

Transcript: 2019 CES Aptiv Investor Event

Las Vegas, NV | January 8, 2019

APTIV CORPORATE SPEAKERS

- Elena Rosman, VP Investor Relations
- Glen De Vos, Chief Technology Officer, and President, Mobility & Services Group
- Jada Smith, VP Advanced Engineering
- Lee Bauer, VP Infotainment & Driver Interface
- David Paja, SVP and President, Advanced Safety & User Experience
- Hank Skorny, President, Connected Services
- Karl Iagnemma, President, Autonomous Mobility

PRESENTATION

Elena Rosman:

Slide 1: Hi, good afternoon, welcome to Aptiv's Technology Pavilion here at CES 2019, this is actually our 23rd appearance at the show. And hopefully a number of you had an opportunity to ride in one of our seventy-five automated vehicles that are riding around the streets of Las Vegas. Those are the same vehicles that are operating on the Lyft network, and just conducted thirty thousand rides since May of 2018, with an almost perfect rating of 4.95 driver rating, so nearly a perfect score, really underscoring the quality of that ride experience.

Slide 2: Before we kick things off, just a little bit of housekeeping, I do have to remind everyone that today's discussion contains forward-looking statements, which reflect Aptiv's current view of future financial performance, which may be materially different from our actual performance for reasons that we cite in our form 10-K and other SEC filings.

Slide 3: So turning to today's discussion, we're really going to talk about Aptiv's unparalleled position as both the brain and the nervous system; and how that's allowing us to conceive, specify and deliver the advanced software and vehicle architectures that are solving our customers' toughest challenges. And then our commercial teams will talk about how they are translating those technology solutions into sustainable, strong business wins for Aptiv.

Following our presentation, you'll have plenty of time to explore the technology pavilion, and talk with a number of senior Aptiv leaders who are here with us as well as subject matter experts who will be able to answer your follow up questions. So with that, I'd like to turn it over to Glen De Vos, Aptiv's Chief Technology Officer, and President of the Mobility & Services Group.

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Glen De Vos:

Page 4: First of all, welcome everybody, it's great to have you here today. As Elena said, we've been in operations here for quite some time, in fact we set up the tech center here in Vegas earlier this year, and just officially opened it. We have over three hundred people working here. Vegas is much bigger than just CES for us - it's really about deployment and moving our technology away from labs into commercial realization. That's what we're going to talk about today. We're going to talk about our technology, the trends we're seeing, what's driving that, but more importantly, how we're taking that into commercial proposals to our customers, realizing that and most importantly, how are we making sure that we stand in a position that increases our shareholder returns, our margin, and our content in a meaningful way.

Aptiv is about a year old, but we've really been around for a hundred years... that has a hundred-year history of developing automotive-grade solutions. The last ten years or so, we've been talking about the megatrends of safe, green and connected. And they continue to be relevant even more so today than last year or the year before. You'll see that throughout the discussion today with the subject matter experts. But with that in mind, and with the capabilities we have as Elena said, with the brain and the nervous system, compute, software, signal and power distribution; this positions Aptiv really uniquely to bring those new mobility solutions which are more and more based on software, and advanced software features like automated driving or Level 3 performance, that in turn is driving advanced architectures. You can't simply load more content into the vehicle. You have to have these new advanced architectures, which and then again helps us develop new mobility solutions. This is how we maintain a competitive advantage over our peer group, and really solve problems that many of our competitors don't know exist yet.

Slide 5: So if you take those advanced software capabilities and that advanced hardware capability, those are really our core strengths. Those are on the left side of the chart. Where you see data and software, sensing and compute, signal and power distribution, and connectivity. It's really the complete portfolio of skills that allows us to then develop those advanced solutions. We call it the vehicle solutions stack. It starts at the bottom, sensors, peripherals and actuators, these are the things that really touch the world around the vehicle and it works its way up to the cloud. Today, we'll go into a lot more detail of what we're doing in each of these spaces. But what's important for Aptiv is that we understand how this needs to be constructed, really from the sensor to cloud, and where we add value, and where we should be positioned to make sure we continue to add the best value possible in that.

The other comment I would make is that OEMs don't have a single solution for this. Each OEM looks at this a little differently. Aptiv is able to adjust our approach to make it fit directly for the OEMs. That flexibility, and the ability for us to customize around our customers' needs, is really critical to us being able to offer a full solution.

