

Company Name: Nvidia
Company Ticker: NVDA US
Date: 2018-11-15
Event Description: Q3 2019 Earnings Call

Market Cap: 90,938.80
Current PX: 149.08
YTD Change(\$): -44.42
YTD Change(%): -22.956

Bloomberg Estimates - EPS
Current Quarter: 1.410
Current Year: 7.265
Bloomberg Estimates - Sales
Current Quarter: 3401.759
Current Year: 12957.059

Q3 2019 Earnings Call

Company Participants

- Simona Jankowski
- Colette M. Kress
- Jen-Hsun Huang

Other Participants

- Harlan Sur
- Toshiya Hari
- Vivek Arya
- C. J. Muse
- Stacy Aaron Rasgon
- Joseph Moore
- Pierre C. Ferragu
- Mark Lipacis
- Aaron Rakers
- Chris Caso
- William Stein
- Craig Ellis

MANAGEMENT DISCUSSION SECTION

Simona Jankowski

Financial Measures

During this call, we will discuss non-GAAP financial measures

You can find a reconciliation of these non-GAAP financial measures to GAAP financial measures in our CFO Commentary, which is posted on our website

Colette M. Kress

Financial and Operating Performance

Revenue Contributors

- Q3 revenue reached \$3.18B, up 21% from a year earlier with all four of our market platforms growing double digits:
 - Datacenter
 - Professional Visualization
 - And Automotive

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- All hit record levels

Channel Inventory

- However, gaming was short of expectations as post-crypto channel inventory took longer than expected to sell through
- Gaming card prices, which were elevated following the sharp crypto fall-off, took longer than expected to normalize
- Our Q4 outlook for gaming reflects very little shipment in the mid-range Pascal segment to allow channel inventory to normalize
- In Q4, we also expect minimal sales of Tegra chips for game consoles due to the normal seasonal build cycle

Long-Term Fundamentals

- While channel inventory situation presents a near-term headwind, it does not change our long-term fundamentals
- Our competitive position is as strong as ever, and we have expanded our addressable market with Turing and our recent software announcements
- We remain excited about the growth opportunities in ray-trace gaming, rendering, high-performance computing, AI, and self-driving cars

Gross Margins and Net Income

- GAAP gross margins grew 90BPS year-on-year and non-GAAP gross margins rose 130BPS
- This reflects our continued shift toward higher value platforms, but also included \$57mm charge for prior architecture components and chips following the sharp fall-off of crypto mining demand
- Both GAAP and non-GAAP net income exceeded \$1B for the fourth consecutive quarter

GPU Revenue

- From a reporting segment perspective, GPU revenue grew 25% from a year ago to \$2.77B
- Tegra processor revenue was down 3% to \$407mm

Gaming Business

- Let's continue with our gaming business
- Revenue of \$1.76B was up 13% year-on-year and down 2% sequentially
- Year-on-year growth was driven by initial sales of our new Turing-based GPUs, as well as strong notebook sales, which more than offset gaming console declines
- In mid-September, we began shipping GeForce RTX series, the first gaming GPUs based on our Turing architecture

Turing RTX Technology

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- Turing RTX technology delivers up to 2x the performance of its predecessor Pascal and 6x more for ray-traced graphics
- These are the biggest generational gems we have ever delivered in gaming GPUs
- The first two GeForce RTX gaming cards to hit the shelves were the 2080 Ti and the 2080, delivering 4K HDR gaming and 60 frames per second on even the most advanced AAA titles, a major milestone for gamers
 - This is quickly becoming the new performance baseline as 4K displays are now reaching affordable price points
- These two high-end cards were quickly followed by the rollout of the GeForce 27D
- NVIDIA RTX technology brings games to life like never before
- The highly anticipated Battlefield V launched this week with the first release of RTX ray tracing, enabling lifelike reflections on GeForce RTX GPUs
- With a pipeline of upcoming games supporting NVIDIA RTX features, RTX is well on its way to establishing itself as a game-changing architecture
- Although the cryptocurrency wave has ended, the channel has taken longer than expected to normalize

Pascal High-End Cards

- Pascal high-end cards have largely sold through ahead of RTX
 - However, on midrange Pascal gaming cards, both channel prices and inventory levels remained higher than expected
- Pascal is well positioned as the GPU of choice in the midrange for the holidays, and we expect to work down channel inventories over the next quarter or two

Datacenter Business

- Moving to datacenter
- We had another strong quarter with revenue of \$792mm, up 58% year-on-year and up 4%, sequentially

Turing T4 Cloud GPU

- Demand remained strong for Volta architecture products, including Tesla V100 and DGX systems, and our inference business continued to grow, benefiting from the launch of the Turing T4 Cloud GPU during the quarter
- Just two months after its launch, the T4 has received the fastest adoption of any server GPU
- It is integrated into 57 server designs, and it is already on the Google Cloud Platform, its first cloud availability
 - The T4 delivers world record performance for deep learning inference and accelerates diverse cloud workloads, including high-performance computing, deep learning training and inference, machine learning, data analytics, and graphics

