

## Evercore ISI Autotech & AI Forum

### Company Participants

- Ali Kani, Vice President and General Manager of Automotive
- Unidentified Speaker

### Other Participants

- C.J. Muse, Evercore ISI

### Presentation

#### C.J. Muse

Well, good morning, good afternoon. Thank you for joining us Evercore ISI's Autotech and AI Forum. My name is C.J. Muse, Semiconductor and Semiconductor Equipment Analyst here at Evercore ISI. Very pleased to have NVIDIA with us today, specifically Ali Kani, VP and General Manager of Automotive. We've got roughly 35 minutes to hear from Ali, he's going to present briefly, and then we'll move to Q&A. If you have any questions in the audience, please feel free to e-mail them to me, and I will try to put them in. And with that, thank you, Ali, great to have you here, and I'll turn it over to you.

#### Ali Kani

Thank you very much. It's a pleasure to be here today. We can jump in. So these are just going to be our forward-looking statements.

Okay. So just wanted to start by talking about our automotive strategy at NVIDIA. And I think where we really differentiate ourselves is that, we're very focused on building a platform that's open and modular, such that partners can work with us at any level of the stack. So, we have some customers who just buy our computers in the car and they built the full autonomous driving stack, do the training, simulation, build their own AV application, and cockpit application themselves, and that's a great partnership for us.

But we have cases where customers also ask us to build their autonomous driving application, and do the training and simulation for them. And we design this stack in a modular way such that you can actually pick and choose what you want from NVIDIA. And the fact that we sort of build this stack end-to-end ourselves, makes our product better across the stack.

And just to note that we also have customers who don't use our computers in the car, but they work with us in the cloud for training and simulation. And so, having that open and modular platform that happens to be end-to-end is really fundamental to our strategy and a big reason of the success that NVIDIA's having in the automotive business. Next slide.

So one of the things we do to make self-driving development easier for our partners is we try to build a platform that makes it easy for people to build their own applications. So even though we're building an autonomous driving application and a cockpit application, many of our customers and actually most of our customers build it themselves. And so we try to build a platform that is really attractive for those partners. So we have a computer architecture and a sensor set that we create that actually is designed to be functional, safe and secure. And we provide the infrastructure and tools for an OEM to build their own AV application and cockpit application. And the fact that we built the platform in this sort of open, modular way, we design it to be upgradeable across generations.

It makes it so much easier for our partners to develop on our platform, we have customers who were, for example, using the Xavier platform. And since our platform is designed to be upgradeable, it's easy to take -- I'm sorry, a point computer and upgraded from a Xavier computer, and we design that platform to be software compatible. So the applications you build on Xavier can just run on Orin when you get it. And designing the platform that way saves customers so much time and wasted investment, right? And that's a big part of our strategy, is just make it easy for people who want to build their own AV development. And the only reason why we can do this is we're building the platform ourselves and we recognize those issues. And so we try to enable the things that help us to develop faster to our partners in the ecosystem.

Okay. So we talk about making the platform upgradable, the way I think about this is similar to how Tesla builds their cars is, you could buy a Tesla with a hardware 2, but then you can upgrade it with the hardware 2.5 and then you can upgrade it with a hardware 3. Part of what we're doing is building this equivalent sort of TDP computer form factor and TDP compatible computer that you can then just plug in from your vehicle. And so we keep giving you these upgrades as an OEM. Take your Xavier computer, upgrade it to Orin computer, upgraded to Atlan computer. And the pace of innovation that NVIDIA offers OEMs is really significant. And because it's software compatible, all the investment you make on us, on our Xavier platform can be pulled over to the Orin platform. And this is why the ecosystem in our platform is growing, because once you develop on our platform there's a lot of advantage for you to stay on it, not just because the roadmap keeps getting better, but we make the platform so easy to go from one generation to the next.

Okay. So once we move up into the application software, there's just a lot of work for OEMs to do. And one of the areas that we're differentiated is, we have the full self-driving application that's available for our partners. And so if OEM right now wants to invest in electrification and the base vehicle OS, they can partner with us to do the Parking application, the self-driving application, the end cap application for them.

