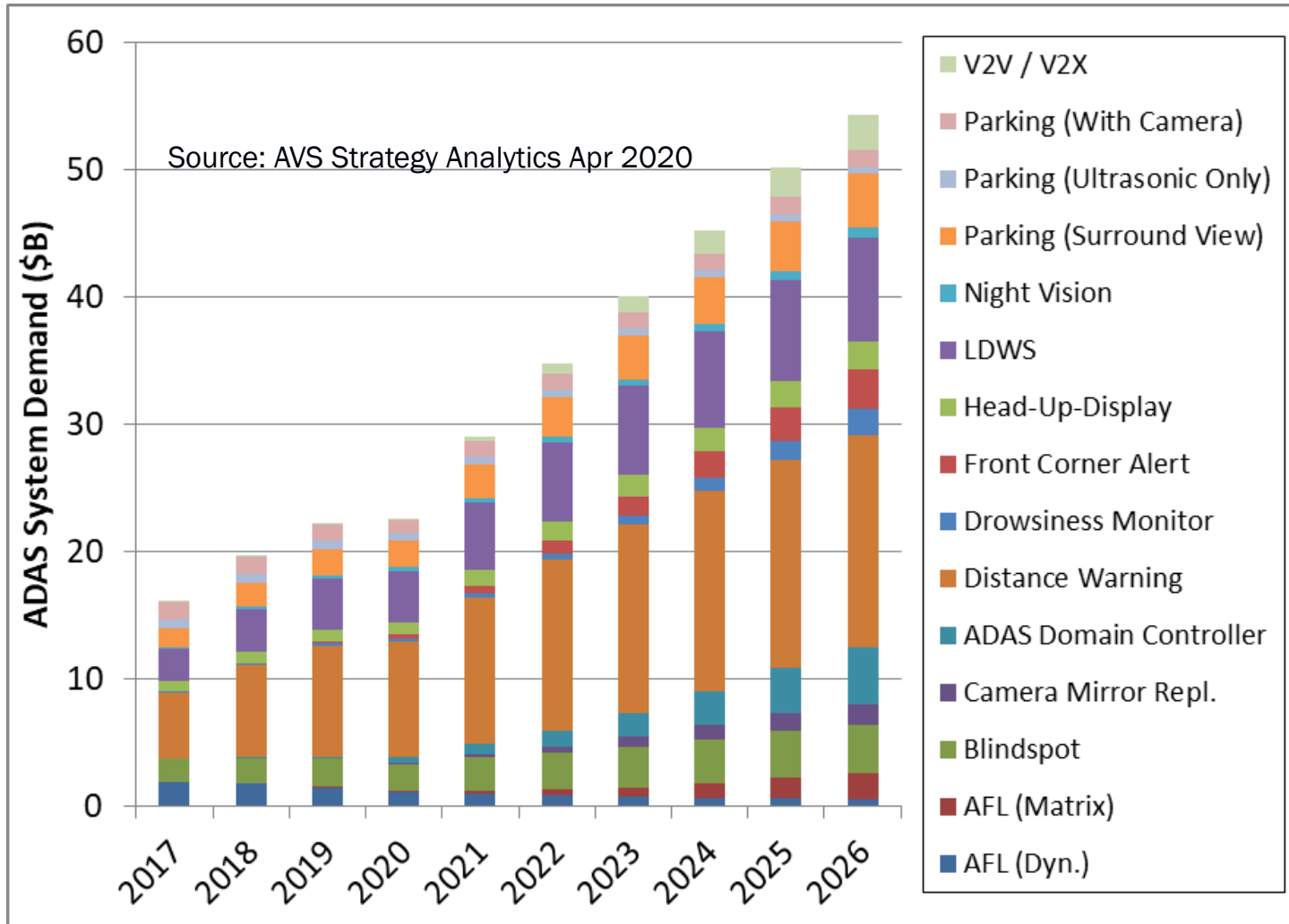
- Best combination of growth/size remains in Distance Warning

- **AEB** is the key feature in that category

- V2X forecast reduced in latest update

- AFL = Adaptive Front Lighting

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What is a Realistic autonomous deployment scenario ?

Source: AVS Strategy Analytics Nov 2019
Standard Scenario

Left chart — Vehicle Volumes (MU) by SAE level (L0–L5), years 2015–2050.

Right chart — Penetration into Annual Light Vehicle Production:
- SAE L4 or Higher Capable - Standard
- SAE L4 or Higher Capable - Delayed