New Software Platforms

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- We also announced an updated TensorRT software stack and NVIDIA TensorRT Hyperscale Platform (sic) [Hyperscale Inference Platform]
- This new software includes two critically important capabilities that can drive deployment of the NVIDIA Inference Platform at scale in hyperscale datacenters:
 - First, it enables multiple models and multiple frameworks to run on the same GPU at the same time
 - This can drive higher datacenter utilization directly translating to significant savings
 - Second, it integrates with Kubernetes, the leading orchestration layer for hyperscale datacenters
- Completing our Inference Platform, the new T4 GPU delivers 12x, the peak inference performance of its T4 predecessor
- All told, our Inference Platform delivers 40x faster performance in CPUs and with the TensorRT software stack; it is ideally suited for hyperscale datacenters
 - With this launch, NVIDIA is poised to take the datacenter inference market targeting every server node in the hyperscale datacenters

NVIDIA RTX Server Reference Architecture

- Another important launch for the quarter was the NVIDIA RTX Server reference architecture, which incorporates up to eight Turing-based RTX 8000
 - With this product, Turing opens a new market to GPOs, photoreal rendering or the creation of computer-generated images that look real
- Rendering is instrumental to large industries, such as media and entertainment, retail, product designs, manufacturing, and architecture
 - Yet prior to Turing and its ray tracing capabilities, GPUs were not able to address this workload, so most rendering end – up to this point has been done on CPUs
- An RTX accelerated render farm compared with an equivalent performance CPU render farm is one-fourth the cost, one-tenth the space, and one-eleventh the power
- NVIDIA's RTX platform has garnered major industry support, including from key developers such as Adobe, ANSYS, Autodesk, Dassault, and many others

RAPIDS

- Lastly, NVIDIA announced a GPU-acceleration platform for data science and machine learning called RAPIDS, which enables companies to analyze massive amounts of data and make accurate business predictions at unprecedented speed
- Up until now data analytics and machine learning has been the largest high-performance computing applications not to have been accelerated
- Virtually all enterprise use data analytics to extract insight from big data for a wide range of use cases, such as predicting credit card fraud, forecasting retail inventory, and understanding customer buying behavior
- RAPIDS is an open-source suite of libraries for GPU-accelerated analytics, machine learning, and soon, data visualization

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- With RAPIDS, NVIDIA GPUs can now accelerate machine learning as we have done with deep learning with performance up to 50x faster than CPUs

Major Clients

- The RAPIDS' launch opens up \$20B server market used for data analytics and machine learning workloads to GPUs, and it's received broad industry support, including from:
 - Oracle
 - IBM
 - SAP
 - Dell EMC
 - Hewlett Packard Enterprise
 - Microsoft Azure Machine Learning
 - Google
 - Q-Flow
 - As well as the open-source community

One Unified Architecture and Ecosystem

- With one unified architecture and ecosystem, NVIDIA GPUs can address the redefined high-performance computing market, including scientific computing, deep learning, and machine learning
- Our GPUs and software stack accelerate a broad and diverse set of workloads ranging from scale-up software in supercomputers to scale-out deployments in hyperscale datacenters
- Just earlier this week this capability was on display at Supercomputing Conference in Dallas, where the number of systems on the TOP500 supercomputer list using NVIDIA GPUs jumped 48% from last year, including the number one and number two systems in the world

Pro Visualization Business

- Moving to pro visualization
- Revenue reached a record \$305mm, up 28% vs. the prior year and up 9%, sequentially
- Strength extended across the desktop and mobile, as well as several key industries, including the:
 - Public sector
 - Manufacturing and architecture
 - Engineering and construction
- At SIGGRAPH, in August, we announced our Quadro RTX 8000, 6000 and 5000 GPUs based on the Turing architecture
- And earlier this week, we introduced the Quadro RTX 4000, the most advanced professional GPU priced under \$1,000

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- These GPUs will revolutionize the work of 50mm designers and artists by enabling them to render photorealistic scenes in real time and leveraging AI in their workflows
- The Quadro RTX series started shipping in Q3 with the server-grade, high-end products recognized in datacenter
- We already engaged with a range of customers on RTX, including the major movie studios and game developers, and their reaction has been very positive

Automotive Business

- Finally turning to Automotive
- Automotive sales in Q3 reached \$172mm, up 19% from a year ago and up 7%, sequentially
 - This reflects growth in our autonomous vehicle production and development engagement in addition to the ramp of next-generation AI-based cockpit infotainment systems

Next-Generation Volvo Cars

- At GTC Europe, we announced that Volvo Cars selected NVIDIA's DRIVE AGX Xavier next-generation – for next-generation Volvo Cars
- The initial production release slated for the early 2020s will deliver Level-2-plus assisted driving features, integrating 360-degree surround perception and a driver monitoring system
 - This is our first Level-2 mass-market car design win
- In addition to Volvo, global automotive suppliers Continental and Veoneer announced that they have selected NVIDIA DRIVE AGX for their autonomous driving systems