And this is more about, do OEMs want that help or not. But having that capability, one gives us the opportunity to help OEMs in more ways than just a standard component supplier. But it also -- all that learning that we have in developing this application feeds into our next generation chip. And our chips are actually better next generation, because we're delivering all this application where we realize, well, if we put this into the chip, it will even be better for someone building a self-driving computer next time. And so our products actually are increasingly sort of differentiated for people who are actually building self-driving cars.

So we talk about that end-to-end flow from training to simulation. The real differentiator for anyone building AV in our mind, is the speed of that development flow. And the reason why I say this is building an ML ops development flow that has to be safe and secure has never been done in the industry. This isn't like you're building software in a cluster or it's an Android tablet or iOS tablet, if you do something wrong, it's okay, you just later do a software update and it can get better over time. Building a self-driving computer, you have to make sure that it's safe and secure. So you want to be able to test software in simulation before you roll it out to the car. You want to be able to test the software in shadow mode inside the car before you update it in the car to make sure you're not causing any negative experiences for drivers. And to do that, you need a software development flow that has a bunch of interconnected AI leaks happening at the same time.

The way you build a map is a AI loop, you have to take data from the road, you need to train networks off of that data, you need to build a map and then you need to OTA it into the car. You take that mapping network, but you also feed that mapping network into your perception network for the car, because a map is actually a good way to train your path reception network. And so those loops are interconnected, and everything you're doing also gets tested in a single loop as well as a self-driving loop, and making that self-driving loop essentially be identical to that digital twin simulator is a lot of work. How you build that software development flow such that all these pieces are interconnected safe and secure and actually designed so that you could quickly find an issue, root cause it, fix it.

And then OTA it in a car, the speed of doing that is a core value proposition for anyone building autonomous driving software. And that's where we're investing as a company, is that end-to-end flow. We have a DGX system that we sell to help people with training. We have constellation systems that we help people with simulation, and we have the AV software. All of those things have to intertwine together to form a software development flow that's efficient. That's where we're focused on innovating and differentiating, and I really believe that that actually is the core source of advantage for one AV company versus another.

So, I think here we just wanted to point out the NVIDIA ecosystem is going through significant growth. There's traditional OEM's, like a Mercedes, and a Volvo, and a Hyundai; but there's a whole slew of NEVs [ph] most of which were building a car the way you would want to build it, if you could reimagine what a future car would be. Most -- all of those companies are developing on the NVIDIA platform, whether it's Neo, the Auto, X Pang, Farady Futures. And then all those companies are also

building robotaxis, or autonomous trucks, vast majority of them are also developing on our platform. And I think that ecosystem is also a source of advantage. And the reason is, is when people develop on our platform, we learn from them. They tell us, hey, there's something here that you could do next time. Can you make your software better in this way? Could you make your hardware better in this way?

And we take those learning's and we incorporate them into our roadmap. And I'm particularly proud of the fact that there's hundreds of companies developing AV and it's not just an OEM strategy, it's a platform strategy. This slide show you guys OEM partners develop on platform. But we actually just work with camera vendors and radar and lidar and mapping partners and Tier 2s, Tier 3s, all of those OEMs, all those ISVs and startups building software or hardware vendors in ecosystems, they're also bringing up their products on our developer platform. And we think that's great, it's not -- we're not just trying to service OEMs. Anyone's building an application or a product that connects to our computer, we want to work with them to make their application run best on our platform or their sensor work best on our platform. And I think that's a core part of our advantage.

We always talk to you guys about it, but I wanted to give you guys the background of why we do it and why we think it really helps us differentiate. And I think we've mentioned this before, but our pipeline is growing and it's across the board. It's not just passenger vehicles, its robotaxis, its trucks. And it's not just in terms of hardware, right, there's customers who now increasingly want to work with us on software. And so when we put all those options together, our pipeline is growing significantly, we have more than \$8 billion pipeline now.

