Software defined vehicles

Automotive's latest holy grail

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Software-defined vehicles (SDVs) have been everywhere these past few months, with the noise reaching a crescendo after the recent CES in Las Vegas. Trouble is, it's not exactly new. It's just that the auto industry loves a mega trend or a concept that helps explain everything. And to be fair, SDV does knit together a whole gamut of developments in the industry rather neatly.

Software is the number one enabler for how the automotive industry wants to transform into the mobility sector. It's also one area of Tesla's competitive advantage that the chasing pack of OEMs are looking to chip away at. Software's been essential to vehicles, and their development, for a long time. Think of how combustion or propulsion is controlled in modern powertrains or electric vehicles and there's software embedded in the electronic control units involved. It is the same case in active chassis control or infotainment systems. However, SDVs puts software front and center in vehicle development and look set to transform the automotive environment.

This latest issue of Talking Heads gathers the views of S&P Global Mobility subject matter experts in the software, E/E and connected car domains.

Tawhid Khan

Director, Software practice, Supply Chain & Technology

Automakers have long dreamed to own and control their own feature development. However, the lack of software expertise, together with extended supply chains has been a barrier to that ambition. Now, with the software-defined vehicle that ambition can be realized.

The software-defined vehicle (SDV) is the ultimate expression of the customer-oriented vehicle. Specific functions and capabilities, controlled through software, can be updated and maintained using software developed by their own software engineers. It will transform customer' vehicular experiences to be just like those they are regularly exposed to in their technology hardware such as smart phones.

A way to achieve this is by decoupling software development from vehicle development. SDV also requires deep integration between cloud technologies and vehicles, allowing the vehicle to function as essentially a node within a much larger computing infrastructure.

There are many benefits to SDVs. These encompass all stakeholders within the automotive industry, starting from OEMs and suppliers, ecosystem providers and, finally, end users. For example, OEMs and suppliers can drive business efficiencies by using cloud infrastructure, and software reuse across product platforms, hence improving Bill of Materials costs and generating new revenues.

However, a key barrier to developing SDV is the lack of computing power within electronic control unit (ECU) functions and the embedded nature of vehicle functions. In today's vehicles changing a small bit of code requires wholesale modifications within the vehicle. A costly validation process also must be carried out. Furthermore, software changes for non-SDVs can only be made at certain vehicle upgrade points, unlike a mobile phone that can be updated with Over-the-Air (OTA) software downloads.

This is the reason automakers are busy developing a new architectural trend that standardizes the non-consumer-facing functions and that is focused on consumer-facing applications that can be updated using OTA features. Furthermore, software is also seen as a new revenue-generating opportunity to supplement product sales.

Richard Dixon

Senior Principal Analyst, E/E, Supply Chain & Technology

SDV will have a significant impact on the electronic hardware in vehicles going forward. While SDV is a software topic ultimately – bringing as much of the software into one place, in the middleware – the hardware can be optimized to support this activity.

We see that new in-vehicle network designs are emerging. These are based upon powerful center computers with high processing capability and memory concentration to support the centralized software. The idea is to have fewer, but more powerful, computers and to replace many small ECUs distributed about the vehicle in which small bits of code exist. The present situation – multiple small ECUs with small bits of code – does not make it efficient or straightforward to update functionality. Zonal architecture will be used to support many of these designs. The center computer is the decision maker based on all the sensor input from outside the vehicle, the zone controllers communicate the decisions back to the actuators for processing into motion.

Tesla leads the market by at least five years with this approach and much of the industry is trying to follow suit. We see Chinese OEMs, especially those with performance battery electric vehicles (BEVs) in their portfolio, as being the fastest followers, with major EU/NA OEMs not far behind. Toyota, Mazda, Hyundai work on SDV but using standard vehicle E/E architecture that is less disruptive to their existing networks. The goal for OEMs is to supply post sale services using connectivity, and centralized architecture makes this efficient. Side benefits of zonal architecture and center compute is a reduction in wiring and weight in the vehicle, especially important as OEMs move to significant BEV content in their respective portfolios.

Brian Rhodes

Associate Director, Connected Car and Vehicle Experience, Supply Chain & Technology

The term Connected Car used to be simple to define, it was merely considering a vehicle's ability to connect to the outside world, be it from an embedded telematics control unit or using a connection from your brought-in device. As an industry we've moved beyond this - the SDV is the next steppingstone - to instead focus on the *capabilities* that connection brings to the ecosystem, and this has been transformed more by software than anything else.

One of these transformations is in updatability. OTA updates are often discussed in the hardware sense as we're still in the deployment phase, but ultimately software defines the reach, capability, and strategies that OTA can enable. While many OTA deployments are including the ability to update an ECU for activity safety content, for instance, the software competency is what will separate an automaker from being able to deploy wide-scale updates to these features.

The other shift is even more obvious to the end consumer, and that's referring to the content brought to new vehicles. Google is once again dominating headlines from Android Automotive operating system (OS) wins to decoupling components of Google Automotive Services (GAS) to bring to Mercedes even without the underlying OS. Google aside, we're seeing an explosion of in-car commerce that is redefining the financial targets of many automakers because of the demand from their consumers. All of this is made possible by a combination of enabling connectivity paired with scalable software platforms.

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