Credit Suisse Technology, Media, and Telecom Conference

Company Participants

- Colette Kress, EVP & CFO
- John Pitzer, Analyst

Other Participants

- Unidentified Participant, Analyst, Unknown

Presentation

John Pitzer {BIO 1541792 <GO>}

Perfect. Why don't we go ahead and get started, I'd like to welcome everyone to this afternoon session. My name is John Pitzer, I'm semiconductor analyst here at Credit Suisse. It's my distinct pleasure this afternoon to introduce Colette Kress, who is the EVP and CFO of NVIDIA Corporation. We're going to go through a fireside chat for the next 20 to 25 minutes. We do have a microphone circulating throughout the room. You guys have been a very bashful crowd today -- conference today. If you have any questions, raise your hand, we'll make sure you get a mic.

With that Colette, let me start things off, my guess is there's not a lot of people in this room that aren't somewhat familiar with the NVIDIA story. But it's always helpful in a room like this, just in case to someone that is a little bit less familiar to spend a few minutes just position the company. What's your core IP, the core end markets you try to attack, your core strategy. I guess importantly, talk a little bit about how you do things beyond just the chip level at the software ecosystem (inaudible) really distinguishes you from a lot of those semiconductor companies.

Colette Kress {BIO 18297352 <GO>}

Yes, I think that's a good place to start. So our Company was founded on being the leader in visual computing. But as we work through a key part of our transformation, we started about four to five years ago, we are really focusing on being a GPU computing company and what does that mean when you are new to a GPU computing company. Before, we were looking for places, where a GPU, standing for Graphics Processing Unit could be leveraged as a component in platforms.

The main component that we were a big factor on was obviously the PC platform and probably our key most important application that we did at that time was gaming. And moving towards that. But as we've transformed as a company, we

focused on very key markets that we felt had tremendous growth potential in front of them that were extremely hard problems to solve. And where the GPU would be leveraged ever so uniquely for those platforms. Moving away from just being a component. But being a platform that is incorporating the key GPU but also a development infrastructure platform that incorporates development language and many times our key design capabilities, libraries and frameworks that can be used for each of these markets.

Our core markets today are gaming. It's still a significant portion of our business, represents about 55% of our business. But also pro visualization, we are essentially taking that graphic processing capability to enterprise applications. Our third one is the data center, which has many different parts, which we'll talk about and also our automotive business. And this in terms of our automotive today, is focused on infotainment, where we're using computing graphics inside the center consoles. But moving to the future in the strategy of self-driving cars and the overall AI platform that's going to be necessary for those cars going forward. So those are our four markets. What puts us in a unique position is that we have the ability to have a unified architecture or essentially the same product for each one of those markets that allows us to leverage or essentially invest in all four of those markets with one significant amount of operating expenses.

We probably have the most engineers on the planet singularly focused on the GPU here at the Company. So the business is going well and that strategy has really allowed us to expand into markets that are probably 10x where we were even three or four years ago.

John Pitzer {BIO 1541792 <GO>}

That's a helpful start. I kind of want to drill down for each one of your four business segments into some of the growth drivers. And gaming is probably a good place to start at that because it's still sort of the largest of the four businesses that you're in, as you said about 55% of the revenue. This has been a business that you've been able to grow at a compound annual growth rate over the last five years of about 20% or little bit greater than 20%. Now, I know this is not tied to new PC sales. But you did that during a period of time where PCs are down almost 30% from the peak. Can you talk a little bit about some of the drivers that are helping you to keep on that CAGR and specifically ASPs as the biggest driver of that, because you probably had better ASP growth than unit growth driving that CAGR over time.

Colette Kress {BIO 18297352 <GO>}

Sure. Let me kind of talk about the gaming market. And the gaming market, which is primarily for us focused on the PC. Yes. The overall PC market is enormous, more than 300 million. But not necessarily a growth business. What we sell is the actual gaming platform underneath that PC platform. Rarely, our sales in terms of the GPU for this market associated with the PC. What is normal, people have a PC and essentially just opening up and change their overall experience for gaming by inserting a new GPU for that business. So overall business has been focused on

providing a gaming platform for every type of gamer. If you think about many of the other types of platform for gaming, you get one choice.

