

# EVOLUTION AND TECHNOLOGY DRIVERS FOR NEXT-GENERATION ELECTRICAL AND ELECTRONIC ARCHITECTURES



E/E architecture decisions made now will be a vital part of meeting the autonomous, connected and mobility expectations of consumers 5-10 years from now.

From evolutionary decisions around **domain controllers, hypervisors, OTA and gateways**, to step-changes including **Service-Oriented Architecture (SOA), ethernet backbone** and **zonal architectures**, OEMs face critical decisions on if, how and when to adopt these next generation technologies in their future models, both volume and premium.

To help explain the features, functions and attributes of emerging E/E architecture solutions, and how they relate to the entire CASE design space, SBD Automotive is creating this report to inform, clarify and support your strategic E/E decisions.



## Project Scope - Chapters & overviews

Chapter 1. Why Electrical & Electronic Architecture?	
Experiencing the Architecture.	In this section of the report, SBD will introduce the factors that should be considered by an E/E architect when planning the design of their next generation solution. With lots of examples, SBD will cover the factors that drive the overall electrical architecture.
What must be considered?	

Chapter 2. State of the Art	
'Architypes'	This section will classify the E/E architectures adopted by 10-15 of the leading global OEMs, including model-level analysis for the major market segments. Here, SBD's experts will distil a large amount of architecture data into a series of <b>'Architypes'</b> , for example: <ul style="list-style-type: none"> <li>• Domain-based architecture with ethernet backbone</li> <li>• Multiple CAN - single gateway</li> <li>• Zonal architecture.</li> <li>• Etc</li> </ul>
Examples of details	
Matrix	

Chapter 3. Drivers of change	
Connected	A high-level review of connected, autonomous and shared mobility technologies, as well as the legal and commercial landscape changes. This section will focus on trends and examples to inform the reader ahead of the following chapters, which offer solutions to issues raised.
Autonomous	
Shared	
Electrified	
Manufacture	
Service	
Legal	Key topics include - <ul style="list-style-type: none"> <li>• Trends</li> <li>• Landscape changes</li> <li>• Multiple screens</li> <li>• 5G</li> <li>• Remote driving</li> </ul>
Commercial	

Chapter 4. Technical solutions	
Networks (Physical & Wireless)	A review of technologies: how they work, what they achieve and an indication, where possible, of levels of adoption. Some of these will be established technologies which will continue (e.g. LIN networks remain offering great value) and some will be newly adopted technologies, such as <b>hypervisors</b> and containers. Cyber security solutions will be included. The routes taken to establish a <b>Service Orientated Architecture</b> will be discussed, including consideration of the spectrum and scale of how they can be implemented.
Software Virtualisation	
Service Orientated Architecture	

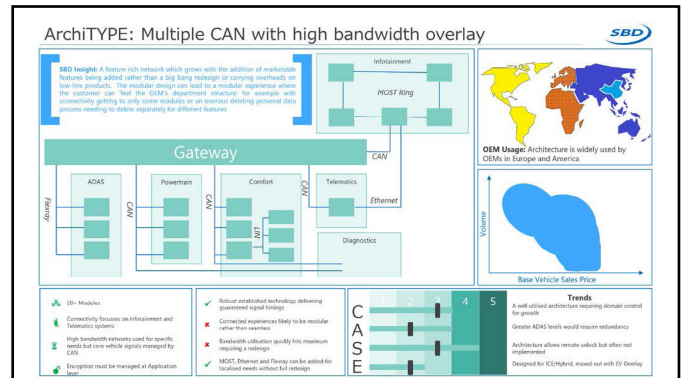
Chapter 5. Future outlook		
Common Pictorial Language	By this point in the report, as the reader will have a view of future trends, solutions and a thorough understanding of the state of the art, the report is able to review various players' view of the future and provide SBD's insight into how we see the market evolving. The spread of sources and views of the future will include OEMs, Tier 1s and, where appropriate, will draw from broader sources such as tool set providers, academia, governments and Tier 2s. Finally, SBD will provide insight to how these views come together into an overall outlook for the major market trends and technology winners and losers.	
OEMs		Tier 1s
Tier 2s		Tools
Analysis		
Infographic with History		

