APTIV 2021 KICKOFF

Transcript

January 11, 2021

WELCOME

Speaker: Kevin Clark, President and Chief Executive Officer

Hello everyone, and welcome to Aptiv's 2021 kickoff event celebrating "Innovation in Motion"!

Today we are excited to share with you some of the innovations that Aptiv has developed over the past year and how they help enable our vision for Smart Vehicle Architecture™ and the software-defined vehicle.

Never has Aptiv's mission of delivering sustainable mobility solutions had more meaning than it does today – everyone is re-evaluating how they view safety, efficiency, comfort and convenience.

Throughout the pandemic, Aptiv kept our most important asset – our employees – safe. They never stopped innovating, and they never stopped delivering for you, our customers. They put innovation in motion throughout 2020, and it shows in the advancements we are sharing with you today.

We are all here – virtually – because we know there is always a better way – a better way to design vehicle solutions, and a better way to work together to make our shared vision a reality. This means digitization of development processes, faster cycles of prototyping and commercializing solutions, and broader collaboration between our traditional and emerging OEM customers.

Aptiv helps our customers thrive in this rapidly changing environment by serving as a trusted partner who can enable this transition.

Our unique position with both the brain and nervous system of the vehicle allows us to take a holistic approach to the vehicle solution stack. As a result, we can balance performance and cost, tailored to your specific needs. We can act as a partner to help solve some of the industry's toughest challenges and democratize technologies as they mature – delivering higher value, at lower cost, for our customers.

As you would expect, our efforts to enable a software-defined vehicle are aligned with Aptiv's approach to Smart Vehicle Architecture™ – our "north star" for powering and enabling the advancements that consumers are demanding.

There's a lot to talk about. So let's get started.

Let me now turn it over to Aptiv's CTO, Glen De Vos, to help explain how today's discussion is a vital part of the Smart Vehicle Architecture™ journey.

ENHANCING VEHICLE ARCHITECTURES

Speaker: Glen De Vos, Senior Vice President and Chief Technology Officer

Thanks, Kevin. And to all of our customers, and other stakeholders around the world, welcome! As Kevin said, Smart Vehicle Architecture™, or SVA™, represents Aptiv's vision for the full electrical and electronic architecture of the vehicle. It includes all of the elements that we believe are necessary to simplify the feature-rich and highly complex vehicles of today while efficiently enabling the electrified, software-defined and highly automated vehicles of tomorrow.

There are so many aspects to SVA™, and in some shape or form, all of the products we'll talk about today fit into the SVA™ vision. To set the stage with some context, here's Lee Bauer.

Speaker: Lee Bauer, Vice President, Advanced Engineering – Smart Vehicle Architecture™

Thanks, Glen. Since we unveiled SVA last year, Aptiv has made key advancements in high voltage electrification, domain compute and zone control solutions – all of which are necessary steps along the path toward fulfilling the SVA™ vision.

Before we get to those innovations, let me briefly reiterate the key elements of our SVA™ approach.

SVA™ is a vehicle-level design philosophy that leverages Aptiv's unique position with both the brain and the nervous system of the vehicle, and our equally unique understanding of the challenges caused by the complexity of today's vehicle architectures.

SVA™ is our approach to balancing performance and cost by adhering to three fundamental principles:

- We abstract (or separate) the hardware from the software
- We separate I/O from compute
- Each of those steps has its own benefits; but,
- when we have those two levels of abstraction, we also have the ability to "serverize" compute – resulting in a truly software-defined architecture that's sustainable well into the future.

That's SVA™.

Its simplified architecture design invites innovation, enables automation and provides fail-operational performance where required, while reducing total cost of ownership.

I like to describe it as "the sum of all our parts", and so as you would expect, the insights and innovations we'll talk about today typically leverage multiple parts of that architecture vision to help solve some of your toughest challenges.

INTRODUCING APTIV'S NEXT GEN ADAS PLATFORM

Speaker: Glen De Vos, Senior Vice President and Chief Technology Officer

Thanks, Lee. As we think about the impact on vehicle architectures, there are few – if any – that have been more disruptive from a data standpoint than ADAS. The proliferation of safety-critical sensor data puts significant challenges on reliable signal distribution.

