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402 - Software-Defined Vehicle Forecast

The Software-Defined Vehicle Forecast provides a grounded assessment of the growth enabling SDV technologies in different regions and vehicle segments. Its ten-year forecast understands how major OEM groups will deploy future E/E architecture elements, while assessing how these elements are expected to evolve. An adjacent Excel version offers detailed, data-driven, analysis sorted by brand and country in addition to revenues.

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#401

Software-Defined Vehicle Guide

As more new vehicles integrate a growing number of hardware and software technologies, E/E architectures are set to play an important role across the vehicle lifecycle. This role will be especially important as software-defined vehicles emerge and place new technologies at the core of this lifecycle – from development and throughout the user experience, to the SDV-specific features and services that help extend it.

The significance of E/E architectures in SDVs, as well as today's vehicles, makes it crucial for OEMs to carefully plan and map out a holistic approach to them. Doing so will allow automakers to create cost-effective vehicles that are safer, more secure, and provide enhanced system usability.

This Guide includes everything automotive planners and engineers need to understand around the state of the art of E/E architectures, and the journey to enable a software defined vehicle. Here, it provides insight into the decisions that enable year-on-year delivery with optimal utility and costs while highlighting relevant trends and profiling key technologies. An accompanying Excel version offers the latest data to encourage strong decision-making, with thousands of data points presented with every release.

COVERAGE	FREQUENCY	PUBLICATION FORMAT	PAGES
GLOBAL, NA, CHINA, EUROPE	ANNUALLY, QUARTERLY, ONE-OFF	PDF, POWERPOINT, EXCEL, ONLINE	120

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Key questions answered

- How are companies making architectural decisions that allow them to deliver year-on-year, without carrying inefficient utility and cost to every vehicle made?
- Which companies are implementing zonal architectures?

This research supports

- Product Planners
- C-Suite
- IT
- Engineering

Do I have access?

100+
Reports published per year

50k+
Slides of insights, forecasts & data

4,000+
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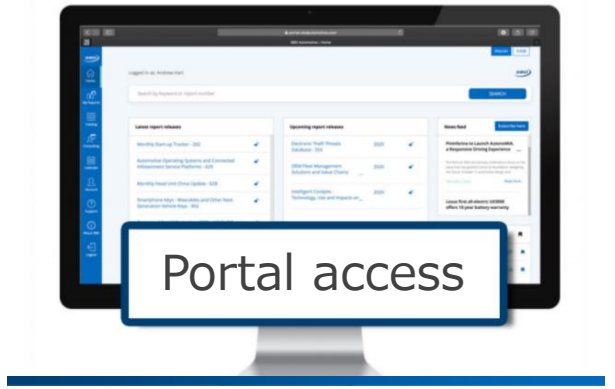
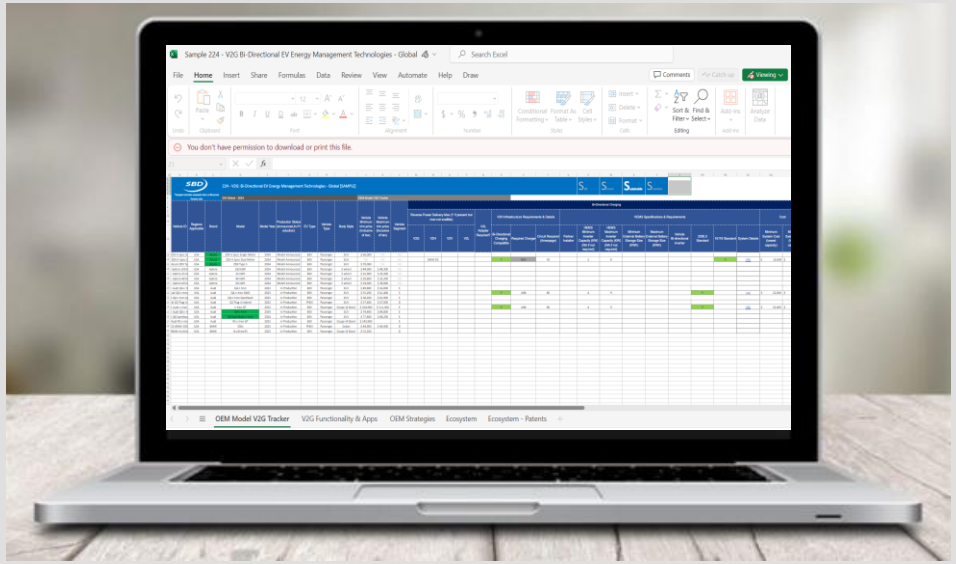