When you think about us, if you've got $100, if you've got $1000, we have something to sell for you for that overall experience. What that allows us to do is really fine-tune working with the software developers and the game developers on better and better games, games that essentially change based on what kind of GPU you actually have in there. So our success over the last three years, about a half year ago, we had calculated overall CAGR to be about 30% historically, much faster than the overall PC market and there is literally both drivers influencing that, both from a unit growth and also from an ASP growth. About half and half [ph] coming from that. But why, why are the units overall growing in the sensitive PC platform because gaming today on the PC platform is not all about just playing the greatest games, it's a social sport. People are not sitting there alone, playing Pong back and forth, they're actually in there because their friends are online. Their friends are on their side bars, their friends are watching their game, you are watching other professionals play. Just like any sport, it's essentially a sport in terms of gaming.

eSports have got people online, watching others in tournaments. If you think about the wealth of videos that are on YouTube focus on how to play games. It's an enormous business that's extremely healthy.

So people get the appropriate gearing [ph] or essentially they are having gamers joining two by two, not necessarily one by one because it is to be there in terms of social. We see expansion of broadband access across the world. We think that everybody has all those broadband capabilities as we do in the US. But that continues to grow. And they look at the western world or many of their sister countries. And they want to be onboard with that overall gaming population. So we continue to see that grow. The gamers continue to be gamers for longer period of time. We have some of them over 40 years old but are still gaming, their discretionary income there to buy whatever they need for their overall gaming experience. Second, it comes into the actual games.

The games that they're playing online are multi-player types of games, multi-strategic types of games going from volumes to volumes, franchises that have been around for ten years, 15 years and they're on version 5, version 6. The more complicated the game, the more complicated you see the overall graphics capability and the rendering is going to be necessary for all of those different scenarios. Because of that additional production value of games, we need higher-end GPUs. So that goes into the second piece of what we're seeing, higher ASPs. That's not a case of price increase, it's a case that people are buying what they need for the types of games that they want to play. They are buying higher-end GPUs.

And so on average, we are selling a higher price point in terms of that [ph]. The fortunate piece that we're in right now is, we just launched our recent Pascal architecture, which is also a very big influence, probably one of the largest increases in terms of performance from the last generation is what you can see in Pascal. What that means is gamers' performance per dollar is tremendously higher. It's a great

opportunity to buy. We exited [ph] the market over the last four to five months with more than six, seven different types of gaming cards unavailable and the great thing about that is essentially anything above the $200 price point, you get to buy NVIDIA because that's what's available for you. So it's going well. This last quarter, we did 60% growth in our overall gaming business and we're in the initial stages of the holiday season.

John Pitzer {BIO 1541792 <GO>}

One of the questions I got after the October quarter was how should we think about the channel, the transition from Maxwell to Pascal, both on an ASP basis and kind of a channel fill basis because clearly when you waterfall the new products out and assuming the high ASP products are kind of first to market, October quarter probably benefited the most from that. As you move into the January quarter, you get volumes. My guess is the rich -- the mix kind of becomes a little bit less rich on the Pascal side. So how do we think about channel fill and sort of mix over the next couple of quarters as you move from Maxwell to Pascal?

Colette Kress {BIO 18297352 <GO>}

Sure. With each of our lines that we've come out with, whether that would be Kepler, whether that would be Maxwell, which is our last generation to Pascal, we've continued to keep our customers on their toes in terms of what's coming up first. And what we've concentrated on, given that it is the exact same architecture across, we have that opportunity to see that market in different ways that we feel will -- both benefit the market. So there is no one said, hey, we want these first for a different type of channel fill because I want to concentrate a little bit here on the actual channel.

Our channel is extremely important to us. These are partners that enable us to do a deal because we're in terms of building the best architecture, we're not here in terms of managing the day-to-day in terms of the channel. We have a great relationship working back and forth on both understanding the demand, what we believe is the demand and as well as what they're seeing locally, because if to grow the growths [ph] that we have been it's really about a factor of every single region growing, every zip code growing, every card that we've in terms of growing. So it's not about channel fill because (inaudible) number of our platform approach is, we have designed a set of key drivers in software for every gaming card that goes out there, we can see you light up, GeForce Experience is the experience that allows you the latest driver for the next game that comes out. We want you online in gaming in seconds. But we can see the games that you're playing, we can see what types of cards that you are overall buying. So it's not a case of channel fill because we can also see them light up on GeForce Experience, which helps us again to concentrate on where is the excitement in the market for gaming going forward. So the growth that we have seen has been a seamless execution of moving from Maxwell to build up in terms of what we have in Pascal.