However, not without good reason! Many of us share a common goal: a future with zero traffic accidents and zero fatalities. This is truly an ambitious goal, and it will take close collaboration across the entire industry to make it a reality. But we also know it's going to require a re-architecting of these solutions to deliver the cost and performance required to democratize it.

According to the World Health Organization, the lives of about 1.3 million people are cut short every year as a result of road traffic accidents. More than half of those deaths involve vulnerable road users: pedestrians, cyclists and motorcyclists. Another 20 to 50 million others suffer non-fatal but nonetheless life-changing injuries. Road traffic crashes cost most countries an estimated 3% of their gross domestic product.

However, the good news is that most accidents are preventable. According to NHTSA, 94% of accidents involve human error.

At Aptiv, we believe in imagining a better future – but we also believe in making it real and affordable. That means delivering technologies that are flexible and scalable, that help protect vulnerable road users, and that democratize safety technology so that it is within reach of all drivers.

To address those needs, Aptiv is proud to unveil the Aptiv Next Generation ADAS platform for safe mobility. This platform combines our best-in-class sensing and perception solutions with a scalable approach, an open development environment, and lifecycle maintenance and enhancement capabilities.

Aptiv leverages our deep expertise and learnings from developing the industry's largest, most diverse safety installed base over more than 20 years, with active safety technologies in use by 20 different global automakers.

Aptiv builds on the strong foundation of Satellite Architecture, which is being deployed today by multiple OEMs on vehicles around the world and is expected to be installed on 10 million vehicles by 2025.

We believe the platform provides the tools to solve your toughest challenges around safety. At the same time, it can reduce your up-front development and integration costs by supporting pre-integrated features "out of the box."

Now let's take a closer look at the elements that make up our next generation platform.

Creating the best advanced safety platform starts with the most comprehensive and reliable environmental model. Here to introduce the Aptiv environmental model is Christian Nunn.

Speaker: Dr. Ing. Christian Nunn, Global Advanced Chief Engineer

Thanks, Glen.

Our portfolio of external and internal sensing solutions is fully integrated across multiple sensing modalities and capable of 360 degree coverage. This provides a rich data set to create the Aptiv environmental model, which fuses data from multiple sensors and sensor modalities together while applying advanced AI and Machine Learning techniques.

That enables us to get more information out of the data, so that the system can accurately and reliably identify objects around a vehicle. As a result, we're able to reduce your total perception system costs, while maintaining or expanding the conditions under which vehicles can effectively operate.

Aptiv uses machine learning strategically. Instead of taking a brute-force approach and applying machine learning to all of the raw data provided by, say, a radar, we first perform classical preprocessing and then apply machine learning to just those portions that make sense. Without this interim step, an AI system would have to be extremely powerful, more expensive and more resource-intensive. It would require long training sequences and would be difficult to troubleshoot. Aptiv's approach is much more efficient.

However, even the best fusion and environmental models rely on the sensing inputs which feed them. That's why Aptiv continues to push the envelope on sensor technology.

Here to give us the latest is Gabor.

Speaker: Dr. Ing. Gabor Vinci, Global Product Line Manager

Thanks, Christian.

Aptiv incorporates our full line of sensors, including advanced automotive radars. Today we are announcing two families of next-generation radars, the SRR6 and the FLR4.

The SRR6 family of corner radars offers up to twice the detection range versus the previous generation while improving angular resolution by as much as three times.

The FLR4 family is our next generation of forward-facing radars, providing twice the range resolution and three times the vertical field of view of previous radars. The FLR4+ is Aptiv's first truly 4D imaging radar, capable of meeting the most demanding applications at an attractive price/performance ratio. It improves range detection by 60% over previous generations, and its elevation target discrimination, combined with machine learning capabilities and signal processing, allow vehicles to figure out at long range and high speed whether they can drive over an object.

Both of these sensor families have the flexibility to support either satellite or smart sensor configurations.

Ensuring these sensors scale in a flexible and cost efficient manner is key. With that in mind, let me turn it over to Parham to discuss how Aptiv is taking scalability further than ever before.

Speaker: Parham Vasaiely, Global Director Product Management, Advanced Safety and Autonomous Driving

Thanks, Gabor.