View Excel Data Sheet Sample

Software-Vehicle Guide

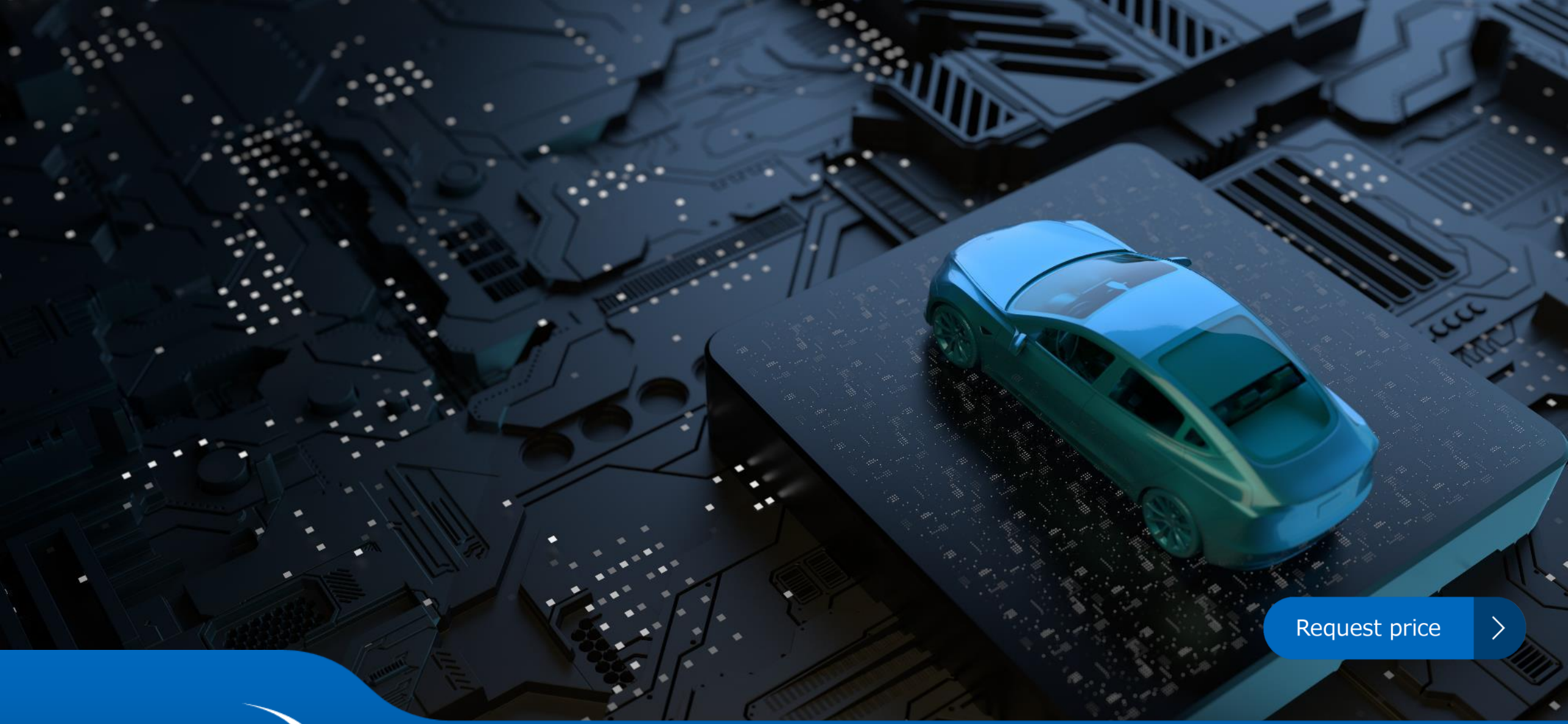
For an in-depth view of architypes and network functionality / elements by OEM platform, rankings, and ecosystem