## Questions And Answers

### Q - C.J. Muse

(Question And Answer)

Great. Ali, thank you for the presentation. I guess to start, I'd love to kind of level set where were NVIDIA's automotive business is today, \$500 million plus in fiscal '21, to what you kind of see in the future, particularly as you look at that pipeline of \$8 billion extending out to fiscal '27. So, is there a way where we can kind of level set what is kind of legacy infotainment, smart cockpit, L2 plus autopilot other? And how we should kind of see that ramping in the coming years?

### A - Ali Kani

Yeah, I mean, we mentioned legacy infotainment is less than a third of our business and will continue to dwindle away, and combined with smart cockpit together legacy infotainment, smart cockpit is a little over half of our business today. But I think what you'll find is that the mix of AV and self-driving will ramp and grow over time, we'll start to see an inflection later next year and will really try to scale it in calendar year '23 and '24.

## **Q - C.J. Muse**

And in terms of that inflection in this second half of '22, what's principally driving that confidence?

## **A - Ali Kani**

It's really just the wins we've announced. There are a good number of NAVs that have announced products that go to production in 2022. Lot of those China NAVs we talked about, as well as the emerging ramp of a couple OEMs, both Volvo, we've announced is going to be going to production in 2022, and SAIC. So as all of those vehicles start to ramp up, our business is going to start to see that inflection later next year, and then you'll really start to hit as they ramp up in '23 and '24.

## **Q - C.J. Muse**

Very helpful. I guess just to take a step back, trying to get my arms around it, the hardware compute side of things. At the heart of NVIDIA is compute, although clearly software is becoming bigger and bigger part of the company, but we would love to hear the benefits of Orin coming into production in '22. And then I guess perhaps more importantly, we drive Atlan scheduled to come online in 2024, what that roadmap will be able to support?

## **A - Ali Kani**

So, I mean, I think, first let me say, I think Orin is a home run. I mean, I think that just the amount of traction and success we've had with Orin is far larger than what we have with Xavier, and we're really excited about the product. And I think it's because the industry has started to truly appreciate something we've been preaching for a long time is you really should build a software-defined computer in the car. It's not just easier for OEMs to update and support and upgrade that experience over time. But if you think of it in terms of software and services business, it's transformative, it transforms the business model of OEMs.

And now that we have all these supply shortages in the chip industry, OEMs also realized that it's a better strategy for their supply management. So there's so many fundamental areas that a software-defined computer like Orin unlocks for OEMs, I mean, I think that's what's driving the success. And so now when you talk about Atlan, when you put our strategy together is, is let's make sure the platform is compatible. Let's build an Atlan computer that's one factor and power compatible to Orin and let's build our software stack such that the APIs that people develop on is compatible from one generation to the next.

Now you see how exciting for us Atlan is because we let our customers upgrade their vehicles but not have to throw away their software. And so what you can find is, is faster generation advancements from OEMs, whereas before they build one architecture, you have to keep it for six to eight years, because they don't want to change the architecture. But our products are architecture compatible, and so what they can really do is just unlock new features and functionality, because there's a form factor and architecture compatible upgrade available with Atlan.

## Q - C.J. Muse

Helpful. I guess maybe to expand on that, IAA Mobility. You focused on speed of development flow as a key differentiator for the AV market. You spoke to it again today. I was hoping maybe you could dig a little bit deeper into the meaning of that? Is that strictly on the hardware side, software side? Does it play a role in how your customers are choosing kind of Tier 1, Tier 2 Tier 3 suppliers? Would love to hear, I guess, more thoughts around speed and how that is so vital for this emerging market.

## A - Ali Kani

Okay. So let me sort of explain what I'm talking about. I'm talking about the speed of an AV development flow. And what I mean by that is, let's just take Tesla as an example. We've been reading about how there have been all these accidents that Tesla's have. If you go analyze those accidents, there's more than 10 of them, almost every one of them is an emergency vehicle with its sirens on. It's a parked emergency vehicle, right, every one of them is a parked emergency vehicle, it could be an ambulance, it could be a police car. But every single case, it's a parked emergency vehicle and the car just hits it.