An important aspect of Aptiv Next Gen ADAS is what we call additive scalability. With additive scalability – as with our Satellite Architecture – each configuration builds on the previous one, which reduces your design and engineering costs, simplifies the interface into the vehicle electrical architecture, and improves lifecycle management. This helps to ensure that you can cost-effectively leverage your investment across the broadest possible range of vehicles.

Aptiv has specified a sequence of "reference" software and hardware configurations, which are highly configurable by each customer, and range from entry-level safety compliance through premium and luxury performance.

- Core configurations support basic ADAS NCAP 3 and 4 Star at the best possible price. With our additive scalability approach, our entry-level system is up to 35% more cost-efficient than the prior generation, while maintaining flexibility, scalability and reuse.
- Plus configurations typically start at L2 automation, which requires corner sensing to support driver-assistance features.
- Pro supports L3 cruising and L4 parking applications running on advanced hardware.

Each of these configurations can be modified to meet your needs.

Speaker: Glen De Vos, Senior Vice President and Chief Technology Officer

Thanks, Parham. That kind of flexibility extends to the way we develop software for the platform.

Aptiv continues the acceleration toward software-defined platforms. By transitioning from a closed platform to an open, developer-friendly platform, we empower you to fully control the software that defines the user experience of your vehicles.

Aptiv Next Gen ADAS will allow developers to easily innovate on top of it. By adopting business models that support creation of advanced features, and by encouraging an ecosystem of partners, we're able to drive greater innovation and unlock value for all parties.

If you have the capability to develop your own features, Aptiv's compute platform and software development kit, or SDK, will provide the ability to scale up or down content you develop yourself or provide from other third parties.

Aptiv Next Gen ADAS fits perfectly into our SVA™, with its centralized approach and fundamental building blocks for creating software-defined vehicles.

These vehicles are not going to stop progressing once they roll off an assembly line. Here to tell us more about lifecycle management and applying a software-defined approach to advanced safety is Jada Smith.

Speaker: Jada Smith, Global Engineering Director, Software Platforms

Thanks, Glen.

Aptiv Next Gen ADAS, like Satellite Architecture before it, represents Aptiv's Smart Vehicle Architecture™ applied to safety. These two technology roadmaps are inextricably intertwined.

Aptiv enables you to move towards the software-defined platforms envisioned by SVA™ in several important ways:

- It abstracts hardware from software with well-designed, standardized interfaces for sensors and feature functions.
- It provides a common software integration platform capable of supporting significant development reuse, and leverages both classic AUTOSAR and AUTOSAR Adaptive standards.
- It separates I/O from compute for OEMs pursuing zonal concentration of I/O.

These are the design principles that will take us into a future of highly automated vehicles. With more than a decade of automated driving experience, we know what it takes to support affordable, fail-operational performance for power distribution, network stability and compute availability and performance. From the first coast-to-coast automated drive in 2015, to the driverless testing we have ongoing in our Motional joint venture with Hyundai, these experiences allow us to better understand the challenges you will face, regardless of timelines or technology roadmaps.

And speaking of timelines, we've designed Aptiv Next Gen ADAS to evolve and improve over time, while minimizing your revalidation and deployment costs.

It supports over-the-air, or OTA, updates and enhancements over the program life, providing a scalable, low-risk and cost-effective way for you to improve the user experience long after the vehicles leave the factory – and we're enabling new business models in the process.

Our continuous integration / continuous deployment tooling allows you to quickly develop and securely deliver solutions, strengthening your ability to differentiate your vehicles.

Our open platform is designed to be able to easily test, integrate and deploy innovations as they happen, regardless of where that innovation occurs.

And by centralizing compute power within the vehicle, Aptiv greatly simplifies security and OTA management.

Speaker: Glen De Vos, Senior Vice President and Chief Technology Officer

Thanks, Jada.

Aptiv provides all the tools you need to create best-in-class active safety systems that scale.

As we mentioned, one of the key elements in Smart Vehicle Architecture™ that enables this kind of innovation is separating I/O from compute. We achieve that by implementing zone control.

Martin Bornemann is here to tell us more.

ACCELERATING CENTRALIZATION WITH ZONE CONTROL

Speaker: Martin Bornemann, Director, Systems and Architecture

Thanks, Glen.