>8,000 datapoints

60 OEMs, 310 models

Dashboard, Ranking and Ecosystem details

Click for Sample



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June 2025

401-25

Software-Defined Vehicle Guide

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401 - Software-Defined Vehicle Guide

Data Deep Dive
View and analyze deep data in your own way

Customer Feedback
Provide your feedback to SBD regarding this report

Total number of pages - 114

Introduction

Current investments in E/E will pay dividends soon

As automakers understand better what it will take to deliver more and ever-evolving features, the implications to the electronics and electrical (E/E) architecture are profound. The vehicle electronic architecture, being the spine of electronic features, sits beneath the various software layers (OS, middleware, application layer etc) and needs to support current and future needs. Making an architecture “future-proof” presents a significant challenge regarding deployment timing and scale
A holistic approach to E/E architectures will increase vehicle safety, security, and system usability, while also reducing costs to the manufacturer. Decisions made now will be a vital part of meeting the autonomous, connected, and mobility expectations of a consumer 5 years from now. There are solutions, such as hypervisors, Ethernet domain controllers, and service-oriented architecture, which are great options for flexibility, but only if they deliver your specific and unique customer requirements at the right price point.

The report looks at the **following key benefits of SDV for automakers**

SBD’s Software-Defined Vehicle Guide covers the SDV strategy (E/E architecture, vehicle platform OS and dynamic software stack, middleware, hypervisors etc.) of automakers in various regions, model-level implementation, technology coverage (Ethernet, FlexRay, zonal controllers etc). It draws necessary inferences from the raw data and provides actionable insights for the strategic and product planning teams to act upon

Layer	Section	Conclusion
STRATEGY & IMPACT	Executive Summary	This report identifies automakers' various SDV strategies and their potential implications for features, challenges, and technology implementation. It provides a balanced perspective on how some architypes are future-ready while some are doing more despite being traditional
LEARNING & ACTION	The Basics	A detailed description of all the SDV layers, E/E generations and other terminologies covered in this report
	What’s New?	Key announcements, partnerships, and acquisitions in the SDV ecosystem.
	Analysis	In-depth information on various SDV trends (penetration summary, advanced architypes, dynamic software stack, regional differences, and much more
CORE INSIGHTS	Summary Tables	Group level SDV summary emphasizing feature capability, future strategy, vehicle development software, along with the topological diagram of the most advanced E/E architype
DATA DEEP DIVE IN EXCEL	Deep Dive Markets Announcements Rankings Definitions	View and analyze deep data in your own way
CONTEXT	Birds Eye View	An overview of the tangential trends to this topic, as identified in SBD’s neighboring products
	Future Outlook	Some groups are hard-pressed to overhaul their existing E/E, which may lead to complex decisions soon
	Next Steps	Can SBD help you with any unanswered questions?

Example slides from the report

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Today's state of the art E/E roll out is largely tied to BEV plans