Slide 6: So, let's get into it, so who you'll hear from today. First, Jada and Lee are going to talk to you about the software capability as well as advanced architecture. They'll talk about the technology and the solutions we're developing. That will be important from a foundational standpoint to understand what we're doing on the commercial side.

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Then we'll go over to David Paja who'll talk about how we're commercializing that in the Advanced Safety and User Experience market, the specifics there, and the growth and the success we're seeing. Hank Skorny, who's in charge of our Connected Services business will then shift over to data and show what we're doing on the data side, the top of the stack. And finally, Karl Iagnemma will talk about our automated mobility solution, and how we're moving that forward.

So, Jada I'll turn it over to you.

Jada Smith:

Thanks Glen, and good afternoon.

Slide 7: As Glen mentioned, I'm a software engineer by trade, so I'm really excited to share some examples of how software is transforming the vehicle. But, in order to understand the role that software has in the vehicle, we must first understand the critical elements that support it. You can think about our portfolio as the brain and nervous system of the vehicle, which combine to support the advanced software required for new mobility solutions. But, you may be wondering, why are both the brain and the nervous system to enable the software - doesn't it just run on the compute or the brain side?

To understand how these work together, let's follow the power - delivering high and low voltage to our electrified systems - that brings the vehicle to life. We have a lot of experience supporting our customers here. In fact, our robust portfolio of electrified solutions allows for an addressable CPV of roughly \$1,000, or 2x that a typical internal combustion engine vehicle for our Signal and Power Solutions segment. Further, it is estimated that by 2022, nearly 13 million of the vehicles produced annually will have a high voltage electrified powertrain. Based on the value of our new business bookings, this product line should reach revenue of more than \$1 billion in that timeframe, representing a 40 percent compounded growth rate.

So we have power, now, data begins pouring in from sources all over the vehicle like active safety and infotainment. That data is critical to delivering the safe and connected capabilities we depend on. Today, this data is transmitted through a variety of protocols - some of which were developed in the 1980s. But that's all changing. The systems knowledge necessary to understand the network speed and reliability requirements is fundamental to the value that our electrical distribution systems bring, and our expanding portfolio of highly engineered advanced interconnect solutions support the high cost of failure applications that depend on this data.

That brings us to compute - we have the data, we can move it, and it's time to act. Analyzing all of this data requires vast amounts of computing power. Consider this, our safety automation computing platform is capable of making decisions 34,000 times faster than a human, that helps to avoid collisions and can even take over the task of driving. We also safely and securely connect that vehicle to the surrounding ecosystem, delivering solutions like improved fuel economy from knowing the status of the traffic lights, to helping you find that last parking spot.

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Now we have the foundation. We have the ability to move the data, we can act on it and we have power, so it's time to overlay my favorite part, the software, to add functionality. Vehicles are becoming increasingly defined by software, and that means software – not hardware – is delivering more and more of the vehicle's capabilities. At Aptiv, we understand this better than anyone in the business. Globally, we have more than 6,000 engineers dedicated to delivering those software solutions. We've grown 60 percent in the last two years, and we will be more than 8,000 strong by 2021. These teams are delivering on our commitments in advanced safety, user experience and infotainment, and connectivity.

Slide 8: Let's consider some examples of this shift from hardware to software. As Glen mentioned, our software expertise cuts across the entire vehicle solution stack it runs the gamut from very basic to highly advanced. Consider the door in your vehicle, it has things on it like locks, windows, maybe some seat controls, all of those are powered by software, and that software is replacing the things that we used to do manually. On the more advanced side, we leverage AI and machine learning to deliver gesture recognition for driver inputs. This was first introduced by the BMW seven series, and after getting some customer feedback, mid-last year, they decided to put it on the three and five series as well.

Our deep domain knowledge also gives us unique insights into the data these vehicles produce. We leverage edge processing to identify the data of value and then we discard the rest. As we like to say, "you don't upload the haystack to the cloud, just the needles". Now of course we often get asked "who owns the data"? The truth is that the driver owns the data, the OEM controls the pipe... and the data is important, but where the real value is in the insights that data provides and Aptiv is uniquely positioned to deliver those insights. You'll learn more about the software solutions we're providing here in a few minutes.