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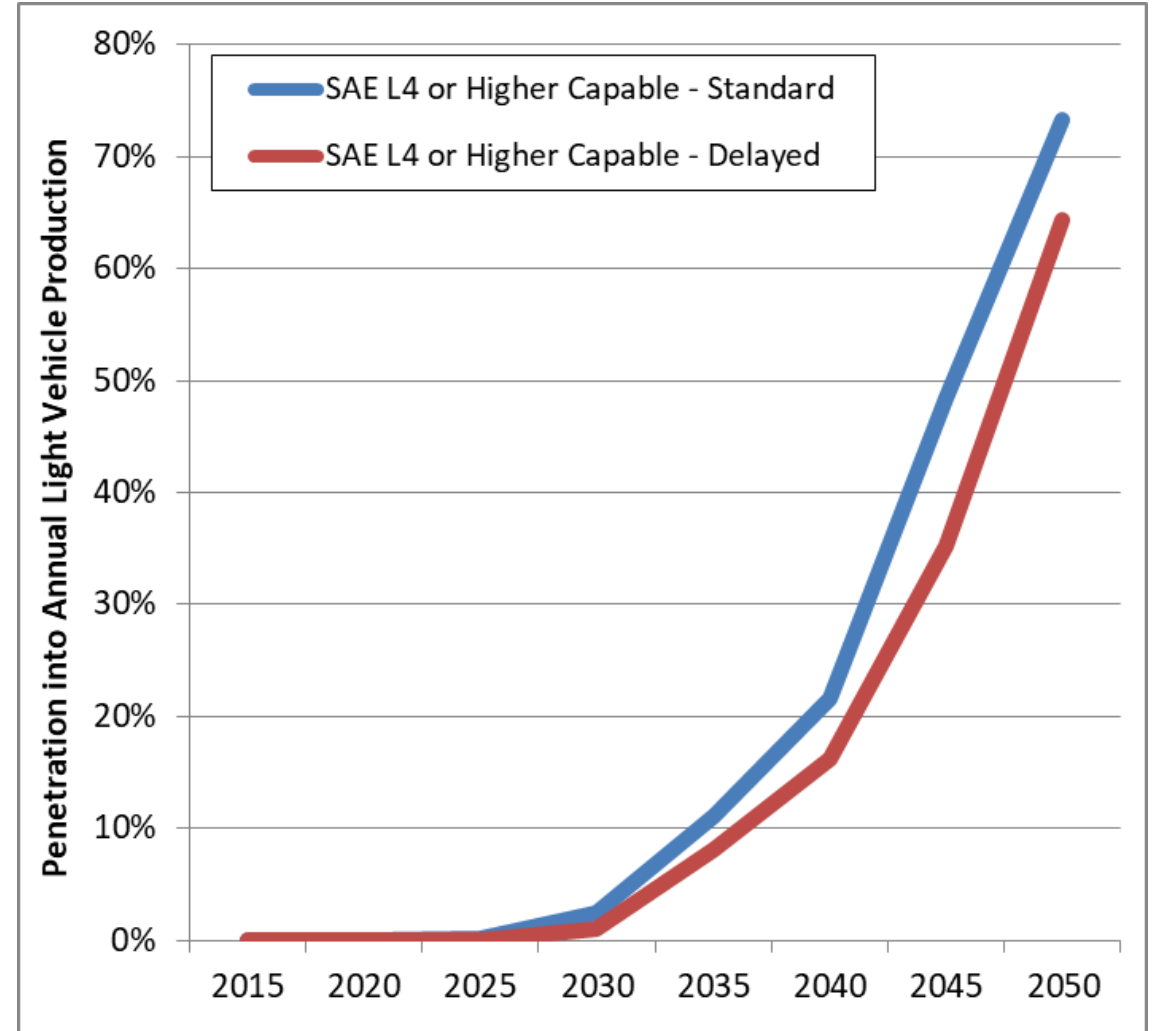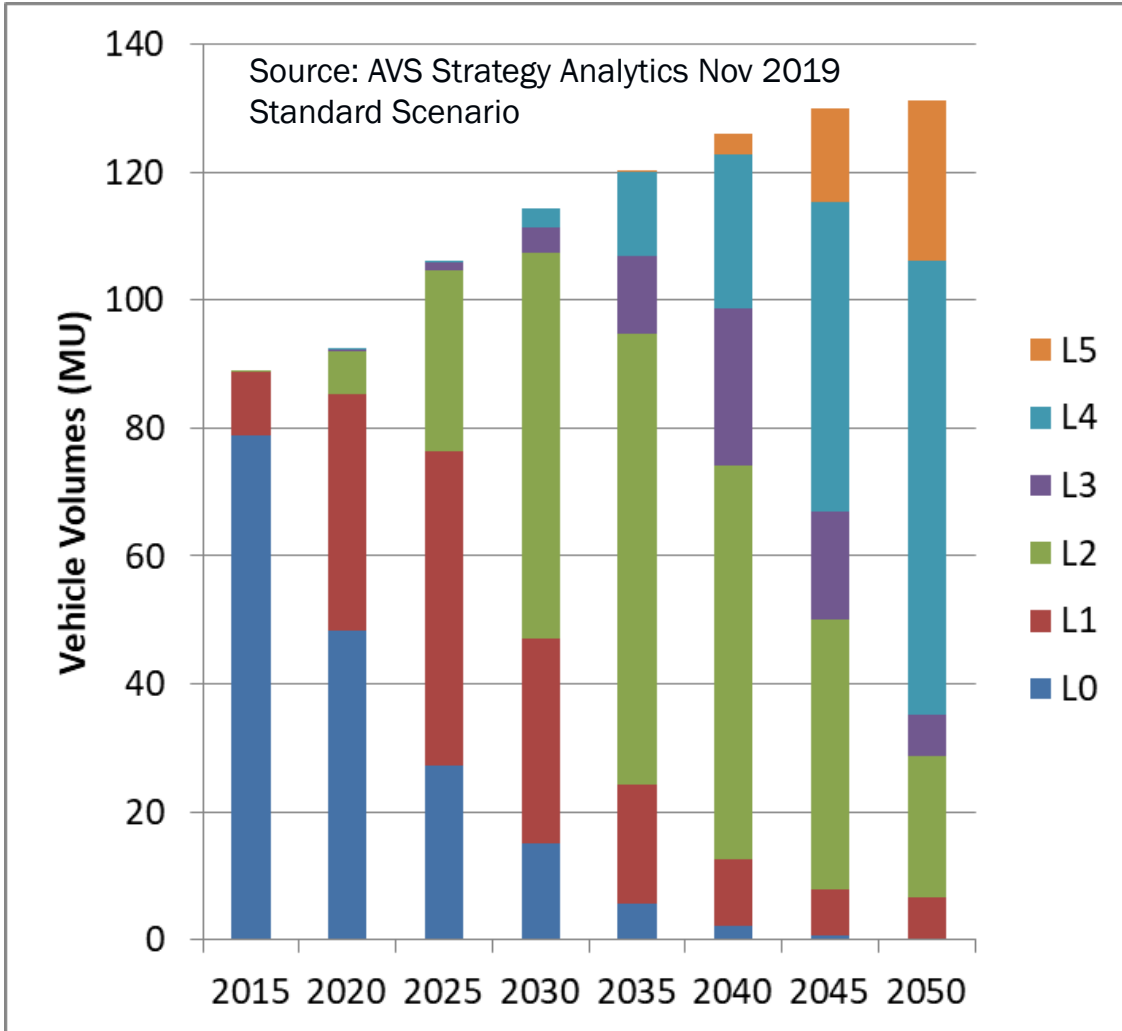
Why is this important? What's at stake?