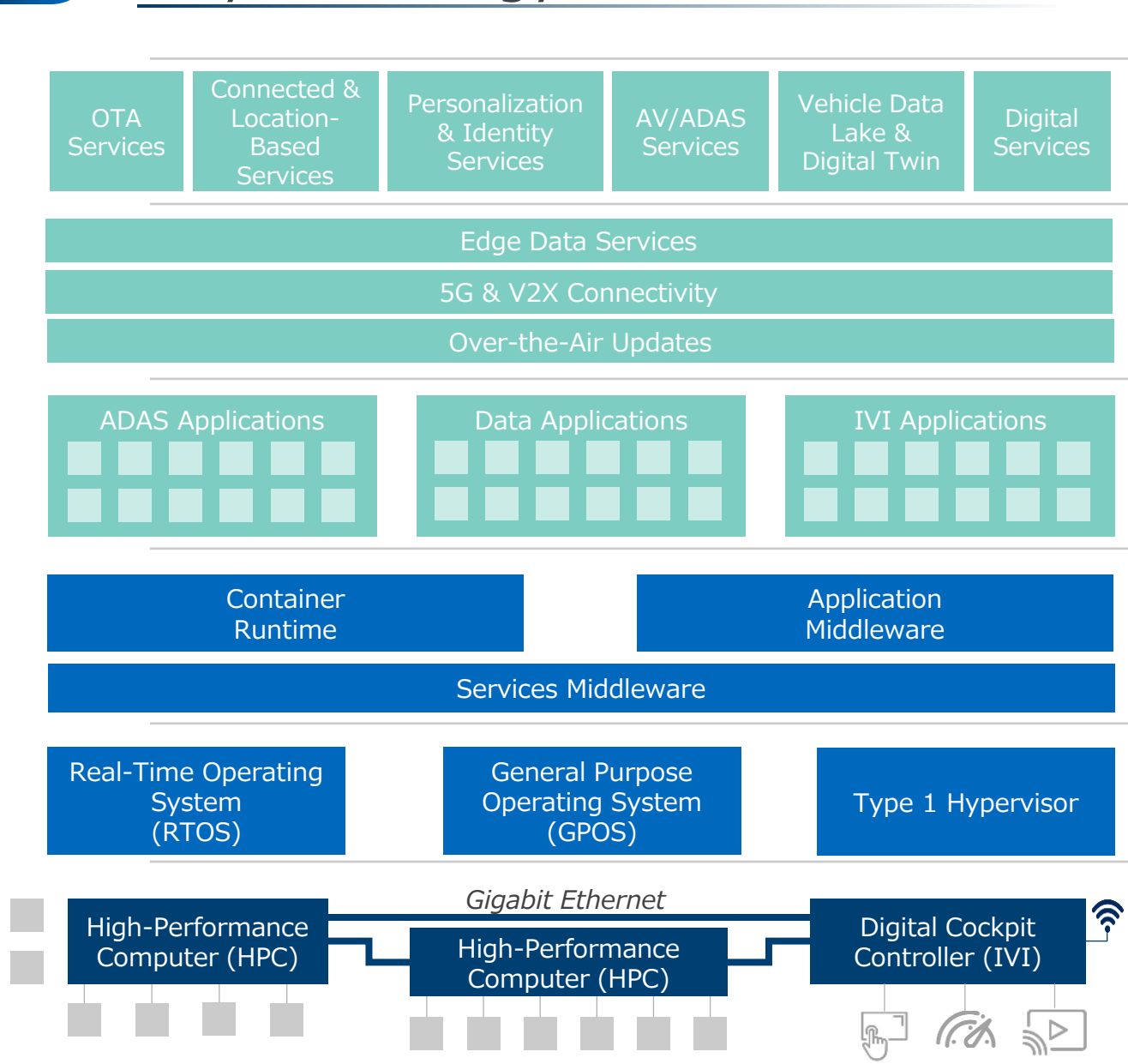
While some European premium brands have approached EV and state-of-the-art E/E role out very differently, we now see all the newcomers following Mercedes-Benz' lead. Automakers haven't been vocal about whether they have plans to roll the same (or similar) architectures onto their ICE models.

ARE BEVs EE LAUNCH PADS OR WILL E/E DIVERGE?

Three approaches to rolling out state of the art architectures onto mixed BEV/ICE portfolios

Launch on both BEV and ICE	Launch only on flagship BEVs	Launch on a wider BEV lineup
Outlier	***Wide adoption***	***Outlier***

Key technology enablers must be delivered across Six SDV Layers



6 SDV Layers		
Cloud Services	Support connected services in the vehicle	The ***dynamic software stack*** is the set of software that is portable and updatable, generally independent of the underlying hardware. It also includes the shared services facilitating this mutability remotely i.e. through connectivity and cloud services directly linked with in-vehicle software. A majority of vehicle features and services are defined and managed in this stack in order to maximize configurability and updatability. In addition, the portable nature of the software allows simulated, automated testing independent of specific vehicle hardware.
Shared Services (In-Vehicle)	Cross-domain enabler	
Vehicle Applications	Independent from underlying hardware	
Platforms & Middleware	Cross-domain Domain-specific Homogeneous computing	The ***vehicle platform***, sometimes called the vehicle "operating system" by some OEMs, is the collection of hypervisors, device operating systems, and middleware/runtime services that provide the underlying framework for the dynamic software stack. In principle, this layer provides hardware abstraction for the dynamic software stack.
Operating System & Virtualization	Hardware abstraction	
Hardware & E/E	ECU consolidation High-bandwidth network	The ***E/E (electrical & electronics) platform*** contains the physical devices on top of which the vehicle platform runs. HPCs run most of the dynamic software stack with commodity ECUs & sensor-actuators on zonal subnets.