And the first accident was 2.5 years ago and the most recent one was a couple of months ago. And so -- and there is no existing proof of any company who is building AV code, autonomous driving code that they upgrade and update that experience over the life of the car in a safe and secure way. Tesla is doing that, Tesla is doing OTAs, right? But I'm saying, there's all these accidents over the last 2.5 years, they are the same accident, and it's still not fixed in their cars. So the speed of the developed flow talks about how do you build a self-driving software stack that when you find an issue you actually can root cause it, truly root cause it, there are so many things in a self-driving vehicle stack. What was the problem that caused that accident? How do you go solve that problem?

Sometimes you need to go get new data, train a new network for that data, test it, and then put it in the car, test it in shadow mode, and then OTA it in the car. How long does it take you to go through that loop? And that capability and expertise is hard because no one has done it for AI code when safety and security is also critical. And what I'm saying is, look at the challenge Tesla's has doing it. Even though they give us OTAs, I have to -- they give us OTAs, the car actually does drive better. But they don't solve all the problems, there's actually bugs that they still haven't root caused and fixed. And the fact that it's taken 2.5 years is really not acceptable for a self-driving car because people's lives are at stake.

And so this flow, this development flow, building it in a way that you can actually do this efficiently requires an understanding of the infrastructure and tools needed for a new kind of software development. There's very few companies in the world who actually even know how to do that. And for NVIDIA it's something very unique, right, is that all these companies that are training their AI networks, they're training them on DGX systems. And then we've built our own simulator based on Omniverse, to

make it such that when you simulate AV, it's actually truly accurate, you could actually train networks on simulated objects that we build.

You can't do that on like an open GL simulator, you have to build a new kind of simulator. That's a part of the software development flow and you need to reinvent and recreate a development flow built for AV driving, and that's why I say it's so hard. And having the expertise to do that is really not something possible for many OEM's and Tier 1s. And so it's really good to partner there and sort of build up that expertise. And I think that's where we really try to differentiate with our partners.

## **Q - C.J. Muse**

So you spoke a bit around working with Tier 2s, Tier 3s, and I guess was curious to hear your thoughts around what you think the landscape will look like when we are full autonomous. Is this a world where you're going to be kind of partnering with best of breed kind of radar or lidar or vision and coming together with a full kind of hardware solution and force maybe Tier 1s or 2s to become more specialized or how do you see kind of a future here?

## **A - Ali Kani**

I think for us the key is, we really want to design our platform to be open and modular, so that if an OEM and a Tier 1 wants to develop their application in their own ways, they can. And so for example, there are cases like Genesect, and Genesect is like Tier 2 that builds the self-driving application for Volvo. And so we just let them build the self-driving application on our platform and they pick what they want, what sensors, what radar they develop the self-driving applications themselves, and we support them in that way. So our platform is open as, pick your own sensors, pick your own AI algorithms, either in some cases partner with a Tier 3 or build it all yourself if you're the Tier 2. They can make all those decisions and we're very supportive of it.

So -- and then we just have other cases where some OEMs might want a little bit more support from us. And so this is why I say, our platform is designed to be modular and open. The first example is, we're open if you want to build most of it yourself. But it's modular such that if, let's say, in the case of Mercedes-Benz, you actually want us to give you the self-driving application. So then we kind of sort of help inform them then, let's we want to invest on these sensors and we'll build that software so we kind of are more involved in what happens. But the platform is designed to be modular such that it really depends on the OEMs.

So I don't think one way is the right way and the other way is the wrong way. I actually feel like it's just based on, where does an OEM want to invest. Some OEMs should maybe focus on electrification in core OS today, and worry about self-driving application development maybe later or maybe never, right? And so we try to have a solution from them. But if you actually can do it, I think, we're perfectly fine saying, let the Tier 2 and the Tier 3 and the Tier 1 define what they want to do and just develop our platform, and I think that's great business and we want to make sure you can support those customers.

## **Q - C.J. Muse**

Helpful. A lot of excitement around your partnership with Mercedes-Benz. So curious if there's any sort of update that you can share in terms of recent activity here and timing of ramp with drive AGX?