Slide 9: All of these trends are creating a challenge, and that challenge is that the architecture, the complexity of it, is increasing exponentially. You've heard Lee talk about an architecture break at level 4, but the reality is that even sustaining the current complexity is a huge challenge for our OEMs. Think about it, the current architecture of today is incredibly hardware-centric; every function is an ECU, every ECU is developed independently and then they're all integrated together into the vehicle, and then you hope they all works seamlessly.

Of course, we test it over and over and over again, but the truth that is as soon as you launch that vehicle, you hope you never have to touch it again because as soon as you change that software, you have to start it over. The truth is that today's architecture doesn't support tomorrow's software, it has to change and in order to do that, we have to consider four fundamental questions.

First, how do we update software or move it to a new piece of hardware without modification?

Second, how do we bring hardware into a vehicle more quickly?

Third, how do we enable fail-safe operation without doubling the content?

Lastly, how do we do all those things as affordably and as sustainably as possible? To answer these questions, I'd like to invite Lee Bauer, vice president of mobility architecture, to the stage.

Lee Bauer:

Thanks you, good afternoon.

Slide 10: I see a lot of faces I've already met, but for those I haven't met, my role is here at Aptiv is really about leveraging Aptiv's full weight of our intellectual capital to solve and answer the questions that Jada just mentioned.

We understood, or better said, we framed the problem, and then took a look at re-architecting the vehicle, and knew there were other industries that we can learn from who went through a similar transformation from a feature focused product to a software defined platform. The reason for this is it gives us insight into how they addressed the technology challenges that are quite similar to the challenges we're facing in our industry. Second, about the industry itself, who wins, who loses, and ultimately, what happens to the business models. Then, we take that knowledge, and leveraging it - applying it in a very focused manner to our industry.

So what you see here on my right is the mobile phone - a very good parallel - it started as a one-time, feature focused product, and was completely revolutionized when we went to platforms, this was done by iPhone and then Android, but the true value was in opening up the hardware to bring in another level of innovation that allowed them to keep pace with what the consumer was asking for.

Second, is the personal computer, the personal computer was very similar but brought a new aspect to it which was really around interfaces. We brought in things like USB and PCI express, which allowed us to change the compute power inside the computer and extend it out to peripherals.

The final one is the server. The server started as proprietary, on premise, purpose-built systems with enterprise level software, but was completely revolutionized with the cloud. Lets take a closer look at that.

Slide 11: We believe the server architecture paves the way forward. Why is that? If you look at the existing business we have today, and apply the server terminology to that, we deliver infrastructure as a service. We deliver the hardware, compute devices themselves, and the high speed networks that are necessary. Second, we provide the platform as a service - the package which includes the operating system to run the apps, the middleware that stitches the whole thing together. And finally, we deliver elements that make up software as a service - this is the application layer, and that's what people see when they actually touch our systems.

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What we're going to add to that is intelligent abstraction and virtualization, and bring it into the first automotive server. So server architecture has a couple powerful advantages. First and foremost, application development is significantly accelerated because developers have access to a piece of hardware before a traditional automotive process, they also have a series of frameworks and toolsets available to them, so a company with eight people can develop on a very robust and powerful platform, completely unique. Second, developers can start small because the cloud expands tremendously horizontally, they're able to add features and functions over time, and scale the compute underneath. Second, orchestration, which is a very interesting concept. Cloud today can do corporate payroll on the one side, sequence the human genome on the other. That is tremendously powerful, and something that we can leverage. Finally, efficient, optimized networking, these are very critical elements for us going forward, certainly in the vehicle.

So if you think the server approach sounds like a good fit for future vehicles, you're absolutely correct.

Slide 12: Aptiv is uniquely positioned in the industry to provide the server architecture because of our comprehensive capability with the brain and nervous system. First, this is realized with smart, and reliable power management. Second, we need stable and flexible networks. Finally, sustained compute performance. SVA – Smart Vehicle Architecture – comprehends functional safety and three-layer fail-safe operation, which I've been mentioning for over last year and a half.

Now that the infrastructure and platform layers are in place to use server terminology again, we can deliver flexible and resilient software that can also address life-cycle requirements, that means feature upgrades far easier than ever before, and do all this at a price that customers can afford.