I know we don't talk about it a lot. But that's a lot of 20 years of hard work to make sure we can manage that very, very effectively both for our channel partners that they

can see through nicely at the end of Maxwell and the beginning of Pascal.

John Pitzer {BIO 1541792 <GO>}

And when you say that Pascal is one of the largest performance improvements you've seen generation to generation, can I replace that with ASP improvement as well as those two things kind of track hand in hand?

Colette Kress {BIO 18297352 <GO>}

I think we're in the early stages of Pascal. We're probably about four, four and half months into what we're seeing in terms of the sales there. So I think it's a little bit early to say, have we seen a significant improvement more than what we saw in terms of Maxwell or the other generations. But yes, average ASP so far has been a driver of that growth, has been a factor -- a large factor of the growth as well.

John Pitzer {BIO 1541792 <GO>}

Then another element of driving the gaming business in the October quarter albeit smaller was the Tegra side of the business with the Nintendo Switch. How do we think about kind of the initial builds for that and how should we think about modeling that over the next three to four quarters?

Colette Kress {BIO 18297352 <GO>}

Yes. So our relationship with Nintendo we can be more pleased about. This was an opportunity to meet all of our key specifications of being inside a console. As much as we love those overall console markets, we are focused on high-performance. We are focused on a relationship where they can appreciate the underlying value of the GPUs that we put through or in this case the SoC. Number two, which will be really important is for us to work on that relationship, we know that it is semi-custom and we need to have engineers 100% focused on making sure Nintendo's product is great.

And we have done that and we have been working on that for some time for them to be ready for the upcoming launch. Then number three, the business model was very important to us that they appreciated the value of what we are producing and that could be a win-win situation for both Nintendo as well as NVIDIA. So I can't be here to announce the numbers because it's Nintendo's great product, it's a great product, it looks really cool and we hope greater success for them. But yes, we are working on ceding those SoCs for their upcoming launch.

John Pitzer {BIO 1541792 <GO>}

The other question I get from gaming from a growth perspective longer term is the impact of AR and VR. I'm kind of curious from your perspective, do you guys look at this as a separate sub-category within gaming or do you look it as an application that continues along this path of higher ASPs over time?

Colette Kress {BIO 18297352 <GO>}

Correct. I think we would look at AR and VR as essentially the next generation of gaming. Gaming today is more of a two dimensional, yourself with the overall screen. As we move to the importance of virtual reality. We thought that it's getting more and more realistic. And you can take on a different character in terms of where you stand within the game.

Hard work has been done for many years now to improve the overall technical capabilities to allow VR and AR. What you need is you need that performance, the ability for it to render at a speed that it is a pleasant experience from a virtual reality. I think we're in the early stages of virtual reality. But we've gotten to a point where it's a great experience with the opportunity to both increase the overall content now that the underlying hardware is capable, as well as to probably improve the overall form factor of VR so it can be in the hands of many.

We have focused our platform on enabling VR on a couple of ways. You'll see almost all of our Pascal cards that come out are essentially VR ready. And we know there is a likelihood, if you're going to come and buy a card, it's going to be a factor in your mind that says, wait, am I buying this so I will be able to do VR at a later point. That doesn't mean that they're going to be spending 100% of their time on VR. But even if they're going to spend 10% to 20% of their time on both new games for VR and old, they want to be ready and that's a factor in the types of cards that we believe that they're choosing today. So no, it's not a separate category. I think it is an extension of where that next wave of gaming will go.

John Pitzer {BIO 1541792 <GO>}

And my last question on the gaming front is just on the competitive side. You guys have done a great job over the last several years, taking share in the marketplace. But you see AMD, your largest competitor coming back into the market this year with Polaris. They've done a roadmap for Vega next year. If you look at the third-party data, they actually on a unit basis took some share back earlier in the year; hard to find out on a dollar basis or a profit basis. So how do you think about the competitive market with AMD coming back in with new product?

Colette Kress {BIO 18297352 <GO>}

So AMD and NVIDIA are two firms that have been together for quite some time. We however took a different approach, probably about five years ago. We are not here to be a component and inside of some type of PCs. We have taken a hold of determining what that end customer, what that gamer is looking for and we use our OEMs to help us see that market. So right now, I think we have established a very high performance level for what we think is the type of gaming that people want to do. And I think we're initially seeing that being well received.