A few strategically placed zone controllers can significantly reduce complexity and cost today, while building the right architectural foundation for vehicles of tomorrow.

As you move from distributed architectures to domain control – in order to support advanced, compute-intensive functionality such as active safety and user experience – zonal implementations are highly complementary. Together, they bring a host of benefits to today's architectures, which Aptiv has validated across multiple OEMs during the past year.

With our unique perspective of both the brain and the nervous system of the vehicle, Aptiv is able to take a holistic, systems approach to zone and domain control, balancing tradeoffs in managing power, data and compute, making Aptiv your ideal partner for this evolutionary step.

Here to take us through the benefits of zone control is Christian Schaeffer.

Speaker: Christian Schaefer, Director, Electrical and Electronic Systems

Thank you, Martin.

Zone control has several benefits:

- Zone controllers can act as an up-integration point for multiple single-purpose ECUs. Up-integration reduces physical complexity by eliminating individual boxes and all of the redundant power supplies, housings and connectors that go with them. In one study for an OEM, Aptiv found it could remove over 8 kilograms of weight, while significantly reducing cost.
- Because zone controllers handle all of the physical and logical connections to peripheral sensors and devices, the architecture allows for a common, optimized power and data backbone from the zone controller to the domain controllers.
- Zone controllers are a less expensive upgrade point as the need for additional I/O expands over time. For example, if you were to add another radar, you would only have to swap in a new zone controller to physically connect to it, while leaving the more expensive domain controller in place and avoiding the additional certification that would go with it.
- The architecture simplifies wiring harnesses, reduces labor costs and enables automation of assembly. An Aptiv study found that zone control could enable about 60% automation for one of our customers, although this is dependent on component design implementation.
- As power distribution hubs, zone controllers become the logical location for smart fusing. This is a key area where Aptiv's brain and nervous system capabilities have helped to optimize performance, so let's take a moment to look at this in more detail.
- Aptiv replaces traditional melting fuses in relays with semiconductors, resulting in a number of advantages.
    - The first is savings in power distribution cabling. In the past, wires had to be designed up to 30% thicker than physically needed to allow enough tolerance for peak load without

having a melting fuse blow. By contrast, with smart fusing, wires can be specified to the physical limit of the load over a specified period of time. That often means a reduction in wire gauge and therefore a reduction in weight and cost.

- The second advantage is better energy management. Smart fuses throughout a vehicle can be managed centrally. This is especially critical with electric vehicles, where if the battery is running low, the system can use smart fuses to switch off functions judiciously, for brief periods of time throughout the vehicle.
- A third advantage is in reliability and predictive maintenance. A smart fuse can detect when the wire attached to it is close to failing and pass that information back to a central system.
- With Aptiv's unique portfolio of both the wire harnesses and ECUs, we are perfectly positioned to bring this solution to market.

Speaker: Lee Bauer, Vice President, Advanced Engineering – Smart Vehicle Architecture™

To help our customers advance their zone control strategy, Aptiv leveraged insights from our unique position with both the brain and nervous system of the vehicle to define multiple variants. Each are optimized for cost and performance requirements supporting battery electric platforms, different vehicle types, up-integration strategies, and levels of automation on the path towards the software-defined vehicle.

- All variants include Safe power distribution and load management, delivering reliable power to the sensors, peripherals and actuators which require it. With integrated smart fusing and intelligent power management, we are able to further optimize the electrical architecture. Different variants help tailor these to our customer's individual electrification strategy and broader approach to architecture.

- Next, Aptiv consolidates input / output, which allows our customers to reap additional benefits from zone control, including simplifying vehicle manufacturing and providing cost- and power-efficient compute for body function up-integration. As highlighted by Martin and Christian, this is a meaningful step which helps reduce the complexity and cost of their vehicles.

- Finally, zonal data routing helps simplify sensor management to enhance the scalability and flexibility of advanced safety systems. Aptiv supports pre-processing, compression and routing of detection-level sensor data where required, while a premium variant will add fail-operational performance for Level 3 functionality and above.

Aptiv will be first to market with zone control with start of production in 2022, and we look forward to leveraging the insights from our unique position with both the brain and nervous system of the vehicle to tailor these solutions to our customers' individual technology roadmaps and architecture strategies.

