

BofA Securities Global Technology Conference

Company Participants

- Jeff Fisher, Senior Vice President, Gaming

Other Participants

- Vivek Arya, Analyst, BofA Securities

Presentation

Vivek Arya {BIO 6781604 <GO>}

I am Vivek Arya from BofA's Semiconductor Semicap equipment team. Absolutely delighted and honored to have Jeff Fisher, the Senior Vice President of Gaming at NVIDIA. And I call gaming the original gangster of acceleration at NVIDIA. So really happy to have Jeff. So what we'll do is, we'll go through a few slides that Jeff has prepared. But then, we will get into a fireside Q&A.

With that, very warm welcome, Jeff. Over to you.

Jeff Fisher {BIO 2373419 <GO>}

Thanks, Vivek, and thanks for having me here. I -- just to repeat, you know, I am talking about gaming. You guys may have thought this is going to be about data center and all that. But as the original gangster of NVIDIA, thank you for that. I'm here to talk about and I'm excited to talk about gaming to all of you. I don't know if you -- most of you are gamers, but I expect all of your kids are and hopefully, they're all GeForce gamers, so maybe you can carry back some of this back to your kids.

First of all, I think you're all familiar with our forward-looking statements. You can refer to our filings online to understand and read about the risks and uncertainties of our business. But that PSA is now over. So let's talk about gaming. PC gaming is strong, and it's getting stronger. It's not the first time you guys have heard me say that. And it's still true and I still believe it.

If you look at from 2019 to 2022, in spite of the tailwinds of pandemic and work from home residing, we have gained 100 million gamers from 2019 to 2022, according to Newzoo. And from that new base, we expect to see continued growth as more people come into gaming. Gaming is arguably the most important entertainment medium in the world today. It provides competitive -- a competitive environment, provides a social environment, provides immersive storytelling and ultimately, we evolve into a complete interactive entertainment experience. And for these reasons, we've continued -- we see a continued growth in folks coming into gaming.

This is also evident in Steam concurrent gamers. They saw a surge of concurrent gamers through the pandemic and work from home. But they continue to see growth setting new records are now 33 million concurrent gamers on Steam. And if you compare GeForce gaming growth to the consumer PC market, the consumer PC market was largely flat ending 2022 from pre-pandemic in 2019. While our GeForce gaming sell-through, units increased a whopping 1.4x over that period of time.

If you look at GeForce gaming revenue from the same period of time, 2019 through FY '23 or 2022, we've seen a 20% CAGR annual growth rate over that period of time. And this reflects also a clearing of the channel inventory through the post -- through the pandemic -- the post-pandemic phase. This growth is driven by new gamers and creators coming to the PC unit lift, as well as ASP lift. And we can see gamers valuing more and more the GPU in their purchase and upgrade to PC of those gamers and creators that we can see have upgraded their PC, on average, everyone is upgrading to a higher class GPU. So our ASP mix is becoming richer, as gamers choose to buy up to a higher class of GPU. Both ASP and units have driven this growth and we expect to see a similar trend going forward.

If you look at our installed base, there's a huge opportunity to continue to upgrade our installed base. Only 44% of the GeForce installed base is yet to upgrade our -- has -- is on RTX. The balance is yet to upgrade. If you look at our latest announcement, the 60 class of GPUs, this is starting at our 299 class, the core gamers. Core gamers have a much longer replacement cycle. They have prior generation architectures, Ampere mostly Turing or earlier and lower performance GPUs. This class of gamer is a huge opportunity for us to upgrade. Only 18% of our installed base enjoys a 3060 class of performance or higher. The balance all needs to upgrade. I'm super excited about the 4060 launch and what this class of gamer, what this segment provides for us in terms of opportunity.

And last, I wanted to share with you a bit about our Ada ramp. As you guys know, we have -- we launch our products, our new generations from the top down, starting at the top. And for reasons you're also aware of, Ada has taken us a little longer to move down the stack than typical generation. So for this reason, we've got a fair amount of history on the 699 up class of Ada, this is our 4070 tie and up. And Ada from -- in terms of the revenue generated is ramping much faster, three times than Turing and about 40% faster than Ampere. We're super pleased with the Ada ramp to date.

Some time ago, it became evident that Moore's Law was -- not was slowing, and was not going to allow raw transistors to continue to drive the gaming market. It was important for us to find alternate -- an alternate path. And in 2018, we announced RTX. RTX featured Ray Tracing cores, so developers could create movie-class cinematic games and Tensor Cores for AI.