I think they've got some ways to go. But I think we're excited to be running around the track with somebody else. I think it makes you run harder. I think it's more fun.

John Pitzer {BIO 1541792 <GO>}

Perfect, switching gears to data center. 10% to 15% of the business today, tremendous growth story. If you go back over the last three years, you've gone from a $200 million annual run rate to now a $1 billion annual run rate. Can you help the audience sort of understand to what extent is this being driven by better penetration within the supercomputer HPC market versus new workloads especially around AI?

Colette Kress {BIO 18297352 <GO>}

So I think it's good for us to kind of introduce what's in our data center business. It seems very -- kind of simple to talk about. But there's actually quite a bit of complexity in different areas in there. We exactly have about five different markets with -- inside the data center business. You spoke about the overall high-performance computing market, that has been an area that we've been focused on for more than 10 to 12 different years in terms of growing that business. Those are areas, where mathematical computations need to be completed that are well known. But using an accelerator such as a GPU, taking workloads off of the CPU and travel through the GPU can speed up those workloads.

You can think about many large data center would benefit from getting the work done faster. So most of the largest supercomputers in the world and the Top 10 applications in high-performance computing are now using accelerated computing using GPUs. And that continues to be a very important growth market for us and is growing quite well. But that has expanded us into some other markets. The second one that we talk about is actually a GRID, which is our virtualization.

That is a case, where you want to leverage in the VDI environment, the use of a GPU. So instead of a one-to-one relationship between yourself and the overall PC, we've a one-to-many to where the GPU is in a cloud environment, if you're interested in streaming down your application, streaming down your overall compute, we now have the capability with the software layer to virtualize that GPU for that experience. That makes up approximately about 10% to 15% of our business in that space.

We've been working tremendously with Citrix and VMware and others to continue to build out that market because we significantly improve the user interface. So that breaks down to what is the rest, what is really some of the fastest growing pieces in there and that's our three types of areas of artificial intelligence. This is first started off after many years of working with many of the high-end hyperscale's around the world. Now, why and why would the hyperscale's be focused on this? They have a significant amount of data. They have a significant amount of data of all different form factors running through the networks. And what they're trying to do for us is to make the applications that they provide us to work better. These are things such as search, these are things in terms of image deduction, this is things in terms of video transcoding. These types of things are very important to us.

As you've noticed, your search command seems to be getting smarter. But the reality is there's artificial intelligence behind the scene. The GPU has been uniquely

positioned and available to expand the use of artificial intelligence with frameworks referred to as deep learning frameworks. Those deep learning frameworks are frameworks working with (inaudible) is allowed to take a significant hundreds of millions of data points and infer what the answer is. Different from high-performance computing, do you know the answer? This is after significant amount of data, the actual accuracy of that information will be better.

So the hyperscale's have been moving to when you speak into your phone, better battery performance in terms of translating your information and returning back in millisecond in terms of what you need in terms of response. Those works have gone application by application, workload by workload in the hyperscale's. We've continued to advance to almost every single or if not all hyperscale's on the planet in terms of working with them in this environment of AI.

Number two, the hyperscale's are also working for availability of AI to the masses. As we know, we are now in the evolution of cloud computing and the importance of being able to just go online and get a cloud instance, one that is generated with the GPU behind that. So we now have whether you can use the GPU for computing, our researcher wanting to do AI can go up to AWS, Microsoft, Google and others to overall do that. That's another key growth area of AI.

And the number three, as we continue to expand out to different industries. And we extend out into many of the parts of the enterprise. And a process with large sets of data, you can now buy a supercomputer, AI supercomputer for us called DGX-1. It comes with eight GPUs, comes fully enclosed with all of the storage, all the memory as well as a development layer and a software layer. We plug it in and we get started in terms of our AI. So those are our five different businesses in terms of data center.

John Pitzer {BIO 1541792 <GO>}

Drilling down the AI, I think one of the things that everyone in this room is struggling with is trying to quantify the market opportunity over time. I have a couple of questions along those factors. First, how do we think about AI with the GPU versus an FPGA versus an ASIC accelerator. Do you feel as this GPU is suitable IP to attract the entire AI market. When do we think about the architectural differences between using a GPU, FPGA and ASIC to do that AI computation?