ACCELERATING HIGH VOLTAGE

Speaker: Glen De Vos, Senior Vice President and Chief Technology Officer

Thanks, Lee!

Electrification is an important part of the SVA™ story. In the race to electrify fleets, Aptiv stands as a global partner of choice that is ready when our customers are, reducing time to market.

Our capabilities were on display in 2020, as we moved at unprecedented speed to support our customers globally with a comprehensive portfolio and a high degree of vertical integration.

Here to provide a couple of real-world examples is Josie Archer.

Speaker: Josie Archer, Vice President Sales, Electrical Distribution Systems

Thanks, Glen.

We know speed to market is critical, and Aptiv knows how to move fast.

For example, when a customer was experiencing issues with an incumbent supplier for an electric vehicle platform, Aptiv was able to offer three proposals with working hardware in less than a month:

- One that was designed by the OEM customer without changes
- One that improved the design by leveraging Aptiv's extensive portfolio to substitute better and lower-cost components and add low-risk optimization enhancements
- And a third that applied advanced innovations to maximize optimization of the overall weight, mass and cost.

Our final design took advantage of those capabilities by:

- Reducing the weight on heavy gauges cables by 40% through alternative material technology, including aluminum and busbars;
- Reducing the weight of the traditional gauge cables by 30% through optimization of routing and more sophisticated cable management; and we
- Eliminated complex welded splice interfaces with Aptiv splice technology for a 45% reduction in the size of the interfaces while enabling automation and increasing durability.

We began shipping 8 months later – far faster than the typical three-year lead time from business award to start of production.

When another customer, a leading EV manufacturer in North America, wanted to expand production to China, and do it fast, Aptiv's global capabilities allowed us to go from business award to SOP within 4 months, while utilizing global best practices and common ways of working to quickly bring a solution to the customer in a familiar way.

Here are the factors that allow Aptiv to move with speed to get you to market fast:

1. A comprehensive portfolio means not having to coordinate with a half-dozen suppliers around the world.

2. Optimized system solutions mean better options for balancing cost and performance.
3. A modular approach gives us the ability to offer the right components for the right application – whether that's choosing between busbars or round wires, or between different inlet modules for different regions.
4. Cable extrusion expertise means we can make cables in-house in all major regions, which reduces overhead and shortens supply chains.
5. Common engineering and manufacturing footprints result in an efficient development process and simplify logistics for production and change management.
6. Finally, in-house rapid prototyping capabilities mean we can print production-grade components in real time to support concepts or advanced development programs.

We are ready now to support you and your EV development program.

Speaker: Chris Reider, Vice President, Global Engineering, Connection Systems

To support the demanding requirements of electrification, we are excited to launch our new family of high voltage interconnects. The connector family has been purpose-built to support the higher power requirements associated with larger battery packs, faster charging, and for the increasing demands of traction motor systems, while maintaining peak performance throughout the life of the vehicle.

Some innovative features of this connector family include:

- Support for 400 amp duty cycles for fast charging and 300 amps continuous for traction motor systems
- A direct-contact terminal system with integrated stainless steel spring that delivers 100X life projection over traditional copper-alloy terminals
- Its compact design enables reduced mass, simplified packaging and reduced cost; and,
- It's available in a variety of configurations, including a direct-contact blade design that simplifies connections and allows current to flow directly through high-conductivity copper.

These families are tooling up today, and validation will be completed by mid-2021.

ENHANCING THE IN-CABIN USER EXPERIENCE

Speaker: Glen De Vos, Senior Vice President and Chief Technology Officer

Thanks, Chris. This is a great addition to Aptiv's comprehensive line of high-voltage components, and we look forward to working with all of you to make them a vital part of your next generation of electric vehicles.

We've talked about a number of SVA™ principles today – electrification, to the up-integration of compute with Aptiv zone controllers, and abstracting hardware from software.

Many of these same advancements apply directly to the in-cabin user experience, and it comes at a pivotal time for our industry.

Consumers expect a rich user experience from their vehicles – one that is more intelligent, integrated and connected. A seamless experience between the passengers, the vehicle and the world around it.