The first technology we delivered -- AI technology we delivered for gaming was DLSS, and DLSS provided a massive performance boost. DLSS 3, our latest innovation is a generative AI approach to rendering games. DLSS 3 uses generative AI to create 7 pixels for every pixel rendered. And you guys now, I think most folks

know how Gen AI works. But it has become a very powerful performance boost and quality -- image quality boost to games and gamers. And we now have over 400 games and apps that are supporting DLSS in our ecosystem.

From the start of our RTX launch, we've continued to innovate both in Ray Tracing performance, DLSS and AI features inside of our chip. The result is a 16 times improvement from the beginning of RTX to our current generation Ada in operations per pixel. This is effectively a function of image quality and performance. So we've delivered 16x image quality and performance, while our transistor count has only gone up by 4x. The result is that, RTX has transformed gaming and built an ecosystem around a new level of performance and image quality.

Accelerated AI, a game changer for all apps, especially gaming and Microsoft gave a huge boost to AI on PC, working to make the PC a first-class client for AI at the Build Developer Conference a few weeks back. At Build, Microsoft announced a framework for AI model plug-ins for all Windows apps. And they released a set of tools for developers -- for ISVs and developers to build and provide models for all the Windows apps. NVIDIA and Microsoft announced a collaboration to accelerate all the AI models coming to Windows on NVIDIA GPUs.

If you look at -- if you consider AI for PC and AI for all apps as the next killer app for PCs, which I believe could easily happen, you will need a range of hardware to accelerate like gaming and like graphics to accelerate all these AI models. If you look at our stack from our entry laptop, all the way up to our highest-end desktop GPU 4090, we provide a huge range. And you compare that to what I'll call DLAs or VPUs or whatever you call them, there's a -- these are AI accelerators that will be built into future CPUs and SoCs for accelerating a number of these, what I'll call, small models.

AI accelerators will be perfect for the type of mainstream AI apps like noise reduction, background blur, keeping your eye gaze at the screen. So that will become a broad base for work for developer -- for AI developer models. But for heavier weight models, things that the developers really want to change user experience like generative AI, all the way up to full character animation, again, like gaming, you are going to need an entire range of performance. And we have a family of GPUs to deliver that range of performance just like on gaming.

At COMPUTEX, I said last week, I forget when I got back from Taiwan, I think it was last week, we announced our first AI platform for gaming, ACE for Games. And it's really a great example of -- and look at what the future of interactive entertainment and gaming will be. ACE for Games is in one of our NVIDIA AI foundries where game developers can bring all of their game lore [ph] or their game -- even their game assets to NVIDIA to train a character to become knowledgeable, specifically on the domain of the game.

If you talk to a character inside of a game, you could ask anything about the history or lore of the game. But if you ask it something about the 2024 presidential election or about Vivek, you don't want it to answer. You wanted to have no clue what's going

on. It will take you out of context. So this is what our AI foundry does, is effectively, you bring your assets, you train them on our models and then you have a domain-specific character inside of a game.

So ACE For Gaming is -- effectively is three components; Riva which is our speech processing. It processes the input speech. You're talking to a character. It has NeMo, which is our large language model Gen AI chat -- chat model, which takes your input speech and ultimately, Riva converts it into text and NeMo will then create a response. And Riva then will take that response and convert it into speech back from the character.

We have another technology called Audio2face, which will take that audio stream and convert it into an animated character, and that's a component of Omniverse. So between Riva, NeMo and Omniverse, these are the three main components that make up ACE for Games. Developers can either take them in total or take any piece of it and provide -- put them into their workflow.

I want to show you a demo of ACE For Games, and I want to -- also want to point out that while that this was recorded in real-time and while the chat and conversation is specific to the game, it isn't prescripted. So let's take a look at ACE for Games.

(Video Presentation)

A peak into the future. So just to close, gaming is strong and it's growing. RTX transformed gaming. We've broken loose of Moore's Law. AI will be a game changer for all apps and specifically for gaming, and we're really looking forward with what that opportunity brings.

So thank you for listening to my opening.

Vivek Arya {BIO 6781604 <GO>}

Excellent.

Jeff Fisher {BIO 2373419 <GO>}

Vivek?

Questions And Answers

Q - Vivek Arya {BIO 6781604 <GO>}

I think we could watch that game all day long and not go through Q&A. But can we? So maybe just to start, so you showed that very impressive chart of how there's a big upgrade opportunity. How large is the deployed base for NVIDIA gamers? And how has that deployed base grown over time?