Strategy Analytics expects very **little volume of L4** until 2030+
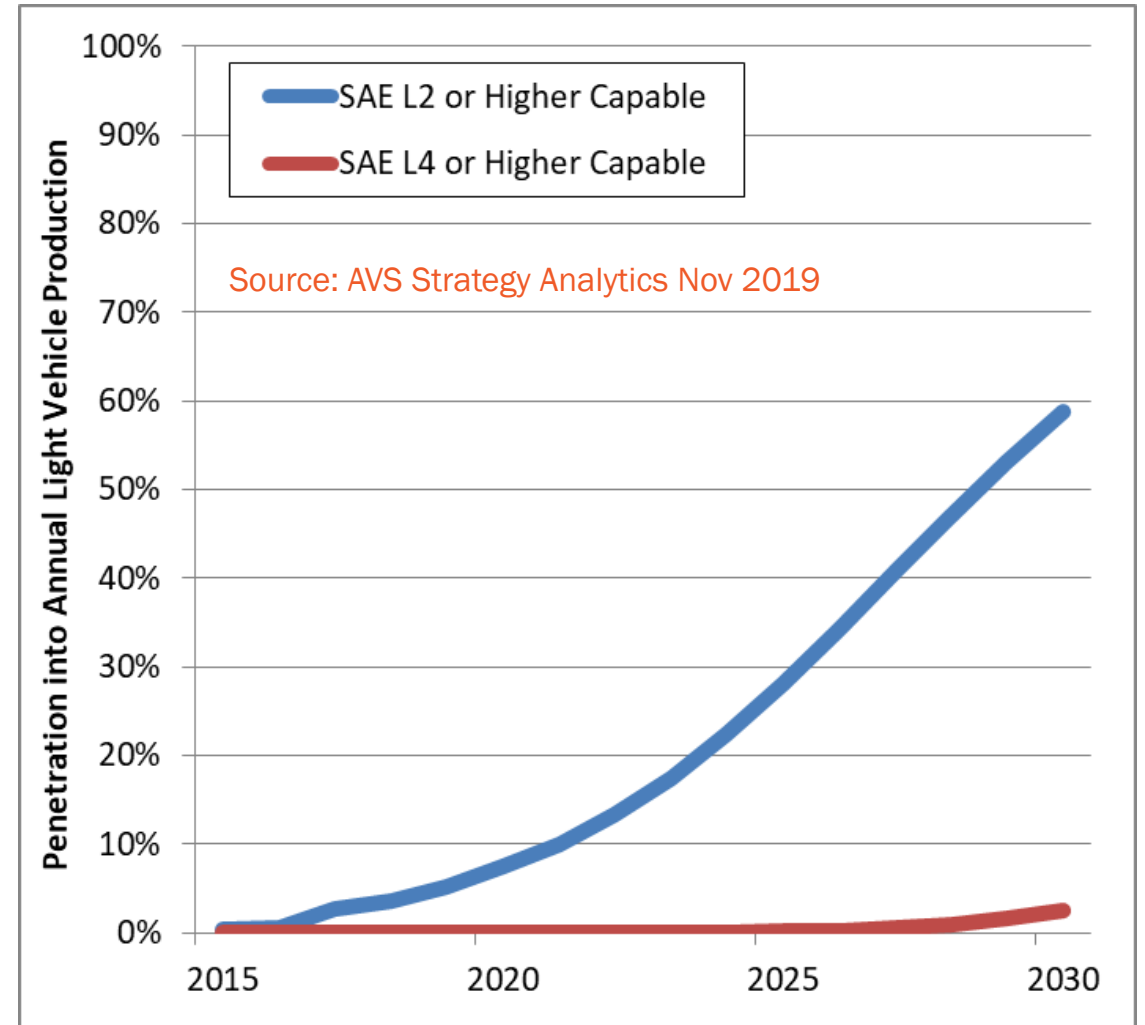
- Our recent update has seen a **delay** to the uptake of L4
- Most research contacts now more **pessimistic**

L2 to expected to start to emerge in high volume **soon**

- The lack of a formal definition of L2+ makes it too nebulous to forecast with accuracy at present
- However, it has the theoretical potential to run to tens of millions of vehicles in 2030, and thus **billions of dollars** of revenue for suppliers and automakers

Many automakers see adding automation options to their vehicles as a vital way of recouping the very real cost of adding on increasingly-mandated ADAS features

- Getting these automation features wrong will thus have a **measurable impact on profitability**

Source: AVS Strategy Analytics Nov 2019

Legend:
— SAE L2 or Higher Capable
— SAE L4 or Higher Capable

Y-axis: Penetration into Annual Light Vehicle Production (0% to 100%)
X-axis: 2015, 2020, 2025, 2030

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Sensors: ADAS and Autonomous Driving Trends

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Covid-19 impact on auto cameras

Standard view has all the gains from increased camera penetration rates in 2020 wiped out by production falls