Slide 13: Smart Vehicle Architecture, shown here for the first time, we've talked about it, you're going to experience the key enabler to it. This has several patents pending. It represents the sum of all our parts here at Aptiv, it is Aptiv to the core, and will expand our competitive moat.

Fundamentally, the problem that I mentioned earlier is about two things which have prevented us from going forward as an industry... I/O is tightly coupled to compute, and software tightly linked to hardware. What SVA does is separates I/O and compute, and abstracts hardware and software.

Starting here to my right, we have the Central Compute Cluster, this is a flexible compute platform and software framework with intelligent abstraction. We will get into it here but basically mirroring the safe and un-safe worlds onto one unit. We have the ability to go beyond SoC and scale each coprocessor individually, that means I can scale compute, I can scale graphics, I can scale my inference engine or my accelerators, my network as well as my functional safety. As I mentioned earlier, about doing corporate payroll to sequencing the human genome - we will be able to run rear-lift gate control to user experience to infotainment to safety automation on one platform... and automotive grade of course.

Moving to the center, a key attribute of SVA is a unified power and data backbone, this is common throughout every vehicle, only varies in length. And it can be made redundant via a dual-ring topology.

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And finally on the right, the key enabler, we talked about separating I/O from compute, this is realized through the Power Data Center. This is a three-in-one solution that provides the docking station for all sensors in the first step, provides redundant power and networking when required, and finally, brings the opportunity for zone control which is a heavy, up-integration point. This is the first time you're going to be able to scale hardware independent of software, I/O independent of compute, that is the key message here.

The PDC is a three-in-one device which is about, first, managing power and data reliably, attaching to the sensors, and finally up-integration using zone control. So the first one is the master - on the bottom, I have a power board which utilizes smart FETs - it is completely electronic in order to switch over the power without any form of loss. Second I have the data board which does the same thing but for the network and on top is where I realize the network itself.

So if we look at a vehicle network today, it has one data and one power connection - what we call a star topology. I've installed cameras to show you a car would see if it had cameras in the front and rear. In a traditional system, if I were to lose the data, I lose the cameras because we don't have redundancy. But with SVA and redundant capability, if I lose the data, nothing happens... same with power, because the ring topology provides redundancy. Those are the critical elements for a sustainable architecture delivering Level 4/5 automation.

Slide 14: On the left, this is an actual vehicle architecture in production today; it was taken from a vehicle we know rather intimately. We started looking at the logical domains. A vehicle is broken up into driver assistance, EV or hybrid vehicle security, etc. - basically, it's deployed box by box in the car. This functionality is then deployed not centrally, but distributed throughout the vehicle. I started counting, but lost track at 35, but this vehicle has hundreds of modules inside. The wire harness has well over four thousand wires, and it takes nine people to install in the vehicle. That is the "state of the union" for a vehicle today.

On the right, this is where we're going, from a domain approach that is distributed into the vehicle, to a logical approach. Imagine a car with a central compute cluster, it has six PowerData Centers, and the Central Compute Cluster operates as one logical computer. That's what SVA brings, and tremendously simplifies the architecture, and allows us to have portability of software like we've never had before because you couldn't when the software was tied to a box. It also allows for the optimization of the power, signal delivery into manageable zones. It then allows us to add automation where necessary. When you go to level 4 and 5 for safety automation, the quality of service required by the system has to reach a level that manual labor will probably not be able to attain.

The good thing for us is this will be content accretive for the Signal & Power Solutions and Advanced Safety and User Experience, in part because of the significant value creation opportunity from the up-integration of the functions.

We know this is the right approach, and to date we have won two advanced development projects to help realize SVA.

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Slide 15: Changing vehicle architecture is like changing religion... you only do this when you have an epiphany. This is a massive effort, and you only do it when there's no other viable way forward. We are here today! We have feature explosion going on right now - you saw it in an existing car that's not even Level 4 or 5. Our customers are realizing we must do this now if we must deliver to our customers the features they need to have in the next 5 years. Everyone understands the gravity of this. You've seen a shift of focus to one of the fundamental problems - architecture. However, there are other incremental value and cost savings that SVA generates for Aptiv and OEM customers.

In development, what we're able to do by separating I/O from compute and hardware from software, we're able to develop both independent of each other. We say we put the complexity in parallel. This will allow us to accelerate the features and functions we want to deliver in any of these vehicles.