DRIVE AGX Xavier Development Kit

- Lastly, our DRIVE AGX Xavier development kit (sic) [developer kit] started shipping in this quarter
 - This is the world's first autonomous driving platform, and it can run our NVIDIA DRIVE software for autonomous driving, including data collection, 360-degree surround perception, advanced driver monitoring, and in-vehicle visualization
- With this platform customers have developed and test their autonomous driving solutions and then easily move into production
- We are excited about the AV opportunity as we look into next year and beyond

Gross Margins and OpEx

- Moving to the rest of the P&L and the balance sheet
- Q3 gross margins was 60.4% and non-GAAP was 61%, below our outlook due to the \$57mm charge for prior architecture components and chips following the sharp fall-off in crypto demand
- GAAP operating expenses were \$863mm and non-GAAP operating expenses were \$730mm, up 28% year-on-year
- We continue to invest in the key platforms driving our long-term growth, including gaming, Datacenter and Automotive

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Net Income and EPS

- GAAP net income was \$1.23B and EPS was \$1.97, up 48% from a year earlier
- GAAP net income benefited from the reduction of \$138mm in our U.S. tax reform transition tax amount, as well as other discrete tax items
- Non-GAAP net income was \$1.15B and EPS was \$1.84, up 38% from a year ago, reflecting revenue growth and gross margin expansion as well as lower income tax expense

Balance Sheet and Cash Flow Summary

- Accounts receivable was \$2.22B compared to \$1.66B in the prior quarter as Turing RTX shipments began in the latter part of the quarter
- Inventory at the end of the quarter was \$1.42B, compared to \$1.09B in the prior quarter reflecting the ramp in production of Turing products
- Quarterly cash flow from operations was \$487mm
- CapExs were \$150mm
 - This FY we have returned \$1.13B to shareholders through the end of Q3

Dividend Announcement

- We've announced the \$0.01 increase in our quarterly dividend to \$0.16 effective in Q4 of FY2019
- We are also pleased to announce an increase of \$7B to our share repurchase authorization, and that we intend to return an additional \$3B to shareholders by the end of FY2020

Q4 FY2019 Outlook

With that, let me turn to the outlook for Q4 FY2019

As noted earlier, our revenue outlook is impacted by the expected work-down of Pascal mid-range gaming card inventory in the channel

- In addition, we expect a decline in our gaming console revenue given seasonal build patterns

Keep in mind that the mid-range desktop portfolio is typically about one-third of our gaming business

Our outlook assumes that channel inventory weeks approach normal levels exiting Q4 and that gaming and demand increases in Q4 compared with Q3

Financial Guidance

- Now in total, we expect:
 - Revenue to be \$2.7B, +/- 2%
 - GAAP and non-GAAP gross margins are expected to be 62.3% and 62.5%, respectively, +/- 50BPS
 - GAAP and non-GAAP operating expenses are expected to be approximately \$915mm and \$755mm, respectively
 - GAAP and non-GAAP OI&E are both expected to be income of \$21mm

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- GAAP and non-GAAP tax rates are both expected to be 8%, +/- 1%, excluding discrete items
- CapExs are expected to be approximately \$190mm to \$210mm
- Further financial details are included in the CFO Commentary and other information available on our IR website

Upcoming Events

In closing, I'd like to highlight some upcoming events for the financial community

We'll be presenting at:

- The Barclays Global Technology, Media and Telecommunications Conference on December 6
- And we will be meeting with the financial community at the Consumer Electronics Show in Las Vegas from January 8 through 11
- And our next earnings call to discuss our financial results for Q4 FY2019 will take place on February 14

Jen-Hsun Huang

Closing Comments

To sum up, the crypto hangover has left the industry with excess inventory – excess channel inventory

It will take one or two quarters to work through it

This is an unexpected near-term setback and doesn't change the fundamental dynamics of our company

The end of Moore's law has cleared a way for NVIDIA accelerated computing as a great path forward

Turing opens up three exciting markets for us with ray tracing games, film rendering, and hyperscale inference

- And with our first win in mainstream Level-2 self-driving cars with Volvo, our DRIVE AV platform is gearing up for the mass market and our competitive position has never been stronger

We'll look forward to updating you on our progress

QUESTION AND ANSWER SECTION

<Q - Harlan Sur>: Within your guidance for the January quarter, is the team anticipating continued sequential growth in your Datacenter business? There seems to be some concern around a near-term slowdown in cloud spending. But on the flip side, we're hearing that the NVIDIA team is actually seeing pretty strong demand near-term from some of your China cloud customers for your Tesla-based products. So just wanted to get your views on cloud datacenter dynamics and the trajectory into the January quarter. Thank you.

<A - Jen-Hsun Huang>: Yeah. We expect to continue to do well in datacenters. If you look at the background of what's happening, we know that Moore's law has ended. And while demand for computing continues to grow and more and more the datacenter is running machine learning algorithms, which is computational and really intensive, the only way to increase computational demand or computational resource is to buy more computers, buy more CPUs because each one of those CPUs aren't getting much faster. And so as a result of that, the datacenter CapEx would have to go up.