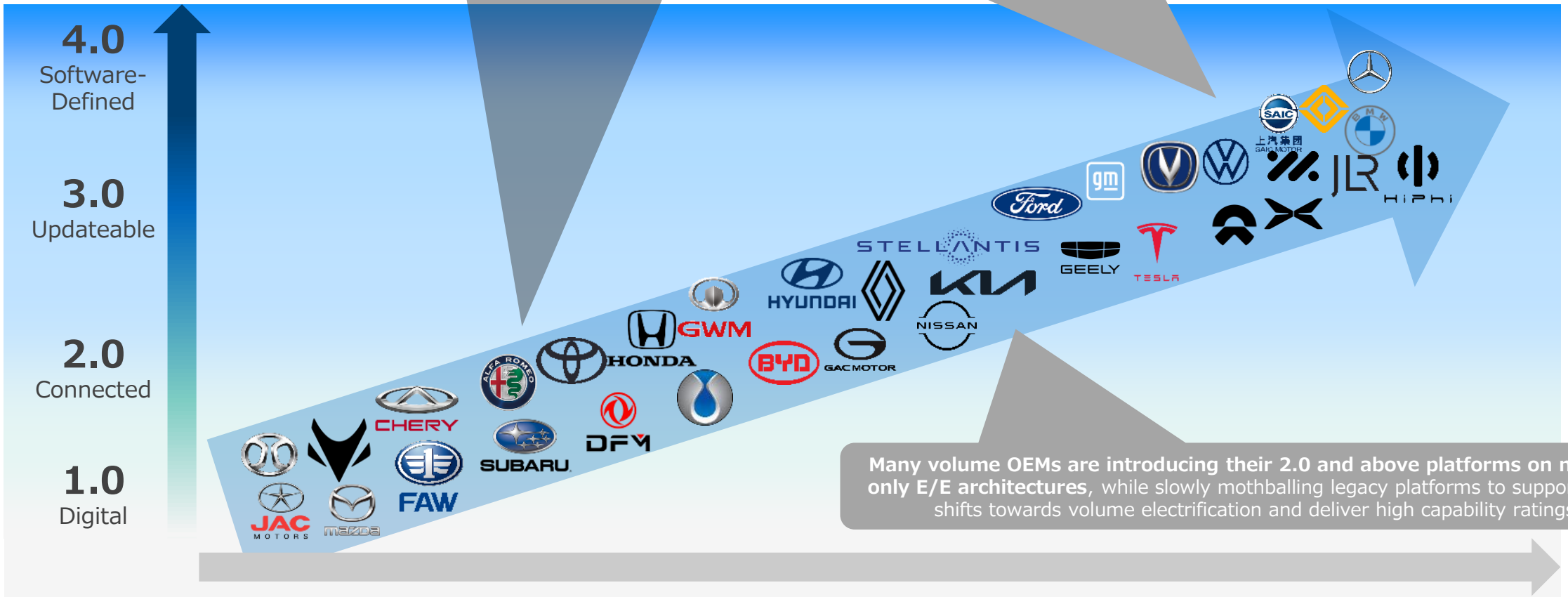
Some brands are ready to take the next big leap

OEMs that still rely heavily on Tier 1 suppliers for core electronics development and support only up to Vehicle 2.0 architecture

Legacy E/E architectures (More CAN buses, Gateways), relatively low volumes, and lack of resources create barriers which become increasingly difficult to overcome.

OEMs with only one or two Vehicle 3.0 E/E platforms have a significant advantage to rapidly adapt & evolve to competitive disruption.