Second, manufacturing and assembly - the modular zone architecture we will provide, made possible by the PDC, will allow us to consolidate the variance in the vehicle, break it down into manageable segments. And the net effect of that is less installation cost, time, and good impact on working capital and lower inventory.

Finally, ultimately we'll have a platform for third parties to innovate which does not exist today.

This is real material value we're creating for the OEMs that does not come at the expense of Aptiv.

With that, I'd like to turn it over to David Paja, Senior Vice President and President AS&UX to talk about how we're benefiting from the commercialization of these technologies today.

David Paja:

Thanks you, good afternoon.

Slide 16: As Lee said, my name is David Paja, and I'm president of the Advanced Safety and User Experience business, which we refer to as the brain of the vehicle. In our segment, we fundamentally bring together advanced sensors, central compute, software, connectivity and data, to deliver improved functionality across multiple domains like safety, infotainment and user experience and others.

The business has seen a significant acceleration in growth over the past 3 years driven by increased consumer demand for our product, and strong commercial wins. This page is a phenomenal example of what Glen introduced before - our full stack capability - how do we leverage our everything we do from sensor to the cloud to drive exponential growth in some of our product lines.

This is an example of active safety or ADAS, where we've been growing 50% per year over the past couple of years, reaching \$1 billion this year, and we expect it to continue very strong growth in the years to come.

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I'll walk you bottom to top and how it works in terms of our capabilities. We start with sensors, the edge devices, and peripherals.

A good example is radar technology. We were the first company to introduce radar technology in the vehicle in 1999 on Jaguar. Since then, over 20 years of experience, we've been able to advance the technology to a level with increased levels of functionality several times, and reduced costs and size significantly to enable broad adoption of the technology, as a result we see our radar volume growing five fold over the next five years.

If we move one level up we talk about something that differentiates us, our unique satellite architecture, the concept of taking the intelligence away from the sensors, and bringing it to a central multi-domain controller which we were the first to do in the industry on the Audi A8. I'm going to explain in a minute how that enables greater scalability for the customers to deploy more advanced software features in an easier way. At the heart of it is our satellite architecture - we have the central compute or multi-domain controller - we are the leaders in this technology. We've booked 10 different programs across multiple OEMs; six being in active safety, three in infotainment and user experience, as well as one related to body, chassis and propulsion.

Moving a level up, we get to software. Software is what delivers the functionality and increases value to the vehicle. We have robust capability in software, from basic functions like automatic emergency braking, or adaptive cruise control. But we also have increased functionality in level 2 plus features, like traffic jam assist or highway assist. We can even keep going up to conditional automation and beyond into autonomous. What's also important is our business model is flexible, we can either sell a turnkey solution as an end-to-end L2 plus system, or if customers want to leverage existing assets, capabilities, functionalities; we can sell pieces as add-ons.

The last piece of the stack is data and data services. As an example, in active safety what we did was leverage our domain knowledge and the huge amount of data that we capture from our pre-development fleets. We developed a complete toolset which takes event-triggered data and puts into storage and puts in the cloud. If something happens - for example, if something fails in one of the functions - we immediately have the data available and triggered in the cloud, and we can use it to advance much faster the development and improvement of our algorithms. This is something that's not only useful to us to improve our products, but also for our customers, who have actually acquired this capability from us.

What's important to know is the full stack capability is not just important today, but in the future. As complexity increases, and vehicles move up to level 2+ / level 3 systems, complexity works to our favor because we can handle the integration and scalability. We've seen this in our competitive position in active safety where we are number three today, but will become number one over the next few years.

Lastly, we view autonomous driving on the spectrum of Active Safety, and we benefit from having both capabilities in-house. Although we run the businesses separately, the reality is that \$1 billion revenue generated in active safety, essentially funds our investments in mobility, and what we learn from the mobility developments, such as here in Vegas, are being applied to improve our active safety systems. This is unique, and allows us to monetize the investments and get returns today, and de-risk the technology path for our customers.

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Slide 17: Although we're excited about active safety, we take this full stack approach to other domains to create new mobility solutions.