- Over 100M "lost" cameras from 2020 to 2026

Pessimistic view sees auto camera volume demand fall by 5% over 2019

- Over 200M "lost" cameras from 2020 to 2026

Euro NCAP Roadmap 2025

FOR SAFER CARS
EURO NCAP
www.euroncap.com
★ ★ ★ ★ ★
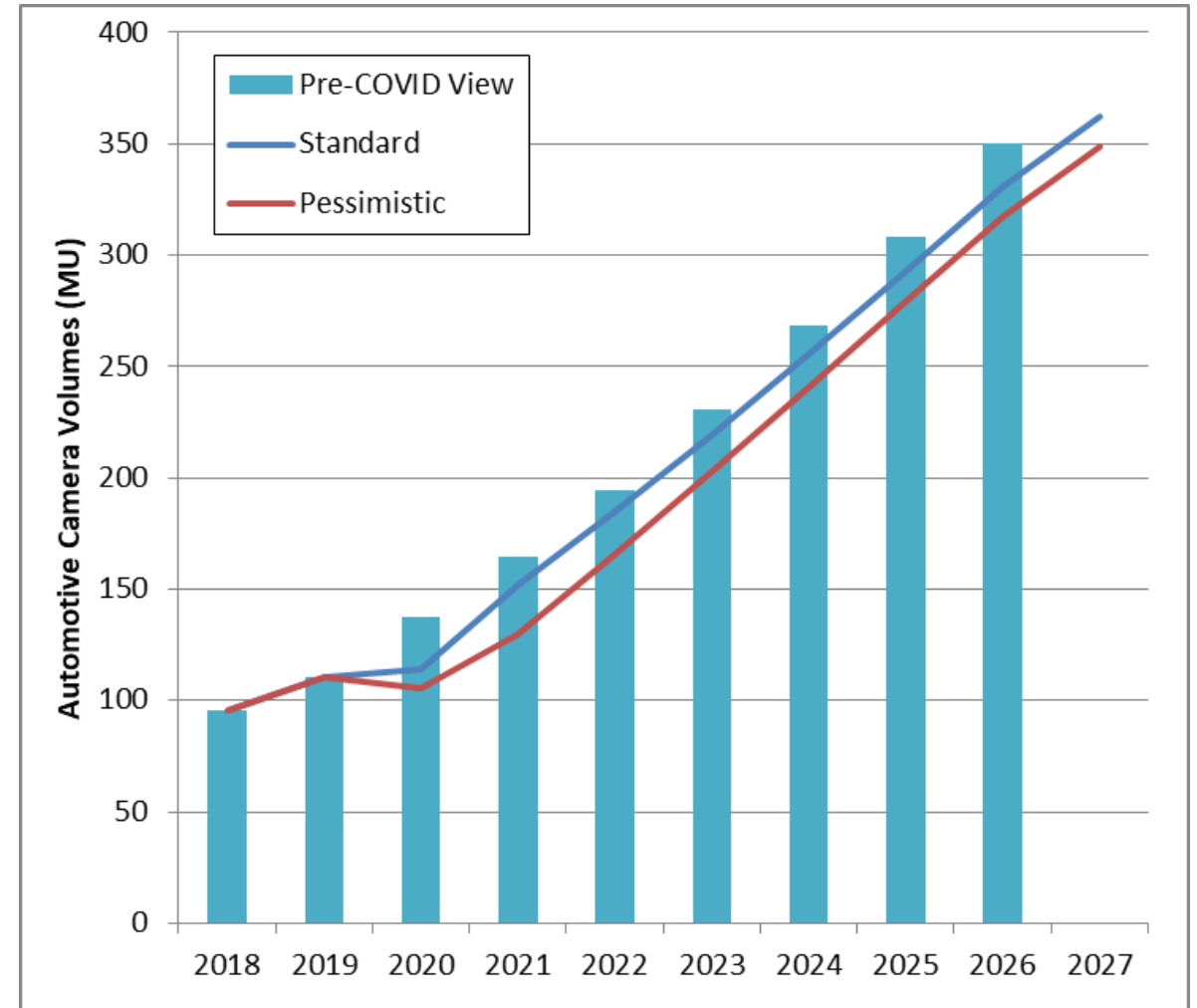
'Driver fatigue and distraction can be major factors in accident causation and can be detected directly by eye-monitoring sensors, for example, or indirectly by identifying driving behaviors which are characteristic of an impaired driver.'

Country/Region	NCAP/Mandate	System	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
European Union	NCAP	AEBS/Front Corner A.	5*		Pedestri	Bicycle			Crossing, Junction & Head-On					
European Union	NCAP	LDWS/Evasive Steer.	5*		Lane Kp.	Road Ed			Evasive Steering					
European Union	NCAP	BSD												
European Union	NCAP	Speed Alert-TSR												
European Union	NCAP	Backup Camera							AEBS Reversing					
European Union	NCAP	DMS							5*					
European Union	NCAP	Rear PCS/Whiplash												
European Union	Mandate	AEBS									New models	All new vehicles		
European Union	Mandate	Alcohol Interlock*									New models	All new vehicles		
European Union	Mandate	Backup Camera									New models	All new vehicles		
European Union	Mandate	DMS									New models	All new vehicles		
European Union	Mandate	Event Data Recorder									New models	All new vehicles		
European Union	Mandate	LKAS									New models	All new vehicles		
European Union	Mandate	Speed Assist									New models	All new vehicles		
European Union	NCAP	Child Presence Det.												
European Union	NCAP	Pedestrian Protect.									Enhanced			
European Union	NCAP	V2X												

- Initial DMS are systems that infer driver capability from movements of the host vehicle will be sufficient. Such inferred systems sense vehicle movement from existing on-board sensors, such as accelerometers, steering angle sensors and front windshield cameras.