Colette Kress {BIO 18297352 <GO>}

Sure. We have been uniquely positioned for some of the initial and continue to work in artificial intelligence, mainly because of the work that was done on deep learning. And creating deepening frameworks.

The overall use of a GPU has been well positioned because of its overall programmability, the openness of accepting every single one of those different frameworks that is out there. (inaudible) we will work with them. We've continued to not just focus on the underlying hardware in that case, which remember to do AI, we're talking about a significant amount of data, a significant amount of processing

and a significant amount of processing that needs to happen at the same time in a parallel standpoint for it to be effective. Waiting a week for the information or answer to come back. So that you could tweak it to get to even a better answer is not an overall value-added process. So the GPU is uniquely situated in those cases. There are and there will be other different form factors. I do believe AI computing is an evolution that will probably be with us for the next 10 years to 20 years. And there will be many different form factors through that. But it doesn't mean they can all perform the same type of work.

John Pitzer {BIO 1541792 <GO>}

One of the ways -- I don't know if this is correct or not. I would like to get your opinion. But there seems to be a perception out there that there is two parts of the AI market. There is a training and there's the inference. And for training, a GPU is particularly well suited. We're still very early in the training market. But people are concerned as you move to inference that perhaps you don't need as the high performance chip and people will move to a different sort of architecture. One is that's too simplistic and two, as the world moves from training to inference, will you have sort of product available that's sort of optimized for that inference market as well.

Colette Kress {BIO 18297352 <GO>}

I think that's a good place to start. Let's say for training, we're not exactly seeing anybody use anything else but a GPU, just because of a significant amount of performance that's necessary. Even if we move to inference, there is a continued set of cards, chips, whatever that we're putting together to enable the consistency from the training environment, the algorithms that are there to the overall inferencing process. But inferencing is going to be wide and broad.

You can be doing inference using your refrigerator, using your thermostat. That is probably going to be a small, watered, very simple functioning type of AI device. That's not necessarily something I agree that you would necessarily need a GPU. But that's not what we're going to concentrate on. There is a significant amount of benefit that we've already seen in terms of an inference using the GPU in terms of the speed in terms of that piece of confirming your overall training environment that you've done as well.

You've already seen us come out with the P4 and the P40 as well. Much, much smaller, small size fitting into existing architectures, allowing you to scale out, scale up and providing that even at energy efficient type of use. So we all approach that. But it wouldn't surprise us if there is different types of pieces along there. But it's going to be probably a sizable market for all. But we'll continue to do our expertise of bringing the computing platform together for that.

John Pitzer {BIO 1541792 <GO>}

Do you have any questions from the audience?

Questions And Answers

Q - Unidentified Participant

(inaudible) some of the markets that you have been attacking. So some of the applications actually flow back to Intel?

A - John Pitzer {BIO 1541792 <GO>}

Just for people on the webcast, the question was just how do you view Intel Xeon Phi or Nirvana acquisition relative to the competitive front?

A - Colette Kress {BIO 18297352 <GO>}

Yes. So lots of different types of competition there. I think it's important to note that even though it may be referred to as an FPGA versus GPU, they are not the same. There can be very likeness on that. But GPUs performance level is tremendously different than anything that we have seen FPGAs have been around long time as well. And not necessarily the growth. We don't have a case that we know that FPGAs are being used in the deep learning training types of environments. It is actually challenging to think about designing on an FPGA or reconfiguring on an FPGA. So Intel is probably working on many different types of strategies. You see them with Xeon Phi, you see them with FPGAs, you see them with different acquisitions and all things that are referred to as coming soon. We're here focusing today. We're here focusing today because the customers are here today.

We're focused on not trying to determine what type of hardware because we know that. We're here to focus on that infrastructure development work that needs to be for each of these different markets. We have been working with the ecosystem building out the libraries, building on top of the frameworks and assisting the speed at which AI wants to go and not with we're focused. Again they have the capabilities I'm sure to do that. But we just haven't seen them develop a cohesive piece together that can serve some of the most important areas that we see that are significant today.

A - John Pitzer {BIO 1541792 <GO>}

With that, we run out of time in this session. But I wanted to thank Colette for joining us, I really appreciate your time. Appreciate everyone in the room coming to join us. Thank you.

A - Colette Kress {BIO 18297352 <GO>}

Thank you.