## **A - Ali Kani**

I mean, I think there's no update, I think it's just we're working hard together. It's a great partnership. We are trying to build software-defined vehicle that's fully upgradeable over the life of the car. We think it's going to have some of the richest parking and self-driving applications in the industry. And we're designing at such that we're going to make it better, customer is going to buy the car, but what the car can do after it goes off, that lot will improve over the life of the car. So I think it's a really exciting partnership and we're really excited to be working with them beyond it.

## **Q - C.J. Muse**

And I guess more broadly speaking, what are the most critical designs that we should be watching perhaps from a magnitude of revenue contribution perspective over the next five years?

## **A - Ali Kani**

Well, let me sort of break it out in a few areas. I think there's -- of course, the Mercedes-Benz engagement is something you should look at. It's going to kick-in in the back half of that range, right, when a car goes to production in 2024, does take years to ramp into the full 2.5 million vehicles that they have in their fleet, but it will ramp into an entire fleet.

And then I think you have some OEM designs, traditional branded designs from Volvo and SAIC that will also be ramping and will be significant. Then I would say, there's a couple buckets that you should sort of put together, there's all these NAVs and they ramp starting next year. And there's a lot of cars that they're selling and there's multiple computers in their car, right? Neo announced four Orin's per vehicle, and many of the others are multiple Orin's per vehicle. And so once all of that scales up, it's a sizable and attractive business that we'll be scaling. And then finally, it's all those self-driving vehicles. If you look at robotaxis and you look at self driving trucks, almost all of them are developing on our platform and that is going to kick in and the volume when you put all of the ecosystem together, and the ASPs of course for robotaxi or not, they're not buying a single Orin, they are buying like multiple discrete GPUs, our highest and ampere GPUs.

So there's in some cases more than \$10,000 with content per robotaxi for NVIDIA. And when you take that and you multiply it by a large volume base, I think that's another big sort of inflection point that you'll see in the years to come. So I think all of those will ramp in this time frame that you're saying. And that's why the pipeline actually is growing and healthy.



### **Q - C.J. Muse**

Helpful. I know Jetson has a focus on driving recurring revenues, and just curious, obviously, there's a hardware and software aspect to your focus. But is there a priority as you think about pricing to kind of driving that razor blade model? Or are you more kind of indifferent in terms of pricing hardware versus software?

### **A - Ali Kani**

Yes. I mean, I think we just tried at charge based on the value we think we're bringing to the table. So we just think of it like that. And I think there's recurring revenues in multiple ways. Of course, if you build an application and when a customer upgrades a feature or a function after they buy the car, then there's recurring revenues from that.

But even when we don't build an application, when you're building a production vehicle that has to be safe and secure, we need to maintain that release over the life of the car, and so there's fees there. Every OEM that goes to production with safe code, we almost need to branch that code for them and give them a stable branch. And so there's recurring revenues there as well for all our customers. And so I think that recurring revenue stream based on software and support will pick up as both the software application customers as well as just traditional chip in OS customers go to production, because we'll need to continue to maintain and support those vehicles for the life of those cars.

### **Q - C.J. Muse**

Helpful. I guess maybe would love to hear your perspective on the competitive landscape, obviously into Mobileye, you now have Qualcomm with being here. How do you kind of see -- how do you kind of see things and how do you see things evolving over the next 5, 10 years?

### **A - Ali Kani**

I mean, I think the market has a good number of competitors who are capable, who have reasonably good strategies. And so I feel like it's good for the industry. There's good options, good choice. And we just try to differentiate with our strategy, right? Like we're unique in that first our platform is open. You can develop on our platform if you're not an OEM, you can just be a Tier 2 and Tier 3. And we take all those learnings and we improve the software and the hardware in the next-generation because of those engagements.

And the second is that we really do have solutions on the infrastructure side. And like I said that back and forth we think is actually a key differentiator for anyone building autonomous driving. So helping customers with a training solution or a simulation solution that's kind of unique to NVIDIA. And so having that end-to-end platform, especially with differentiation and infrastructure, really helps us differentiate. And then we have cases where customers want to build the self-driving application in some more traditional way. You mentioned (Inaudible) and Mobileye use. Their approach is a little bit more NCAP fixed-function CV based AV. Our approach is a

little bit more deep learning, software defined computer. We design our platform to be programmable and be very heavy on deep learning, and it's different than building an NCAP chip, it's very fixed function.