- However, members of the UNECE safety committee believe that, by 2022, the test protocols from Euro-NCAP will be tightened to include direct monitoring of the driver's eyes and face movements – and thus could be beneficial for interior camera-based **DMS.**

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Legislation & Mandates Drive ADAS

NCAP/Mandate	System	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
NHTSA/IIHS	AEB			5* Recommended										
NCAP	FCW					5* Recommended								
NCAP	LDWS					5* Recommended								
Mandate	Backup Camera			New models	All new vehicles									
Mandate Proposal	Child Presence Det.													
Mandate Proposal	FCW													
NHTSA Agreement	AEB													
NHTSA Agreement	Child Presence Det.													

March 2020 NTSB Recommendations:

- For vehicles equipped with Level 2 automation, work with SAE International to develop performance standards for driver monitoring systems that will minimize driver disengagement, prevent automation complacency, and account for foreseeable misuse of the automation.

- After developing the performance standards for driver monitoring systems recommended in Safety Recommendation H-20-X, require that all new passenger vehicles with Level 2 automation be equipped with a driver monitoring system that meets these standards.

Driver monitoring

Strategy Analytics sees the market following **three generations**:

1. Solutions on dedicated hardware – this is where we are now

2. Solutions that are effectively "software only", and which are hosted on a shared ECU, e.g. ADAS domain controller or cockpit domain controller

3. Transition from DMS to multi-seat occupant detection system (ODS), especially for AV / robo-taxi applications

Conventional **camera** (2D monocular cameras, used in conjunction with NIR LEDs) remains the preferred approach. ToF-based sensors remain niche for now (costly, bulky, lack of resolution vs. camera based solutions), as will RADAR and other solutions.

For Gen 1 & Gen 2 the **KEY task** is driver monitoring

- Everything else (ID, emotion, health) is secondary. **"Every OEM is asking for emotion analysis, but no-one seems to know what they want to do with it"** – EU-based algorithm vendor

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Market development of optical DMS

Camera-based solutions forecast to deploy rapidly starting now

Legislative / NCAP interest growing...

Forecast has thus been significantly boosted over recent updates

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Post-COVID-19

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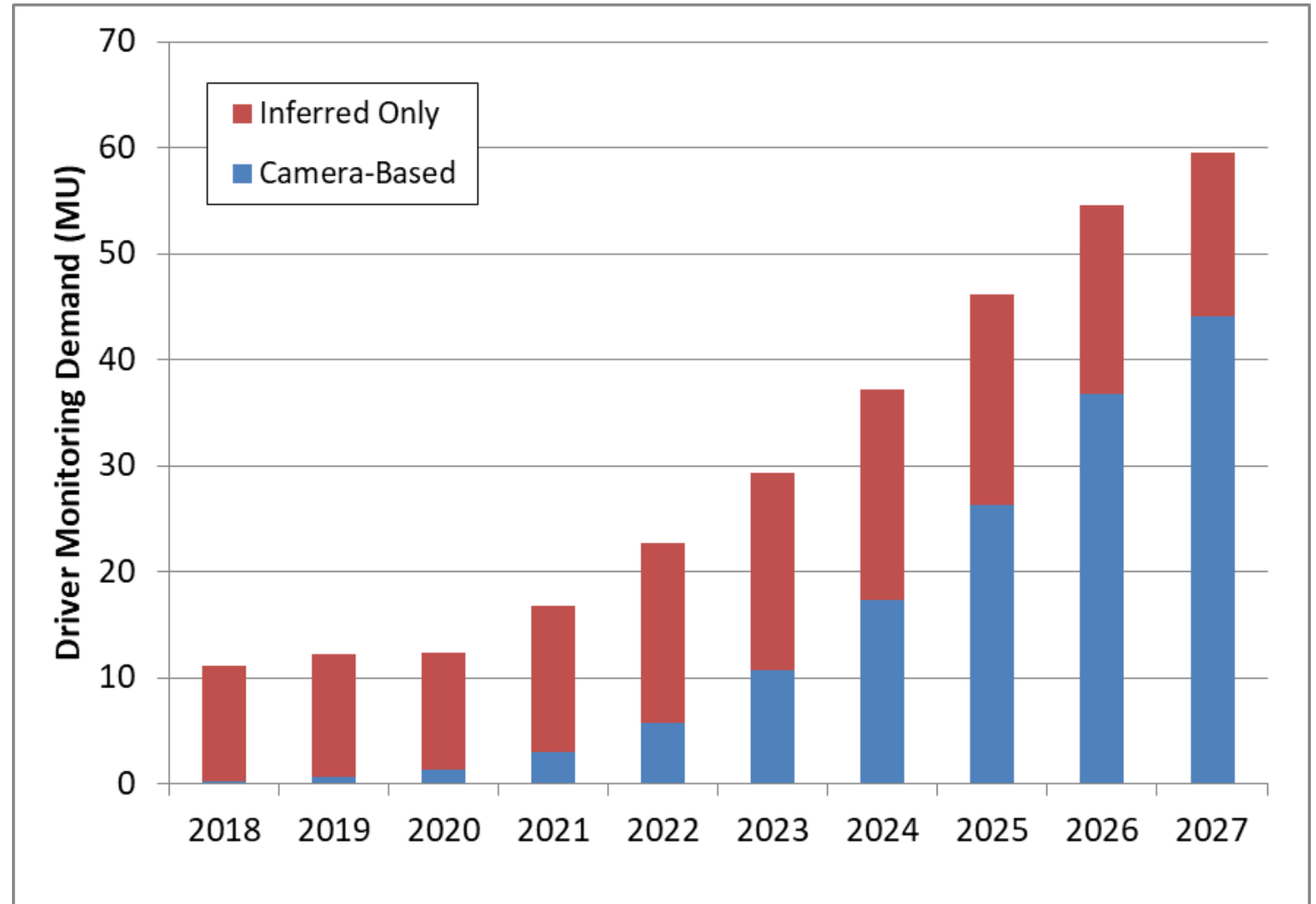
Automotive Architectures

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Key change areas for vehicle architectures

Central ADAS Domain Controllers

Cockpit Domain Controllers

Gateway Modules (A stand-alone module that links vehicle bus networks, e.g. low/hi-speed CAN, FlexRay etc.), effectively acting as a router and firewall for the vehicle.