The alternative, which is the alternative that we offer and was one of the reasons why the adoption of NVIDIA's accelerated computing platform is growing so fast is because the approach that we provide allows for a path forward

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beyond Moore's law.

There are several things that we have done this last quarter that I think is really fantastic. The first is the introduction of a new computing platform, new accelerated platform called RAPIDS. And as you know very well that the vast majority of the industry today, although are super-excited about deep learning, deep learning as a method for artificial intelligence is very data intensive.

And in areas where there's a lot of domain expertise where there is – whether it's in retail or whether it's in financial services or healthcare, logistics there's a fair amount of domain expertise and the amount of data that they have to fuse together to train a model is quite high. The approach using traditional machine learning is quite successful.

That has never been accelerated before. And we worked with the open-source community over the course of the last several years to pull together an entire stack that starts from Apache Arrow, the Dask parallel and distributed computing engine, and then all of our CUDA and all of our algorithms that run on top of that, we now have an accelerated machine learning platform. That's a brand-new platform and the excitement around that is really quite incredible.

The second thing is the Turing architecture allows us to do film rendering at a much, much more affordable way than Moore's law would have allowed.

And then the third, which we just announced recently, is our first Turing-based T4 Cloud GPU. And along with all of the software stack that we've put on top of it, Kubernetes, the Docker, the TRT Inference engine, our second-generation Tensor Core AI accelerator, all of that together has created a lot of excitement in datacenter. So I'm expecting our Datacenter business to be – to continue to do quite well.

<Q - Harlan Sur>: Great. Thanks for that. And then just on the high-end Turing products that the team started rolling out in October, early demand actually seems to be quite strong. And I think part of it is just the lineup of AAA-rated games, esports continued strong as well; obviously, big motivator for your enthusiast-class gamers. I know the team is near term kind of working down mid-range Pascal cards, but do you anticipate your Turing-based RTX product families to drive sequential growth in the January quarter just what appears to be pretty strong demand pull for these products?

<A - Jen-Hsun Huang>: Yeah. The Turing launch happened towards the end of the quarter, and it's the biggest generational leap we've ever had. It introduced real-time ray tracing. It's the first GPU to – gaming GPU to include artificial intelligence. At every single price point it serves, it is substantially higher performance than the last and it's the highest performance GPU in the world, and all the great content are coming.

Today I think it is or yesterday I think it was, the Battlefield V was released with real-time ray tracing, the world's first application to support real-time ray tracing. So, we expect Turing to do really well. As we go on surely we'll bring Turing deeper into the mainstream. And so we don't have anything to announce today, but as usual we want to bring a brand new architecture to as many gamers as possible.

<Q - Toshiya Hari>: I had a question on the gaming outlook and as it relates to channel inventory. Colette, you mentioned that typically the mid-range is about a third of gaming. How much was it in the October quarter? And are you effectively assuming close to zero in the January quarter? And related to that, I think with your game console business, you – I'm estimating you did something around \$200mm to \$250mm in October. Again, is that coming down pretty hard into January? Thank you.

<A - Colette M. Kress>: Yeah. So I commented about the overall size of what we have traditionally seen in terms of the mid-range over a fairly large period of time because keep in mind the launches of products quarter-to-quarter have changed that. So it has been about a third consistently over, let's say, about a quarter period of time. And we think that's a good number for you to use as we look at our guidance in terms of Q4.

From an overall console perspective, we again have seen about in the hundreds and sometimes more than that in prior quarters. What we're seeing is just a normal where they build ahead of the holidays in Q3 and that slows down as we move into Q4 when we're in the middle of the holidays.

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<Q - Toshiya Hari>: Great. And then as a follow-up, you saw nice acceleration in growth in your ProVis business this quarter. Jensen, I think you've talked extensively about the RTX and the long-term opportunity there. What are your expectations going into 2019 for that segment? Thank you.

<A - Jen-Hsun Huang>: I expect ProVis to grow. The ProVis platform – there's more content ever – being created that is digitally created, and most photographs – what appears to be photographs are rendered in software. Almost every catalogue, every video, every movie, every TV show now has a great deal of digital rendering in it.

And until now it's not been possible to do the rendering in an accelerated way. So RTX is the world's first accelerated ray tracing GPU. And the enthusiasm from the digital content creation market is really, really great. I surely expect that – and as I was mentioning earlier that it's been close to a decade that the workstation industry has not had a fundamental platform architecture change. And so RTX is the first one. So I'm expecting ProVis to do really well.

<Q - Vivek Arya>: I'm curious, Jensen, what needs to happen to work down this mid-range Pascal inventory? Is it pricing? Is it something else? Because the thinking was that this could be cleared within the October quarter, but it hasn't. Do you think people were waiting for Turing to come out and maybe that created some kind of pause? And then as part of – part B of that question maybe, Colette, how should we think about seasonality in the April quarter given that you mentioned it could take one or two quarters to work down this inventory? Thank you.