I've never seen a Mobileye product be OTAed in its life, they've been in production for so many years. They'll try to OTA car one day, but I'm just saying it wasn't built to be software programmable and software defined. It's more of a DSP type architecture. So we're trying to approach it in a different way. And so I think where we're investing and where we're differentiated are the places that OEMs are going, and it's the places they seek differentiation. So I really like our positioning. And I think the results show with all the wins we've been announcing.

You haven't seen too many new wins from other people, right? Like it's pretty much been a bunch of NVIDIA wins. The one area where I think you'll see more competition is in Level 4, Level 5. I think Mobileye will have some Level 4, Level 5 wins. But our strategies a little bit different, there is we want the Zoox's, and the Cruise's and the Aurora's, those guys to sort of be the leaders in that industry, and they clearly are. And I think what Mobileye does is they go to people who can't build it and they just kind of build on the platform. And our strategy will be more Hyperion there, we'll give you the hardware platform then you build the application, you build the AV.

I think our strategy is the right one for robotaxi in this cycle. And then longer-term, we may have an AV solution it can help people on that space, right? It just takes time, we're focused on L2 and L3 today, but L4 and L5 can come in the future.

**Q - C.J. Muse**

So we've got roughly two minutes left. So I will leave that time to you in terms of perhaps summarizing or if I fail to ask anything that you think is important and relevant, and let you kind of conclude our half-hour with investors. Can you hear me?

**A - Unidentified Speaker**

I don't think Ali can hear you.

**A - Ali Kani**

I couldn't hear anything.

**Q - C.J. Muse**

Can you hear me now?

**A - Ali Kani**

I can hear you. I can hear you.

**Q - C.J. Muse**

So we've got a minute left. I was just going to turn it over to you to either share something that we didn't touch on, that you think is important or perhaps, just give a quick summary and ending thoughts.

**A - Ali Kani**

No. I mean, I think you've asked really good questions and I think you covered most of the things. I mean, I think the one thing I'll say is that, the automotive industry right now, the amount of areas that we see fundamental transformation are significant. It's not just in self-driving cars, it's also in electrification.

And I think one thing I just wanted to say is, I think one area we haven't yet seen significant investment, which I think is going to be exciting is inside the cockpit. Today a cockpit experience is about cluster and entertainment, those are legacy applications and you can meet those needs with multiple solutions. But long-term, the experience in the car, it's going to be kind of like your concierge. The AV is like your chauffeur, driving the car for you, but you actually will have a concierge in a car that's extremely intelligent and personalized to what you like to do, and you can interact with it, you can talk to it, you can enjoy shows, you can do video conferencing. The amount of AI that's needed to enable a true concierge experience is significant and we're not yet seeing that in the car. And I think that that's an area where we'll see more innovation longer term.

And that also is an area where NVIDIA is unique in being able to provide some of those experience, because it's not self-driving software, it's like AI software, it's video conferencing software, speech, ASR, all those kinds of technologies and putting them together with driver monitoring and document monitoring and fusing it with the AV experience outside the car such that if maybe your child is about to get out of the car and there's a car coming from behind you to not let that happen or if you're about to leave a car and you might have left your purse or your laptop for the concierge to tell you, that your wallet or your purse is in the back and do you want to leave it in the car. So much innovation is possible by fusion -- fusing AV with AI inside the car, and I think that's going to be an area for differentiation long-term that we're excited to work on today, we don't have success to mention yet, but I think it'll be an area where we're going to have some exciting opportunities long-term.

**Q - C.J. Muse**

Can I get your Jetson's oven inside my car? Well, Ali, thank you so much for today. It's always great to spend time with you. So thank you and wish you great health, and will close there.

**A - Ali Kani**

Thank you, guys. Appreciate it.

**Q - C.J. Muse**

You're on.

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## A - Ali Kani

Bye.

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