A - Jeff Fisher {BIO 2373419 <GO>}

Yeah. We've got the installed base of NVIDIA game, there's about 200 -- let's say, about 200 -- over 200 million NVIDIA gamers out there and GeForce-based PCs. So how has it grown over time? I mean, our units have grown at about 10% annualized. So I think that's probably a fair estimate.

Q - Vivek Arya {BIO 6781604 <GO>}

Got it. And one interesting statistic I saw there is that only 18% has upgraded to over a 3060 class. So why use the 3060 as the metric, like what's so special about the 3060 to use as the metric, right? That should be used to compare (Multiple Speakers)

A - Jeff Fisher {BIO 2373419 <GO>}

Yeah. I mean, it's taken us a while to get the Ada series down to that 60 class. So there's a lot of talk about how much opportunity and what do we think of the 60 series. And from my perspective, it is a perfect upgrade for that huge installed base of gamers. And remember, we're bringing 60 series all the way down to \$299, which is below the price of our 3060. So it's to share with the team. I mean, some of my optimism about what's the market we have to go pursue with that device.

Q - Vivek Arya {BIO 6781604 <GO>}

Got it. And what have you seen so far in terms of the Ada adoption trends? Because I think initially, you only launched the high-end SKUs last year. But now I think as you mentioned, you launched the 60 SKU as well. So how has been the adoption of Ada? And who is the typical -- is it somebody who is two generations or three generations old? Who's the typical gamer upgrading to the Ada?

A - Jeff Fisher {BIO 2373419 <GO>}

Yeah, that's a good question. And it kind of depends on where in the stack we're talking about. I mean, I shared with you how the 4070 tie is doing relative to prior Gens. And, in fact, the early results from lower down Ada are also very -- are very strong. I mean, we're -- I'm really pleased with the Ada ramp. But you talk about, who is upgrading. And at the highest end, those gamers -- a 4090 gamer wants to play with everything turned on. They want to play the AAA games, they want to play with everything turned on. And from perspective of Ray Tracing and DLSS, they will see a 2x improvement Gen to Gen. I mean, so if they're upgrading from Ampere, they are going to see a really great improvement. If they're upgrading from prior Gen, it's kind of -- it's a lot more than that.

As you go down the stack, especially in the 60 series, those gamers have a much longer replacement cycle, they'll go back two generations or longer. So their comparison is relative to a Turing or a lower-end device or something even pre-Turing. And they're easily -- in that class, they're even at basic raster gaming, they're going to see a 2x performance as well.

Q - Vivek Arya {BIO 6781604 <GO>}

Got it. What's the typical upgrade frequency? So if I look at a conventional PC, you know, people might upgrade it like in the four or five, six year, right? More likely five year or six year timeframe. What's the typical upgrade frequency for a enthusiast gamer?

A - Jeff Fisher {BIO 2373419 <GO>}

Yeah, it's -- I'll tell you my expectation and that is, at the highest end, those gamers will upgrade every generation. I mean, they like the best, they likely have the wherewithal to afford [ph] the high end, each Gen. And that's about every 2, 2.5 years, right? As you get to the bottom of the stack, I think we're stretching out to probably 3.5 years to 4.5 years for a replacement cycle. It's probably, we see more upgrades than we do new PC sold so it'd be shorter than the overall PC cycle, but that's about the frequency, yeah.

Q - Vivek Arya {BIO 6781604 <GO>}

So averaging somewhere around 3.

A - Jeff Fisher {BIO 2373419 <GO>}

3.5, 3, 3.5 years, something.

Q - Vivek Arya {BIO 6781604 <GO>}

3, 3.5 years. Yeah. Got it. And do you collect data on when they upgrade do they typically -- I assume they would upgrade to a higher-end SKU, right, than before?

A - Jeff Fisher {BIO 2373419 <GO>}

Yeah. Yeah, that's a good question. I mean, they -- we have some of our gamers who are using our client. I think we've talked about this for GeForce now, which will help keep your PC upgraded with the latest drivers automatically, and helps you -- and will automatically set the best settings for every game, which is these days, super important for your hardware. They also share with us their history. And among those users, we can see when they've upgraded a graphics card inside of a PC. And we have seen generation-to-generation gamers buying up more each time. The lift from what they had, to what they're buying continues to increase, which is a great testimony to the value they place on the GPU relative to other components in their PC, and what they're willing to invest in a great entertainment experience. So to answer your question, yes, we do see a increasing investment from gamers who are upgrading within our base of GPU [ph] users.