<A - Jen-Hsun Huang>: Yeah. The – well, we came in to Q3 with excess channel inventory post the crypto hangover. We expected the pricing in the marketplace to decline. It declined slower than we expected. But while it was declining, we were expecting sales volume to grow, demand to grow, and for pricing to be – for volume to be elastic with pricing.

I think it just took longer than – the pricing took longer than we expected and the volume increase took longer than we expected. At this point, most of the pricing has come down to its – and slightly below its prelaunch levels.

And so, I'm hoping that – I'm hopeful that now that pricing has stabilized, that customers will come back and buy. I guess when pricing is volatile in the channel, it probably freezes some people waiting for prices to stabilize. And that took longer than we expected, frankly. But now that it's at the right levels, our expectation is that the market will return to normal.

GeForce GTX 1060 is the number 1 selling graphics card in the world, and we decided not to sell anymore into the channel for the upcoming quarter to give the channel an opportunity to sell through the inventory it has. And so, we'll keep our eyes on it. But our expectation is that inventory levels will come back to normal by the end of the quarter.

<A - Colette M. Kress>: Okay. And, Vivek, to answer your question also regarding Q1 in terms of what we're going to see in terms of the expectation. As the channel inventory normalizes at the end of Q4, we do believe going into Q1, we will be probably up from where we end in terms of Q4. So we won't follow that normal seasonality between Q1 and Q4. We do expect to be up as we go into Q1.

<Q - C. J. Muse>: I guess a follow-up question on the channel inventory side. It looks like it's roughly \$600mm kind of a draw-down here. And just curious, does that sound right, number one? Number two, does that fit with what you are hearing from your channel partners in terms of what's excess? And then as part of that, are you drawing down inventory in the current quarter ahead of Turing architecture launch into the mainstream?

<A - Jen-Hsun Huang>: The last question I'm not sure I understand. I think the answer to your first question is yes. You framed it nicely. It's – the answer is yes. The last question was what again?

<A - Colette M. Kress>: The last question was regarding our mid-range. Is there any statement about future Turing products that were taken into account?

<A - Jen-Hsun Huang>: Yeah. We haven't announced our future Turing product. But it would be expected for us to create a Turing GPU that serves the mainstream parts of the marketplace. And so we're not announcing anything, but it would be conventional of us to do that.

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<Q - C. J. Muse>: I guess the question was whether you were drawing down inventory, perhaps below normalized levels in the current quarter.

<A - Jen-Hsun Huang>: No. We're really not shipping into the mid-range segment of Pascal so that we give the channel an opportunity to sell through the product it has. And we would like to see channel inventory get normalized by the end of Q4, and then we'll get back to doing our work.

<Q - Stacy Aaron Rasgon>: My first one is for Colette. I just wanted to be a little more explicit. If I think about your business, split into sort of gaming and non-gaming, are you looking for the non-gaming pieces in aggregate to grow sequentially into Q4?

<A - Colette M. Kress>: Stacy, yes. I think the answer to that is yes. In aggregate, yes, we do believe the rest of the business will grow sequentially.

<Q - Stacy Aaron Rasgon>: Then I guess that fits with the kind of one-third you're talking about, because that implies the gaming down 30%-plus so that is what your kind of the magnitude that you're thinking about at this point.?

<A - Colette M. Kress>: That is correct.

<Q - Stacy Aaron Rasgon>: Got it. Thank you. For my second question, I just wanted to – for the last several quarters, the idea that the channel could be getting full is not necessarily a new worry. And yet the last several quarters you've been saying, like, on this call that you guys felt like you had a really good handle on the channel and yet it seems like maybe that wasn't exactly the case. Can you give us a feeling, maybe a better feeling for what changed and when you saw it in the quarter? Was this something that happened kind of like late in the quarter that you realized it? Or did you go into the quarter knowing that the inventories were high and needed to be corrected? Like, what happened, because this tone is a little different from what we've heard over the last few earnings calls from you?

<A - Jen-Hsun Huang>: Let's see. We were surprised, obviously. I mean, we're surprised by it as anybody else. The crypto hangover lasted longer than we expected. Prices started to drift down and we expected to come down much more quickly than it did. And but – and when it went down, we expected demand to come up much more quickly than it did. And so, I think, the channel wanted to protect its price. People were uncertain about crypto and demand was uncertain about when the price will be stabilized and so all of that uncertainty, I think froze the market a little longer than we expected. Pricing is now down to below pre-launch normal levels. And so I'm hopeful that we're going to see demand come back and the sell-through will happen through the holidays. And we're seeing that, and so that's – the first one is we just – we didn't expect it either, and we didn't realize the magnitude of it until towards the end of the quarter.

<Q - Joseph Moore>: With regards to Turing ramp, I guess, how is that going relative to your expectations? It seems like availability is quite a bit better now. And where do you stand with DLSS support? I know you've announced a number of games that will have DLSS support by year-end, but how many of those are already supporting that technology?