To the left, you see our revolutionary interior sensing technology, we see this as a nascent market with huge growth potential. We do it fundamentally the same as Active Safety - we have a set of sensors inside the cabin, apply machine learning capabilities, leverage a domain controller or central compute to drive predictive analytics and generate new functions today like the BMWs Jada mentioned that are actually able to track driver attention - is he looking at the road, and paying attention - this is what we call distraction management. We also have the ability to move beyond this and start thinking about attention management, not just about your eyes focused on the road, but is your mind engaged. When you think of conditional automation, level 3 automation, you completely disengage but at the point of time you have to pick back control of the wheel, are you mentally ready to do that, we have the capability, just through sensing and machine learning technology, we can predict or to see if the driver is ready to take over. We can also solve other safety use cases, like a child left behind. That means we expand the sensing capability beyond the driver to the full cabin. And, as you think about the march to full autonomous vehicles, we think about moving them from safety use case to comfort use case; we can monitor passengers in the cabin, for example, do they feel the temperature is too high, do we need to automatically turn up the A/C, etc.

Here in the middle we're talking about data and Connected Services. Through all our sensors and vehicles we're gathering tons of data, and leveraging our domain knowledge, we can turn all the data into insights which are valuable and we can monetize.

To the right is the ultimate challenge which is autonomous driving, later you'll hear from Karl Iagnemma how we bring together all our software and hardware capabilities to tackle autonomous driving.

Advanced Safety Technology Display: But first, let's move to the Advanced Safety display to explain the notion of satellite architecture and scalability. I spent a few minutes on the great growth in active safety, and showed pieces of the stack. There's one element, satellite architecture, that is very unique and great differentiator for us because it enables scalability, a simple way to add functionality as you go up the levels of autonomy.

Fundamentally, we start with domain centralization, that takes intelligence away from the sensors and moves it to a central compute. What that enables the possibility is to start with basic capabilities, and work your way up by just adding simple sensors around the vehicle on the same compute platform with incrementally more capable software. Just by adding more complex software and adding incremental sensors where needed, you can add functionality in a simple way.

If you're a carmaker, this allows an efficient way - in terms of system and development costs - to move up the ladder. I'm going to show you what it means in terms of content per vehicle opportunity for Aptiv for each level.

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Content per vehicle in a Level 1 system is around \$250 to \$300. At L2, you double it. At L2+ advanced ADAS systems, you're at roughly \$1000 per vehicle which includes traffic jam pilot functionality where a vehicle is able to drive by itself under certain conditions. You that is a pretty affordable state to reach, a sweet spot because you get there around the \$1000 per vehicle range and that's where we think most of the volume and most of the industry will be in the coming years.

We're also able to enable this natural path leveraging our satellite architecture and go beyond that, and expand our system - but in that case we add significantly more expensive sensors - and that gets us to \$4000 to \$5000 range per vehicle and beyond.

What's unique about Aptiv is this ability through the satellite architecture approach to be partner of choice for our customers, working their vehicle range all the way up the ladder, and leveraging what we learn from our mobility deployments like fleets here in Vegas to actually bring technology back down and that's a unique capability that we have and enables us to offer great differentiation.

Now I'll turn it over to Hank Skorny who's going to talk about Connected Services. He brings 20 years of terrific experience in connectivity and software, which is really a benefit for Aptiv.

Hank Skorny:

Thank you, David. As you've seen, Aptiv delivers safe and green solutions, and now I'll discuss connected.

Data Services Technology Display: The mobility services platform provides the connected fabric to pull this altogether. There's a couple of key elements that deliver on this. First is on the vehicle, the edge-enabled cloud. With over 40 terabytes of data generated per hour on one of our automated vehicles, you need intelligence on the vehicle that knows how to focus that data and make usable to decrease the total cost of ownership, provide new forms of efficiency, new forms of revenue for customers, and improvements in the environment. In addition to this by putting intelligence on the vehicle, you can offer flexibility and scalability across millions, or tens of millions, of vehicles so that you can manage entire fleets without overloading the network. Finally, with this intelligence, when issues become apparent, you can instantly increase the flow of data so you can do a much richer analytics and diagnostics on the problem, fix it, send that down and even that intelligence can take action on the vehicle to solve the problem it detected.

Additionally, by having the smarts in the vehicle, not only do you increase the ability to do the diagnostics reducing maintenance, warranty supports, but new forms of business opportunities appear; for example, monitoring environmental systems, integrating with smart city environments, smart location services, and finally tracking micro-weather.