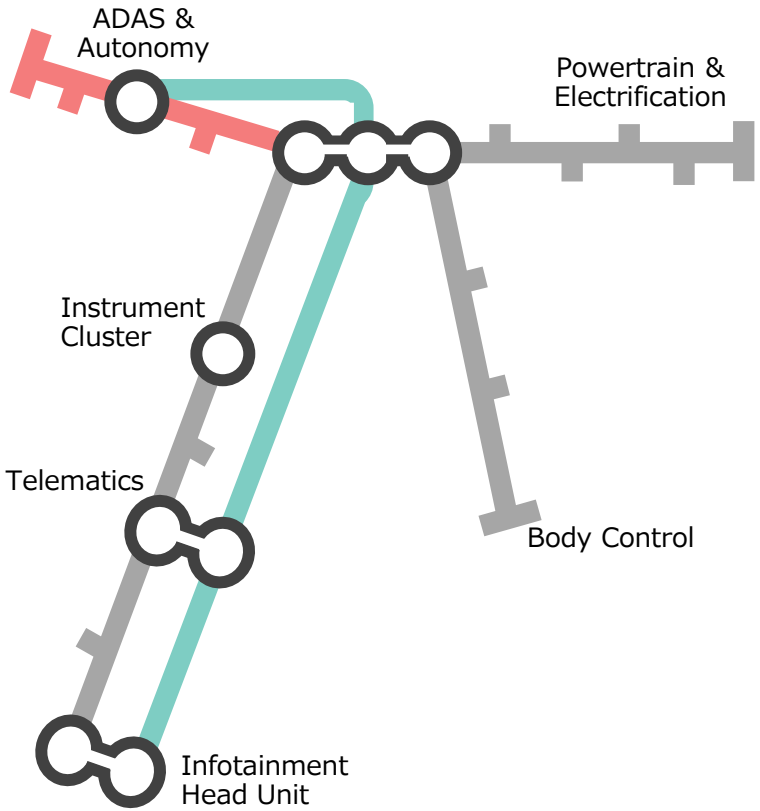
Pure-play EV OEMs or those launching new EV platforms are even more agile thanks to their ability to start designing their vehicles entirely around novel experiences, business models, and technologies. Chinese BEV startups are leading this



Many volume OEMs are introducing their 2.0 and above platforms on new EV-only E/E architectures, while slowly mothballing legacy platforms to support major shifts towards volume electrification and deliver high capability ratings

Ethernet Bus: Commonplace in premiums, a leap for the volumes

The OEMs see **Ethernet as a natural progression to Gateway architypes** driven by the need for high-bandwidth technologies and more security. **Replacing the traditional CAN bus with a faster alternative like Ethernet or FlexRay allows the OEMs to facilitate updating control units and software** (OTA), rather than needing to add more networks to support more features (SAE Level 2 features, connected infotainment etc.)



Ethernet Bus Architype Topology

CADILLAC

Gigabit Ethernet aiding high speed data transfers

Cadillac Escalade featured a high-bandwidth Ethernet Bus architecture that facilitates communication between the telematics and radio ECUs. Cadillac's **Lyriq electric SUV** takes one step further and puts an Ethernet link between infotainment, automated driving mapping (Super Cruise hands-free driving) and image processing modules (driver monitoring).

Ethernet connection to most prominent modules to prioritize OTA updates

While the new BEV range of Volkswagen is migrating to a more "centralized" strategy, many traditional models (Passat, Touareg, Polo) use Ethernet as a backbone for ADAS, instrument cluster, and digital cockpit/infotainment modules. The gigabit Ethernet bus that allows OTA updating of key systems with ease