<A - Jen-Hsun Huang>: Yeah. The ramp is going great. I think this is the biggest generational leap we've ever had. This is the most substantial new technology that computer graphics has seen in a decade. Real-time ray tracing is something that everybody had dreamed about for a long time. It's never seen before. And today with Battlefield V people are enjoying real-time ray tracing for the very, very first time. And the images are beautiful. So the ramp is great.

Of course, Turing went into – towards the end of the quarter and into a much more different situation than any GPU of the past. But nonetheless, the demand on the high-end products are fantastic. The 2080 Tis are largely sold out. I think it's still sold out everywhere. And so I think that the demand is great. I'm expecting it to be just a fantastic new generation.

In terms of the content, you saw the first one. Final Fantasy is also out. And we have a pipeline, about 30 of them we're working hard on that. And so when these games get released, RTX will be enabled.

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But I will say one last thing, which is content aside, RTX is higher performing at the same price point than any graphics card on the planet. And so at every single graphics – every single price point, it is the highest performing graphics card. So, it is unambiguously the highest performance GPU in the world, and then – and of course, all of these great new features will be coming.

<Q - Pierre C. Ferragu>: I'm still trying to put my head around the magnitude of this channel inventory drawdown, because if you don't ship like the mid-range cards for a full quarter that means your inventory today is more than a quarter or more than 12 weeks of sales. And so my first question would be, am I right thinking that? Are you available the full quarter of sales in inventories?

And then my second question is, while you are drawing down these inventories, I would not expected to see, like, the Turing high-end card, the 2080 and the 2080 Ti ramping in Q4. And it looks like excluding the inventory the rest of the business – the rest of the GPU business and gaming will be more like flattish sequentially.

<A - Jen-Hsun Huang>: I'm trying to figure out what the first part of the question was.

<A - Simona Jankowski>: The first question was whether the mid-range of Pascal had more than 12 weeks of inventory, if it's going to take more than a quarter to bring it down.

<A - Jen-Hsun Huang>: I think the channel has more than 12 weeks of inventory between us and the other brand. One of the things that is hard to estimate is how much inventory the other brands have. And our quarter is one month later and so whatever action we take, whatever we see in the channel is one month after their end of the quarter.

The amount of inventory is not just us, it's also the other brands. And our ability to see the other brand's inventory is just much harder. We try our best to estimate it, but obviously we didn't estimate it well enough. And so the answer to your question is yes, I think there's about – from our perspective, about 12 weeks of our inventory to sell through at this point.

<Q - Mark Lipacis>: Thanks for taking my question. I was hoping you could contrast this product cycle transition to Turing to the product transition you had to Pascal. And is the only or is the main difference the crypto hangover, or is there something else impacting the transition do you think? I mean, you've described Turing as the greatest generational leap and I'm wondering if that larger delta has an impact to the transition as well. Thanks.

<A - Jen-Hsun Huang>: Turing is the highest performance GPU at every single price point. And so it played no role in transition. It's all about crypto hangover. This is the new experience as we made this transition.

If you look at Turing on – just on the basis of Turing, it had a great launch. We ramped it at the end of the quarter as we expected. It was back-end loaded as we expected, and the ramp was great. Everybody did a great job. And the performance is fantastic and the excitement is great. And so I think Turing's ramp was a big success.

Underneath Turing was choppy as we're talking about. And we really didn't see that until towards the end of the quarter. And as we looked out into this quarter this coming quarter, we came to the conclusion that the best thing to do was just not to ship any more products into this segment of the marketplace because there's a fair amount of inventory and let the channel sell through the mid-range Pascals. And then a quarter's time, we'll get back to business.

And so I think I knew this is surely a setback and I wish we had seen it earlier. And the final analysis can't exactly share what we would have done different. But between the unexpected – unanticipated slow decline of pricing in the channel and even after the prices came down, it took a little longer than we expected for volume to tick up and the other brand's inventory in the marketplace, those factors kind of compounded and made it a lot worse than we expected.

<Q - Aaron Rakers>: Maybe I can ask the question a little bit differently on the gaming business. If I look back over the past several quarters, let's say you've been running at roughly \$1.6B to \$1.8B revenue level since the October 2017 quarter, prior to that you were at \$1.1B to \$1.2B. We look like we're now going back to that level. I guess, the question is, do we build off of that level? Do we bring back half of the inventory burn? How do I think about the return of y-over-y growth in that gaming piece of the business as we start to look into FY2020?

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And then a quick second question. Over the past years you've had really strong seasonal sequential growth in the Datacenter business in Q4 about 20% sequentially. I'm just curious, how is your guide factoring in the sequential growth in that piece of the business into this current quarter?