Q - Vivek Arya {BIO 6781604 <GO>}

Is it an easy way, Jeff, to look at how much -- so you mentioned you have seen double-digit kind of unit growth, right, in your installed base. What about the content expansion for NVIDIA is? Has that also been 5%, 10%? What is the right way to think about what that content growth has been over time? And I asked that question because I think there have been two instances where I hesitate to use that

word again, crypto because it caused a lot of confusion. But that created and have a normal lift on the pricing side. So if you kind of normalize for that, what do you think has been the average content right or mix up in your installed base?

A - Jeff Fisher {BIO 2373419 <GO>}

When you say mix up, that's what you mean by content.

Q - Vivek Arya {BIO 6781604 <GO>}

Yeah.

A - Jeff Fisher {BIO 2373419 <GO>}

Okay. Well, it's a good question. I -- the -- first of all, when we look at -- when I look at mix up or upsell, remember, even in the days of, I'll call it, product shortages throughout the pandemic and work from home and crypto as you mentioned, we didn't really change our GPU pricing. I mean, the way I measured upsell was from my core price not what it ultimately got inflated to in the end market.

And what we've seen today for Ada in this class 699 and up is a \$300 to \$400 upgrade in mix in the high end. So gamers who are buying our high-end of our Ada are buying from a much lower class of product, which is super exciting for us. Ampere, it wasn't -- it was -- I'll speculate, it was in the \$200 to \$300 upgrade range. And Turing was probably a bit below that, so we've seen an increasing mix of upgrades over time.

Q - Vivek Arya {BIO 6781604 <GO>}

So just to get it right. So what you're saying is that people who upgraded to Ampere on an average bought a card that was \$200 more expensive. And now those who are upgrading to Ada are buying something that is \$300 or \$400 more expensive?

A - Jeff Fisher {BIO 2373419 <GO>}

Right. Relative to what they had.

Q - Vivek Arya {BIO 6781604 <GO>}

Relative to what they had.

A - Jeff Fisher {BIO 2373419 <GO>}

Yeah. Relative to what they had in their PCs.

Q - Vivek Arya {BIO 6781604 <GO>}

Right. So if you were to do a similar mix up math over long periods of time. Is that also kind of a double-digit average across your base? Or is that a simple -- we like simplicity, so if you give us -- units and mix up, it will help us.

A - Jeff Fisher {BIO 2373419 <GO>}

Well, we've -- I think -- I'm not sure if I'm answering your question exactly, but historically, we've seen about a 10% lift in units and a 10% lift in ASP over time. And I don't see any reason that necessarily that trend would change.

Q - Vivek Arya {BIO 6781604 <GO>}

I see. The one other interesting thing that you also alluded to is kind of the synergy in NVIDIA between gaming and data center. So from your perspective, right, how do you benefit from having data center in the same company and that it's vice versa right? How do they benefit?

A - Jeff Fisher {BIO 2373419 <GO>}

Yeah, that's a great question. I thought you're going to ask me why are we -- are we going to throw all of our money at data center and -- but I like it the way you phrased it better. The -- effectively, I've been in NVIDIA a long time, and it's easy to see how this company has grown. I mean, we have a unified architecture across all of our devices. And unlike, I guess, many companies, certainly our scale, we have a single engineering -- hardware engineering team and a single architecture team. And the core of our products is, if you took it down to the atomic level, I guess, there's CUDA cores. And CUDA cores were used to build our gaming franchise, but they also are powering our AI hardware.

So the investment in CUDA cores will continue to drive road maps, both on the data center AI side, as well as the gaming side over time. Also, our -- I think Jensen just often describes our company as a giant kitchen and he likes to be involved in the cooking, as you can imagine. But inside the kitchen is -- are these really incredible technologies that are shared across our businesses, and while we've been investing and driving our AI platforms for data center for quite some time, we're now starting to bring them over to gaming.

I mean, you could see ACE for Gaming is taking Riva, NeMo, Omniverse, all things you've seen in our other businesses, and we're now bringing them into -- formatting them, bringing them into a game development community. So it's a very powerful the company, and the way we've organized and our unified architecture is very powerful for all of our business. And you can see we try not to stray too far outside of them, because it's hard to leverage that investment.

Q - Vivek Arya {BIO 6781604 <GO>}

Got it. Just one near-term question. As you look in the back half of the year, there's a lot of concern about consumer spending, right, the non-rebound in China and so forth. So how do you think about the growth of gaming? Do you think you're expecting kind of a typical seasonal lift? Or do you think that right, things are going to be tougher in the second half, given all the consumer macro concerns?