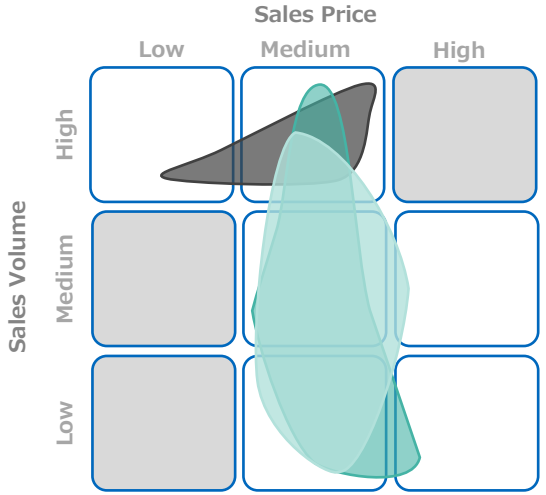
Jeep

An improved E/E strategy leveraging Ethernet

The earlier generation of Jeep models was based primarily on Dual-CAN/Gateway architypes, star connectors etc. These connectors reduce losses compared to long harness lengths but are still restricted on bandwidth. Jeep is now migrating to an Ethernet-based architype on its flagship (**Grand Cherokee) and new Wagoneer models.**

Ford Group

Architecture Spread



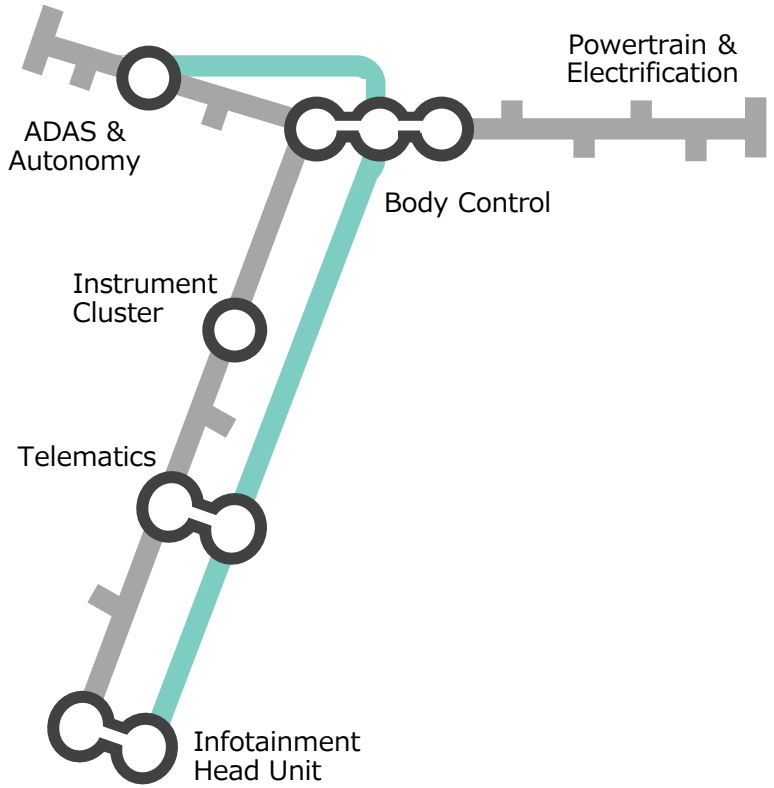
Key Takeaways

- Ford Group is providing an Ethernet bus architecture on most of the Ford and Lincoln models with a high number of CAN buses, which also supports a high number of functions and OTA update ability**. A centralized computing architecture (at least on the flagship models) is the natural progression to reduce the complexity of the system.** The entry/mid level models can be Ethernet with addition of FlexRay to support autonomy.
- Mustang Mach-E has an upgraded E/E based on a zonal-central gigabit Ethernet network. More details on its SDV stack including hypervisor and middleware information is yet to be published.

Summary Table

Architype	OEM Model	CAN Buses		MOST	FlexRay	Ethernet					
		3 - 5	6+			Available					
Ethernet Bus	Lincoln Corsair PHEV		●			●	●	●			
	Ford F-150 Lightning		●			●	●	●			
Basic Ethernet	Ford Mustang		●			●	●				
Gateway	Ford Ranger		●			●	●				
	Ford Bronco Sport	●									