<A - Jen-Hsun Huang>: Okay. Let me take the second one first. Our Datacenter business is doing great. I mean, the fundamental dynamics of accelerated computing is spot on. And with Moore's law coming to an end, it's the path forward. You take a look at the number of systems in the TOP500, 127 systems I think this year was, a growth of nearly 50% y-over-y, where the number one system in United States and the world in Europe and Japan. We're 22 out of the top 25 most energy-efficient computers in the world.

And then this quarter, we announced three new initiatives that's going to expand us into a broader part of the high-performance computing market with machine learning, which is as we know is the largest part of artificial intelligence today, which has not been accelerated and now it is.

The second is the ability to do rendering fulfillment, photorealistic rendering for the first time. And then the third is a brand-new Cloud GPU. We call it T4 that the enthusiasm around it is just incredible. And from the time that we went to production to the time that Google put it in their cloud was literally 30 days. It's just an incredible speed of adoption. And so I expect T4 to do quite well. So I think our Datacenter business dynamics are really quite great.

In terms of forecast, we'll just see how it turns out. But I think the fundamental dynamics are great. Back to your question about gaming...

<A - Colette M. Kress>: So the statement came in regarding you've bumped up the overall gaming somewhere in mid of the year to about \$1.7B gaming business, where maybe if you look back two years you're at about \$1.1B. At this stage when you come out of the setback that we have here to get through the overall channel inventory, where will you come out after that and what type of growth could we expect?

<A - Jen-Hsun Huang>: Yean. I'm going to let you guys do the modeling, but let me just take those. There's nothing fundamentally different about the gaming market that we know. Cryptocurrency is an extraordinary factor that we all have to just internalize that it is. And we thought we had done a better job managing the cryptocurrency dynamics. But when the prices came down – started to come down and we hoped that demand would start to reflect the declining price, it just took longer than we expected. And that is – and that's what we're experiencing.

In terms of the gaming marketplace, if you take a look at some of the dynamics, our notebook gaming, which is not affected by crypto, grew 50% y-over-y in China. And so the gaming market seems quite robust. RTX is going to unquestionably redefine gaming computer graphics. And so I think that the dynamics are good. We have to work through the channel inventories. This quarter, of course, we had simultaneous decision of not shipping any more mid-range products into the channel as well as seasonal – normal seasonal console build plans. And they tend to build out a quarter before the holiday season. So you have these two simultaneous effects. But there's nothing about the gaming marketplace or the gaming business that we see that's fundamentally different.

<A - Colette M. Kress>: Yeah. To kind of add to that, think about our gaming business in several pieces that we talked about in terms of the tremendous strength that it's also continuing. In terms of our success in terms of Turing, our notebooks for gaming are growing extremely strong, and our overall console business is also extremely healthy as well. So to think about all of the different components, we just have a piece of channel inventory at the mid-range, but overall as you can see gaming is also growing quite well.

<Q - Chris Caso>: A question with regard to inferencing and what we can expect from that for both Q4 and going forward. And perhaps, I don't know if it's a valid comparison to compare what we might expect from inferencing after the new Quadro launches to what happened in training after the Volta launches. Is there any comparison there in terms of magnitude or how the ramp goes?

<A - Jen-Hsun Huang>: The ramp of T4 is completely related to customers porting their model on top of our platform. And the inference model is really complicated. This is one of the things that I've talked about in the past that on the one hand people think that inference appears to be simple because there's so many ASICs built being talked

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about. The vast majority of the complexity of inference is actually in the optimizing compiler on top. The TensorRT fifth-generation optimizing compiler that we announced just recently took three to four years to build.

And then on top of that in order to get it to scale as quickly as what people saw in Google's Cloud, requires us to build something called a TRT server, an inference server that allows multiple models to run on top of Kubernetes in the cloud. That piece of software is also super complicated to write. And so the pieces of technology that we're putting together have come together. And now we're engaged with Internet companies around the world to port their most heavy workload applications on top or models on top of T4, and so we're working hard on that.

And when that happens, it comes down to their decision of how many they would like to buy and that tells us about our adoption rate. I think from a high-level perspective, if we step back for a second, the high-level way to look at it is this. We know for a fact that Moore's law has come to an end, and at the same time we also know that more and more datacenters are deploying deep learning models and machine learning models into their datacenter and it's computationally really intensive.

And at this time and as we look out into the horizon, the T4 Cloud GPU is just unquestionably the most effective. It can run models whether it's an image model or a recommendation model or a speech synthesis model, it is the highest throughput processor in the world at 70 watts, which fits into a hyperscale datacenter OCP server. It is also the lowest latency of any processor at inferencing in the world, at less than one millisecond.

And so between the architecture, all of the software technology and all the software capabilities we put in place and the fact that the conditions would suggest that Internet companies need an accelerated path forward, I think T4 is really well-positioned. And I look forward to coming back and telling you guys about success.

<Q - William Stein>: First, Jensen, I appreciate all of the details on the T4 for inference in the datacenter. Can you likewise highlight the current traction you're seeing and the long-term growth expectations for the Jetson product that's designed for really, I think, a different market? It's inference at the edge, right?