"Full" centralization still appears very much "next-gen" or beyond for mass-market vehicles.

Next-stage evolution will most likely be to location-based controllers
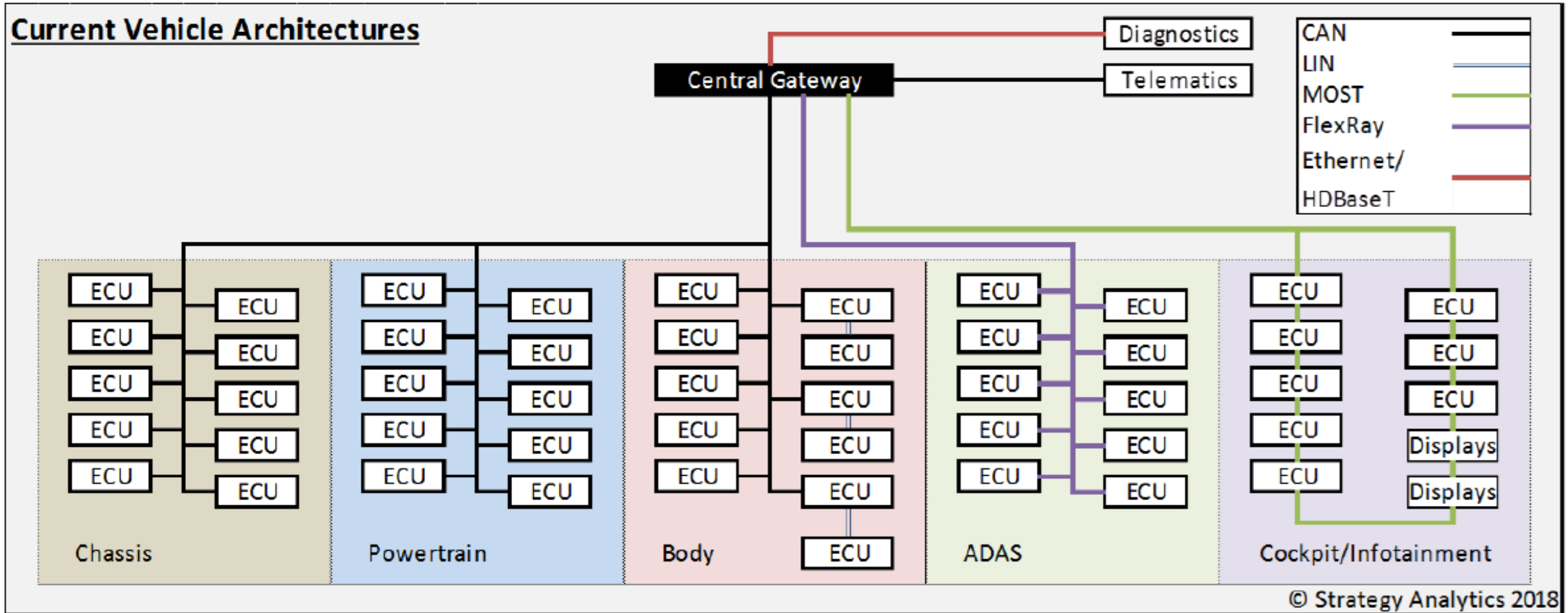