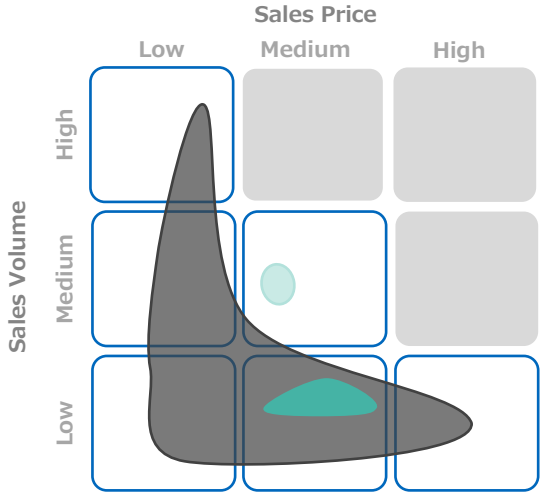
Ford F-150 Lightning



Capability Ratings

Nissan Motor Corporation

Architecture Spread



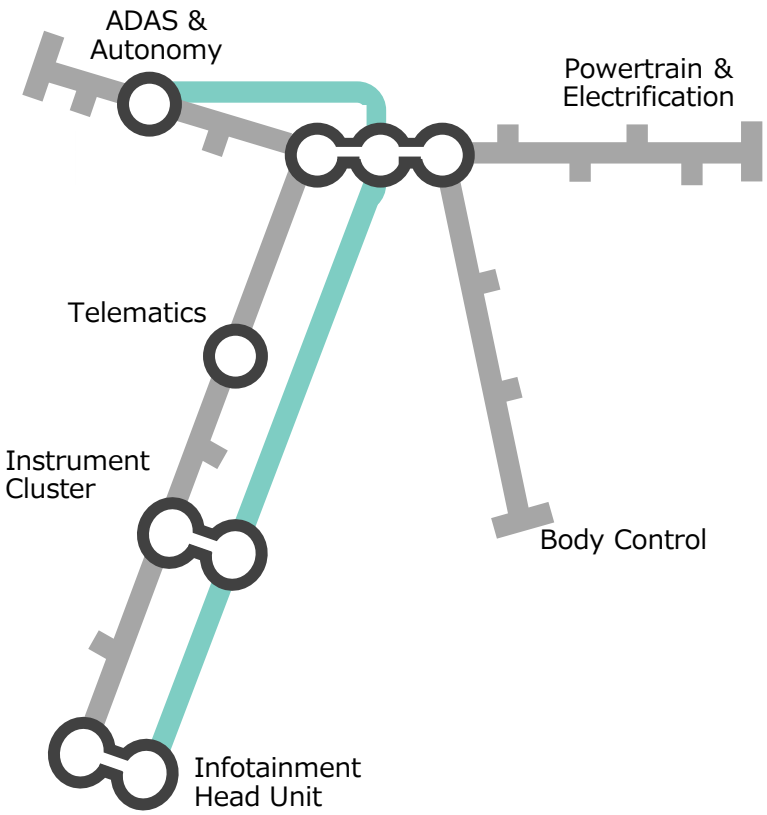
Key Takeaways

- Of the vehicles studied from the Nissan Group (including Infiniti), most have traditional CAN-heavy gateway architype while some flagship models get Ethernet Bus.
- **Nissan Ariya scores the highest in terms of capability ratings and is a architype leader** (one of the few models in US to get hands-free assisted driving). Like some Renault models, Nissan Ariya gets Ethernet Bus that connects several modules (infotainment, ADAS)
- The next logical step for Nissan is to **introduce a centralized computing platform (like Volkswagen, Xpeng)** hosted on Ethernet backbone.

Summary Table

Architype	OEM Model	CAN Buses		MOST	FlexRay	Ethernet					
		3 - 5	6+			Available					
Ethernet Bus	Nissan Ariya	●				●	●	●			
	Infiniti QX60		●			●	●	●			
Basic Ethernet	Nissan Pathfinder	●				●					
Gateway	Infiniti Q50		●								
	Nissan Altima	●									

Nissan Ariya



Capability Ratings

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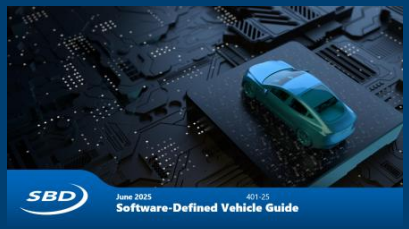

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