<A - Jen-Hsun Huang>: Yeah. Jetson is designed for edge AI. One version of Jetson, which is a functional save high-performance with a lot of complicated software, one version of that you could say is self-driving cars. And this quarter we announced winning our first mass market Level 2. We've been really successful in robotaxis and Level 4s and trucks and shuttles and high-end systems where the number of processors, the number of sensors, the combination of LIDARs and surround cameras requires a lot of computation.

But we've never been successful until now with taking the DRIVE platform all the way down to Level 2 mass market cars that – Volvo is our first announcement, our first win in high-volume, early 2020s production ramp. And I'm expecting many more. I think we've positioned and created a solution that is both highly useful and easy to use, as well as could deliver Level 2 capability in a single chip for the very first time.

And Xavier is in production. It is the only single chip, autonomous vehicle processor in production today. When you take that same platform and you could apply to all kinds of other edge AI devices, it could be manufacturing picking robots. It could be autonomous retail, basically AI retail and autonomous warehouses, so – or medical instruments, medical imaging instruments that in the device itself recognizes and identifies anomalies. And so all of these type of applications are leaning towards AI and that's the reason why we built Jetson.

<Q - Craig Ellis>: I'll ask a clarification and then a question. The clarification is just on the inventory issue and thanks for all the color. But one, are Pascal 1070s and 1080s and then Ti flavors still selling, and if so could they present any kind of inventory risk either later this year or in early FY2020?

And then the question really, Jensen, is trying to get a better understanding of how you see the intermediate term growth rate of that Datacenter business. You had spectacular high-performance compute TOP500 accelerator penetration performance up 50-plus percent, that about matches the growth in the Datacenter business. Those may be somewhat coincidental, but can you just talk about where you see penetration across key end markets like HPC, like cloud and hyperscale, like enterprise, which offer you the best growth from here and where do you feel like your penetration may be more mature? I'm just trying to get a sense if there's an acceleration coming off of the 50%

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year-on-year growth that we're seeing now or if consistent with the recent trend we might be moderating potentially down into the 40% or 30% range as we go into the next CY. Thank you so much.

<A - Jen-Hsun Huang>: Our high-end Pascal GPUs are largely sold. And we did a fairly good job making sure that with that transition before we ramped up the high-end Turing products. Our Datacenter business, I would say that Q2 – or excuse me – Q3, this last quarter, the inventory setback aside, I actually have to say it's one of the best quarter we've ever experienced. And the reason for that is because our datacenter position, our accelerated computing position as a company, which is the foundation of this company, the accelerated computing focus of our company expanded in really several ways.

For the first part of our journey into accelerated computing was really following scientific computing, simulating first principle laws of physics for scientific computing and high-performance computing codes. About five years ago, deep learning came into the fore, and we were alert and agile to have invested a great deal and mobilized the company to go help the world put deep learning into software developers' hands all over the world.

The area where I'm super-excited about right now are the three that I've mentioned that we've opened up in this last quarter with the launch of Turing and with the launch of RAPIDS. The first is our film rendering opportunity is – we think that there's about 10mm CPU nodes around the world that are used for film rendering – they can now benefit from accelerated computing as Moore's law comes to an end.

The second is opening up inference. The hyperscale datacenter marketplace is something along the lines of 15mm CPUs sold this year. And it was growing, let's call, it growing at about 15% per year, and the number of CPUs. And we know for a fact that Moore's law has come to an end and those servers are going to have to be accelerated going forward. And so I think that T4 is just ideal for that. It was designed from the ground up to deliver computing in a very, very compressed and very condensed and power-sensitive environment, which these hyperscale datacenters tend to be.

And the software stack from Kubernetes, to containers, to a TRT compiler, to the TRT inference server, and our NGC cloud with all of the stacks fully accelerated and containerized in the cloud, certifying all of the major cloud providers around the world for our containers, that process took us several years and it's put us in a really great place. So T4 is really fantastic.

And so that's the second segment of high-performance computing is deep learning.

The third and potentially the largest currently is machine learning. This is where Hadoop goes. This is where Spark goes. This is where scikit-learn, Python, Pandas all of the data scientists around the world in retail, in transportation and logistics, in healthcare, in financial services that are using algorithms like Random Forest and XGBoost and K-nearest and K-means and PCA and all of these different buzzwords have never had the opportunity to have accelerated computing until now.

And this took a couple two, three years for us to pull together. RAPIDS has been open-sourced. You can go into the NGC cloud download it. IBM is going to integrate it into their machine learning platform. SaaS, SAP, Oracle, the cloud providers are all integrating the RAPIDS open-source SDK into their machine learning platform. And so this is a new segment for us.

The answer about our growth rate is, I believe that our accelerated computing, our datacenter opportunity has significantly expanded during the quarter. Between the T4 hyperscale cloud GPU and RAPIDS machine learning platform, it has sure – and our RTX server film rendering, we surely have expanded our datacenter opportunity. And so, I fully expect us to continue to do well in accelerated computing for datacenters.

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