The next area is how this data can be utilized. This is an example of utilization of that data. It's an operational console for our autonomous fleet currently driving around Las Vegas right now - this is a live view, but it could just as easily be trucks driving around the city, a fleet of busses, anything else really.

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We see various cars running the Las Vegas strip now. If I'm managing this fleet, I'm going to look at what's concerning; some vehicles are offline, some vehicles have warnings. I can look at the warnings of each one of those, see the current issues, and this way I can ensure I have the right number and type of vehicles on the road, picking up customers and generating revenue as much as possible at all times.

Additionally, I have a lot more detailed information that I can see. We have thousands of points of data that we can analyze and look at every second. For example, because of the intelligence and analytical tools we have, we can look at oil life and predict when the oil will need to be changed, and we can also optimize that along with other things like brake life, and other maintenance data points to optimize the exact point to bring the car in for service for the least amount of downtime and most amount of time in front of customers.

I can also do things like integrate with external software packages, such as look at the fuel level and have it integrate with the mobility provider application to ensure that the rides schedules will never cause a fuel light to come on when someone is on the way to the airport... or the last thing you want on the way to the airport - a check engine light.

Let's move from the instantaneous, operational view to a more strategic, analytic view, so having all this rich data and smarts on the vehicle empowers new forms of revenue that can be generated from these vehicles.

As an example, I'm looking at a heat map of where people are getting picked up and dropped off at on the Las Vegas strip. The interesting part about this is casinos run their business on data, when people arrive, when they leave, when they stay in their hotels, are all part of maximizing their revenues.

What we can do now, is select a casino, and the net arrivals at 6:00PM is pretty high, and I'm curious to see where people are coming from and what can I do to affect that and make it even greater and target it. I see it's coming from a collection of smaller casinos, and I can pull demographic information on those particular casinos, and now I know how to do targeted marketing on the displays as people enter casinos and target them to increase the level of play. I can look at where people are going to, drive insights and take action through the vehicles and loyalty programs I have access to.

With that, let me turn it over to Karl Iagnemma.

Karl Iagnemma:

Thanks, Hank.

Aptiv Solutions Display: I'm President of Aptiv's Autonomous Mobility Group. I'm going to talk very briefly about two things that we focus on intensely in my business. First is developing foundational, enabling technology for Level 4 and Level 5 systems. Second is transforming that technology into a real commercial opportunity for Aptiv.

First, let me tell you about technologies, and one of the things that differentiates Aptiv from our competitors is the driving policy. The policy is the brain, the intelligence of the car, the part of the software that helps the car make decisions. Why is this hard? Let me give you an example. This picture illustrates a simple turn we were attempting to make with one of our cars in Singapore, you know, no problem right? This particular turn, before we made the turn, we saw a pedestrian crossing the crosswalk, so we have to wait for that pedestrian to pass. OK. We continue passed the pedestrian, and encounter a motorcycle parked along the side of the road that decided to depart, it stopped position and started moving toward us, so we had to wait and give way to that motorcycle. Then as we started to complete the turn, there was a truck parked in our travel lane, and so we started to pass that truck, and as we passed, the truck took off and our passing maneuver changed to a merging maneuver. And by the way, it was raining this whole time. So even a simple turn has us make decisions on pedestrians, cyclists, merges, passes, other cars, etc. It's a hard problem!

So how does Aptiv address this problem? We have a technology that we call structured AI, this is different from the traditional approach in the industry. Traditionally, in the industry, you look to solve this problem one of two ways. First way would be let's write down a set of rules that will cover all the possible scenarios that our car may encounter on the road. This is hard because there's so many scenarios the world can throw at you. A lot of scenarios, so this isn't a scalable approach. Second approach is finding examples of data that corresponds with all these different scenarios, and actually let the car learn from how to drive itself through these different scenarios. It's hard for the same reason, you now have to collect data for all the various scenarios the car may encounter.

Structured AI is different, because we rely on the best of both worlds in the sense that we write down the rules where we can - for example, we have a rule that says don't hit anything, a rule that says stop at red lights, another rule that says yield to pedestrians and crosswalks - and then we learn from actual examples of human driving in scenarios where the rules are a little more squishy. So for example, you want to change lanes and merge, well how much space did you between those cars during that merging maneuver. Let's observe how humans do it, and draw from that experience, so by combining the rules that we can write down and the observations from human driving, we have the best of both worlds, and can avoid the problems associated with either of these traditional approaches.