A - Jeff Fisher {BIO 2373419 <GO>}

Yeah. We are -- Q1 came in as expected and it's seasonal. I expect the year, we'll see. I expect the year to play out with a seasonably larger second half. I think the -- and I'm also assuming some stability relative to where we stand today in the world. I mean, anything can change. China has got some pockets of strength and also macro weaknesses. Europe, I would say, has a similar scenario as the US. But generally, the base of business, the foundations of our business relative to people want to game and they want to play the latest games. And (inaudible) caught it, but Diablo IV, a huge game is now out in open beta, soon going to be released. We expect that and Starfield and Call of Duty next to really be drivers for folks coming out and upgrading their hardware for games. So in spite of the -- all of the macro, we are optimistic that we'll see a regular seasonality this year.

Q - Vivek Arya {BIO 6781604 <GO>}

Got it. Jeff, if you look out over the next 5 years, 10 years, do you think this remains a hardware business? Or does it become a software and subscription business over time? And what would be the pros and cons if that were to happen?

A - Jeff Fisher {BIO 2373419 <GO>}

Yeah. Well, I think it's going to be a hardware business for the foreseeable future. I mean, I think that as games have got a long way to go to deliver what I always refer to as real life in real time is going to take a continued hardware investment and the most economical way to deliver that is really on the client. Gamer buys a PC, he can have the best experience local. It may continue to move up the stack.

As you guys know, the volume of the mainstream has largely disappeared that entry class of GPU, but the gaming segment remains quite strong. So -- but I don't know if you have a question about the cloud there, but I -- ultimately, gaming will expand, and we'll have these massive universes. I hesitate to use a word metaverse, because it may be a dirty word in the room. But I do think that these large interactive shared experiences are going to become super important and not just important, but the way people are going to want to play games over time.

So while local PCs are going to be used for rendering and some AI modeling, the cloud will play a more important role over time. And that -- the cloud part of that will likely be subscription-based. Software will always be a component of driving gaming, but I think what you'll be either buying or subscribing to is hardware local or in the cloud.

Q - Vivek Arya {BIO 6781604 <GO>}

All right. And maybe one last one. So NVIDIA has enjoyed very strong 70%, 80% market share, right, among enthusiast gamers. Your competitor is also bringing out a number of new products, and they can also buy transistors from the same foundries if you can.

A - Jeff Fisher {BIO 2373419 <GO>}

Yeah.

Q - Vivek Arya {BIO 6781604 <GO>}

So what gives you the confidence that you can maintain this kind of very high, right, premium market share?

A - Jeff Fisher {BIO 2373419 <GO>}

Yeah. Well, they buy the same transistors. So that's great. I mean, at the core level, we're at a level playing field, and we can then innovate on top of that. I mean, I want to point out that those of you read the headlines about ASPs and pricing, and we offer a full stack. I mean, we now offer -- our 4090 is actually priced below the 3090 tie. I don't know if anybody realizes that, but -- and the 4060 is priced below our 3060. So we have a range of prices. And if a competitor comes out with certain pricing, that's fine. A gamer can pick between them or GeForce.

But what we've built really is a promise of compatibility and performance to our gamers. I mean, we release a new driver with every major game that -- that comes out. GFE will update your PC or you can go get it from the web and download it. And that's a cadence about once a month. And the new drivers aren't fixing bugs because the stability, compatibility is awesome for GeForce, they are improving the performance of new games that have come out, and they've been fully qualified on new games that come out. So gamers know that.

We've also built a broad channel. Our channel knows that if they stock GeForce, that it will sell. So they can confidently take in our new product and make it available globally worldwide in every country within about three weeks of us launching a brand-new product. So availability is huge. And we also have an ecosystem. We have a very large, massive team of hardware and software engineers that call on game developers. And the purpose of that is to make sure that games and our technology really shines and game developers know how to take advantage of some brand new things like AI and ACE. As a result, games coming out, they run best on GeForce, 400-plus DLSS games and apps is a real testimony to that.

Q - Vivek Arya {BIO 6781604 <GO>}

Excellent. Thank you so much, Jeff.

A - Jeff Fisher {BIO 2373419 <GO>}

Okay. Thanks, Vivek.

Q - Vivek Arya {BIO 6781604 <GO>}

Really appreciate your time. Thanks to everyone.

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