Source: NXP

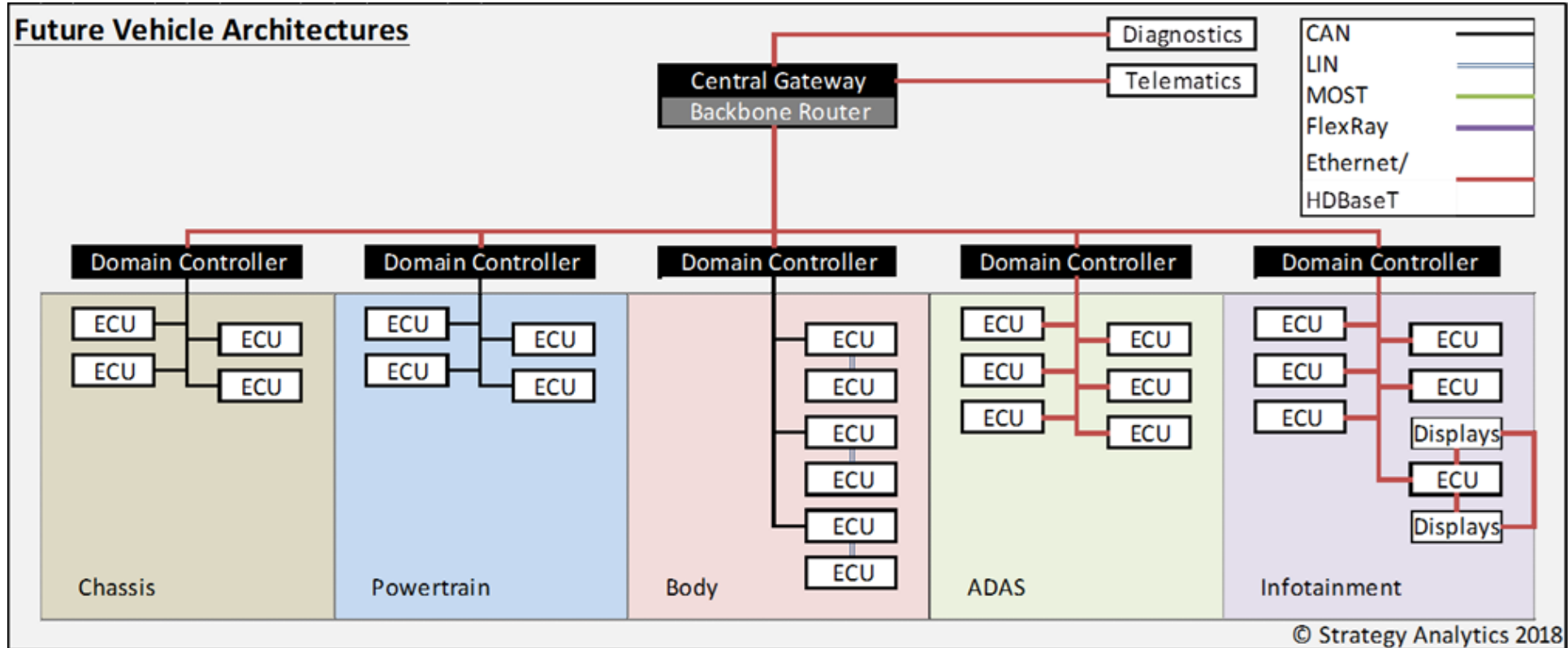**2019 Big News - Volkswagen's goal:**

- Reduce ~ 70 ECUs/modules computers to three.
  - Each powerful enough to handle the processing necessary to run its portion of the automobile
- Software largely developed in-house - has proven to be difficult
 - OTA updates
- Single electronic architecture

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Current Vehicle Architectures

© Strategy Analytics 2018

Centralized architecture allows automakers to leverage advancements in processing, memory, software and high bandwidth networking technologies to meet future ADAS and autonomous driving performance requirements such as: reliability/fault tolerance, latency, redundancy, security, flexibility/updatability/OTA updates and cost.

Location-based architecture
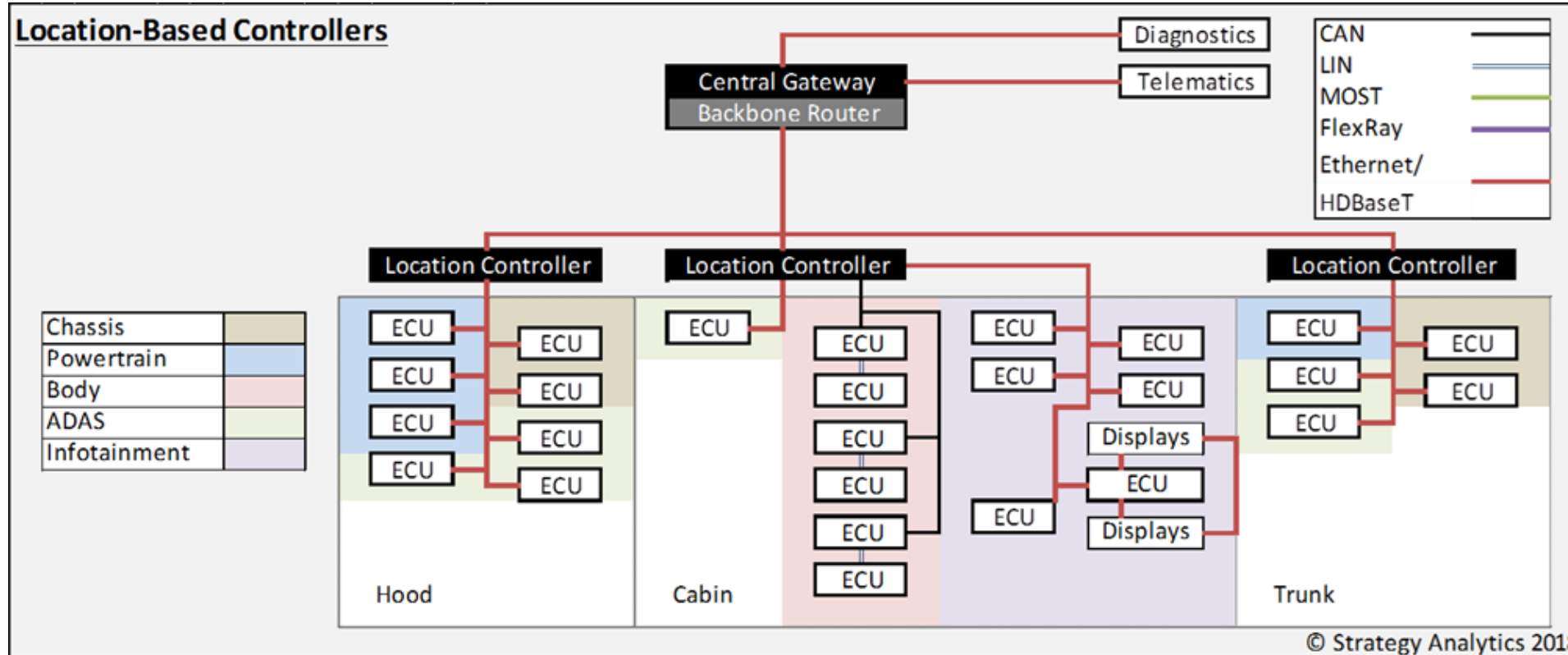
- Control centralized based on the **location in the vehicle** of the function, reducing cabling costs and weight