# What must be considered?

# State of the art

**Why Electrical Architecture: What must be considered?**

What & Where?	Sensors & Actuators	Processors	Storage
Connect	Usually the location of these is fixed by requirements, and the nature of the item drives how it will connect	The functional tasks will require varying resources driven by the position in the architecture flow	Can be localised or centralised, onboard and offboard, compressed or raw
Physics	<b>Bandwidth &amp; Latency</b> What is the nature of the data? Steering Angle will be treated very differently to a movie	<b>Digital or Analogue</b> At what point is the antenna signal digitised? When is the audio translated to a wave?	<b>End to End</b> Not just the phone and car but everything and every 'customer' who is not the user of the vehicle
Lifecycle	<b>Cable Types</b> Twisted pair Shielded Special Cables (USB/Antenna)	<b>Packaging</b> Placement of items will affect harness and likely the method of connection	<b>Cable Lengths</b> Many limitations for varying technologies. Direct impact on cost and weight
Secure	<b>Updates</b> At a dealer, over the air, plugable hardware. Warranty reduction, Experience improvements, Upselling	<b>Manufacture</b> How is an issue diagnosed? How is software uploaded to the modules?	<b>Service</b> Issue detection and fix, upselling, data gathering, avoidance
	<b>Cyber Security</b> Where is a connectivity bind triggered? What are the attack points? Firewalls	<b>Local Security</b> Can access to network be obtained? Is a backup battery required for theft use cases	<b>Privacy</b> Types of data stored. How many actions required to remove from vehicle, binding, profiles
	<b>Robustness Requirements</b> Depending upon the function performed, different requirements will fall upon the architecture	<b>Commercial &amp; Legal</b> Factors such as strategic alliances, over committed sourcing strategies, Market requirements	<b>Power Management</b> Systems which must operate during EV charge / remote use etc. CE device charge and connectivity



## Drivers of change

## Technology solutions

**Drivers of Change: Connected**

Physicals	Displays	Critical Services
<p><b>5G Early Digitalisation</b> High attention at high frequencies means shielded cables are at their limit for short lengths to antennas. 5G mmWave will continue this trend</p> <p><b>Cost &amp; Weight</b> Special shielded cables and the increasing volume of copper around the car adds weight and piece cost</p> <p><b>Increasing number of Application Processors</b> Increasing functionality means more expensive chips sets being added in multiple locations around the vehicle</p>	<p><b>Common Themes</b> Multiple Screens need a common User Experience with themes operating together and information aligning and passing between them</p> <p><b>More Displays</b> LCD screens are becoming cheaper leading to increased usage. HUDs are becoming common place. What hardware can be shared between them?</p> <p><b>Rear Camera</b> Startup requirements for a rear camera are far higher than for other infotainment uses</p>	<p><b>Location as a Service</b> With e-horizon, navigation is no longer the only user of location. Some users are safety critical, other not. Each with varying latency and granularity requirements</p> <p><b>Remote Driving</b> Remote Driving features such as Remote Parking pose new requirements onto wireless protocols and decisions on where on the architecture to host functions</p> <p><b>SBD insight:</b> Connectivity is now required by most services but adding it by traditional methods adds significant piece cost, so new approaches are required</p>

**Technology: Software Virtualisation through Hypervisor**

**SBD insight:** Virtual machines live on a common ECU with resources allocated to them such that the applications are ignorant of the hardware they sit upon. This allocation of resource managed by a hypervisor but can be configured in middleware. Most automotive middleware statically allocates resources as it's more robust technology but dynamic allocation allows different applications to consume resources depending upon what is available (reducing the overhead but making a worst case consideration a complex calculation).

**OEM Usage:** An emerging technology.

**Trends:** Virtual machines can be used for partitioning software from customers, utilizing different Operating Systems, and for complex tasks like IVI, infotainment, navigation and safety. Many OEMs have been considering Connected Car services for the last 18 months.

**SBD insight:** Virtual machines are useful for partitioning software from customers, utilizing different Operating Systems, and for complex tasks like IVI, infotainment, navigation and safety. Many OEMs have been considering Connected Car services for the last 18 months.

## OEMs face a significant number of (often contradictory) E/E architecture choices, including:

- Bespoke software platform – VW proposes 'vw.os', a Services-Oriented Architecture (SOA) for its 12 VW Group brands, from VW Up! to Audi A8
- New in-vehicle architectures – GM plans to roll out new Digital Vehicle Platform to most of its vehicles by 2023, whilst Aptiv and Altran propose alternative next-generation software platforms for connected and autonomous vehicles
- Domain controllers – Visteon powers MBUX's multiple screens with a cockpit domain controller, which can independently operate the infotainment system, cluster and other domains on one system-on-chip
- Hypervisors – A key building block for OEMs looking to integrate Android Automotive, Linux and/or RTOSs into their next gen IVIs
- AUTOSAR Adaptive – Ethernet-based ECUs can now be used as central application servers with the ability to update applications over a vehicle's entire life cycle and add new software functions at a later time
- Secure gateway – Will continue to play a leading role in preventing cyber attacks as a standalone component, as part of a connected gateway or consolidated into other ECUs/DCs

## How do you know you have made the right choice?



### Pre-order

To get early access to this report in December 2019, contact the SBD Sales Team

Contact Sales