For vehicle infotainment systems to provide that experience and continue to bring value to consumers, they must overcome some very real challenges specific to automotive applications, including lifecycle management expectations, app availability, speed to market and security.

Here's Alwin Bakkenes to show us some recent implementations of Aptiv's user experience solution, and give us a glimpse into what's coming next.

Speaker: Alwin Bakkenes, Vice President Europe & Global Product Lines, Aptiv Advanced Safety & User Experience

Thanks, Glen.

Aptiv has the software capabilities and architecture vision through SVA™ to meet those challenges and collaborate with you to develop fantastic user experiences, with ways of working aligned to your individual strategies and capabilities.

We have deployed solutions across every major platform – most notably Android – while tailoring the solutions to customer- and region-specific requirements.

Specific examples of our current-generation systems can be seen on vehicles which are available today.

- Volvo XC40 and Polestar 2 is the first to market with native Android Automotive running Google Automotive Services. Our Android software and hardware platform allows full application abstraction, enabling you to deploy Google Services globally while seamlessly deploying a different regional ecosystem provider.
- The Audi / Porsche MIB3 is one of the world's most complex and capable integrated cockpit controllers ever developed. It was first launched on the Porsche Taycan and is now rolling out on other vehicles.
- Great Wall Motors' V3 Integrated Cockpit Controller was the first to be deployed by a Chinese OEM. First launched on the Haval and Wey brands, this system implements two functional domains: an ASIL-B cluster, and Android for infotainment that hosts Tencent's TAI app ecosystem.

At Aptiv we strive to empower OEMs to control and enhance the software that defines their vehicles. This enables and infinite amount of individual experiences as they form new memories on the road ahead.

At Aptiv, we believe that a more connected user experience starts with open platforms, deeply integrated with the sensing, compute and interface devices that support them.

As a result, our next generation platform takes a highly centralized and software-defined approach, which represents our Smart Vehicle Architecture™, and provides the most comprehensive in-cabin user experience platform available.

Up-integrated into the next generation platform will be three domains: infotainment, driver information and interior sensing, resulting in approximately 30% savings versus a standalone ECU while improving overall performance.

The infotainment domain is based on Android and fully compatible with Google Services as well as AOSP requirements. With full software abstraction, we can easily support a range of open platforms to meet OEM and regional requirements – and can be fully customized to represent your unique customer experience.

The driver information domain implements services such as rear view camera, system sounds, and tell-tales, guaranteeing sub-second startup times from cold boot, while reducing cost through up-integration.

Interior sensing is evolving from basic driver monitoring for safety to more sophisticated comfort and convenience functionality, so up-integration into the platform is a natural next step here too. We are implementing a full suite of applications, including driver and cabin sensing solutions, on a separate domain abstracted by an interior sensing feature framework.

Aptiv customers can go from Google release to deployment in 6 to 9 months with the help of Aptiv's Continuous Integration / Continuous Deployment services. Our CI/CD infrastructure enables all developers to have access to the latest source code, regardless of location across the full software stack. And the same secure infrastructure can also be used to deliver post-production maintenance packages.

With multiple functional domains, automotive software IP, and life cycle services, Aptiv offers a complete product platform for developing best-in-class in-cabin user experiences while reducing cost of ownership.

CONCLUSION

Speaker: Glen De Vos, Senior Vice President and Chief Technology Officer

Thanks, Alwin.

We hope you've enjoyed this brief look at Aptiv's exciting suite of next-generation products, platforms, software and solutions, and we hope you are as excited as we are about the possibilities.

While I think we're all glad to have 2020 in the rearview mirror, I am proud of the way our teams have stayed focused throughout, collaborating with you – mostly virtually – to create technology solutions that help address some of your toughest challenges, while pushing the envelope to bring solutions to market quickly and efficiently.

That speed and agility is what defines us, as we move with purpose to put Innovation in Motion!

As we look to this year and beyond, Aptiv will continue to seek out collaboration with our customers and other technology leaders to innovate in new ways. Each Innovation in Motion will take us closer to our mission of delivering safer, greener and more connected mobility solutions.

We look forward to exploring – and elaborating on – each of these solutions with you in the coming weeks and months. In the meantime, stay safe, and thank you for joining us.