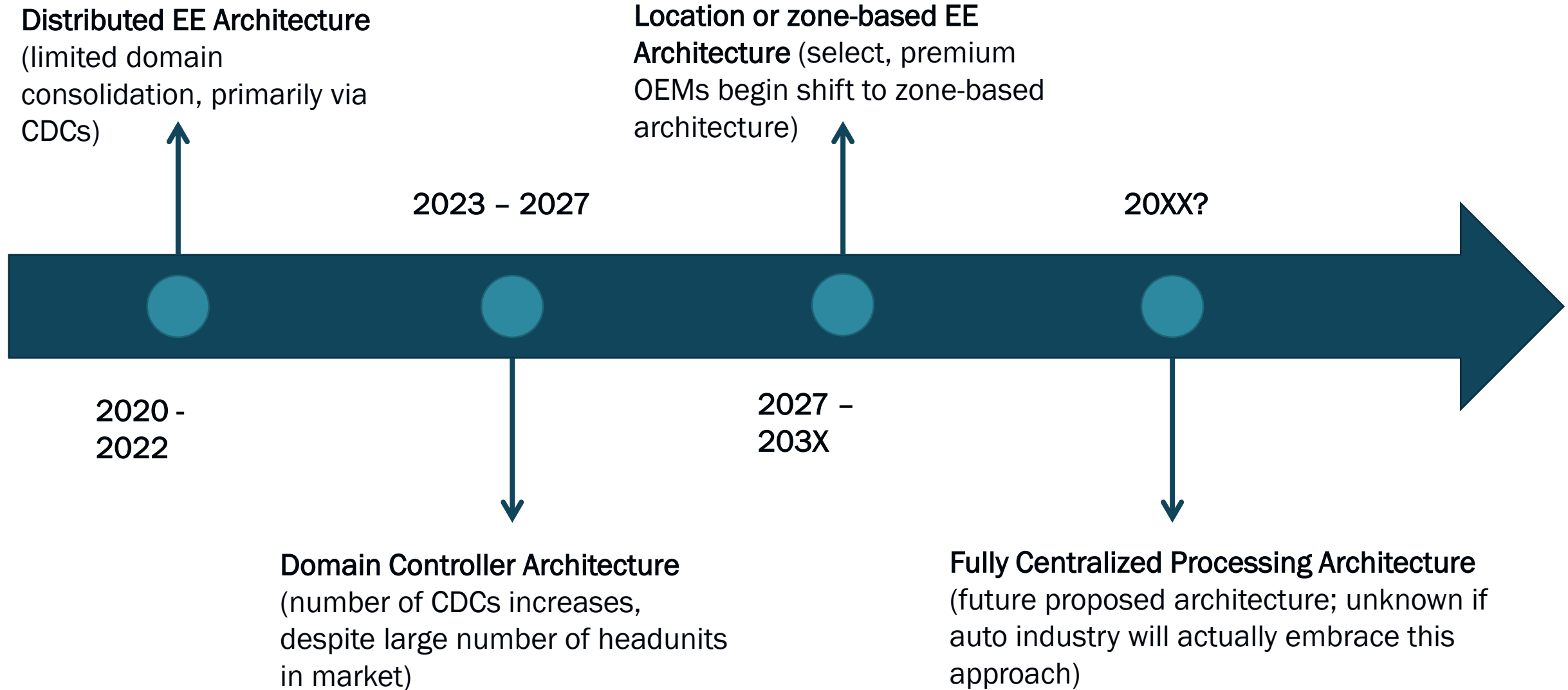- Much more cross-partner integration required

To centralize or not?

Status quo

- Understood technology
- Lower risk, despite complexity
- Allows extra hardware cost to only be carried when feature is present
- "Easy" / "Legacy" relationships with suppliers
- Less need for OEM to act as integrator

Centralize

- Cost-saving potential *if* most features to be centralized are standard and there is little "wasted" CPU/Memory
- Performance benefits – working with "raw" data
- More flexibility on sourcing functions as they increasingly become "software only"
- New OEMs have no legacy to worry about

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Cockpit EE architecture trend and timeline

Distributed EE Architecture (limited domain consolidation, primarily via CDCs)

Location or zone-based EE Architecture (select, premium OEMs begin shift to zone-based architecture)

2023 – 2027

20XX?

2020 - 2022

2027 – 203X

Domain Controller Architecture (number of CDCs increases, despite large number of headunits in market)

Fully Centralized Processing Architecture (future proposed architecture; unknown if auto industry will actually embrace this approach)

STRATEGY ANALYTICS

Conclusions

Full impact **of COVID-19 still** far from certain– PLANNING FOR OVERALL VEHICLE SALES/PRODUCTION TO BE IN THE ORDER OF 15% BELOW 2019 LEVELS SEEMS PRUDENT

ADAS will be hit less then many other application areas, as it is still a growth market in penetration terms – TOTAL ADAS DEMAND IN 2020 LIKELY TO BE VERY SIMILAR TO 2019

For perception-related technologies, where will the revenue be in the next 5 years? **DMS and front facing cameras will see growth**

COVID-19 is accelerating an already present industry trend that is seeing power shift away from traditional automotive players – WHO SHOULD YOU PARTNER WITH?

AV timelines were already receding pre-COVID-19, and the crisis is only pushing launch dates further out (for most) – BIG POTENTIAL WINS FOR THE BRAVE AND WELL-FUNDED

The key decision points for NOW are: DO I JUST NEED TO SURVIVE ?   ...or...
CAN I TAKE ADVANTAGE OF OTHERS' WEAKNESS?

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Questions and Answers

Resource Slide

Freely-available Information

Blogs

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