To put it graphically, Structured AI allows us to combine Rules & Laws with our Interpretation of human driving experiences observations, that results in a nice engineering specification for our system. We translate that into an actual implementation... an actual code on the car. That results in behavior of the vehicle.

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One important byproduct of this is we end up with a system that is explainable - that has traceability from the specifications all the way to the code. So if there's an incident on the road, we can understand why the car made the decision it did; very important. A real snapshot of one of the things that differentiates us from some of our competitors.

Let me talk about some of our efforts toward commercialization. We've got a hundred plus vehicles worldwide in four cities. We're in Singapore, Las Vegas, Boston and Pittsburgh. Everyday we've got the same software stack running on these four cities. The diversity of experience is very valuable, we get data on rain, sleet or snow, left or right hand driving, it's really forced on us to create a software stack that is scalable.

I'll give you an example. We started driving in North America, but we knew wanted to get on the road in Singapore. North America is obviously right hand drive, Singapore they drive on the left side of the road. Imagine, if you've got a rigid approach to that policy question, you're going to bang your head against the wall rewriting that code to work on the right side and on the left side. Instead we have designed from the beginning, scalable and flexible architecture, we were able to go from driving on the left side of the road in a single weekend!

We built it in a high degree of scalability in our fundamental approaches to the autonomous driving problem. That flexibility is what is going to allow us to go from four cities to forty then four hundred cities and beyond.

Let me highlight what we're doing in Vegas in particular. As Glen and Jada mentioned, we've got 75 vehicles in Vegas, 30 of them on the Lyft network, those vehicles over the past several months have given 30,000 paid rides to residents of Vegas or visitors. 30,000 paid rides, so to our knowledge, that represents the largest, open to the public, commercial, autonomous mobility service to the world. We're very proud of that. One other thing we're proud of, at the end of each trip, we get a star rating like any Lyft driver does, 1 through 5 stars. Our star rating today is 4.95 stars out of 5 stars.

That's important to me because that rolls together a few key questions on how we're doing. First, as a rider, did you feel safe in the car? Second was it comfortable and smooth? And third, did it get you from point A to B efficiently. To me 4.95 out of 5 is a resounding yes to all these questions. So we're very proud of that. This activity in Vegas - this investment - is helping us understand what it takes to commercialize this technology. And it's one of the things that's going to allow us to get to \$1 billion revenue opportunity by 2025, which is what we see the autonomous mobility business becoming.

To wrap up, it's very easy to come to work and work on this technology because it gives us a chance to do some good in the world, as we do well for Aptiv. We work very closely with partners on the city side - they come to us with problems about transportation; congestion, pollution, inefficient utilization of the vehicle asset which means it's difficult to find places to park these things. Our autonomous driving technology is able to not only create a massive business opportunity for Aptiv, but to create a transformation in the transportation network to one that's much safer, much more efficient, and ultimately much lower cost for consumers. It's great to be developing this technology, and great to be developing it here at Aptiv.

I'll send it back to Glen De Vos to wrap up.



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Glen De Vos:

Thanks, Karl. Just a little bit of a summary....

Slide 18: You heard about our technology, what we're doing. First, Aptiv's capability is across that full stack that we talked about, it means we're uniquely positioned to understand where the market is going. As Lee talked about, architecture impacts every level of that stack. We understand that deeply which means we also understand how we help our customers get there.

There's been proof points along the way this year. One of my key takeaways from 2018 is the validation with our customers that this is the direction that we're headed.

That capability also means we know how to manage our portfolio. At each level of the stack, Aptiv is positioned so as complexity grows, we're right there to take advantage of that. Whether it's sensors or data and power distribution, the compute, application layers, we're positioned to take advantage of that increasing complexity.

As David talked about with Active Safety - the wins and commercial success there - those are proof points that this is the right direction. This is not about revenue far out in the future... it's about realizing commercial success today! I hope one of the things you take away is we are monetizing now, our commercial wins are now, our proof points and advanced development projects are now, the commercial deployment of automated mobility is now. So they're happening now - it's not about what might happen, it IS happening.

As a result, that's why we're confident we'll be market leaders in terms of growth, profitability, and returning shareholder value.

Thanks for joining us today!