Lenovo Group, LTD

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Arthur Lai: Good afternoon. This is Arthur Lai from Citi. Today's section, we invite Kirk Skaugen, the President of Data Center Group and Executive Vice President of Lenovo, and Chris Danely, our head of semiconductor analyst to join our fireside chat. Now let me introduce Kirk a little bit. Kirk actually joined Lenovo since 2016 as the Executive Vice President and is in charge of Data Centers Group, oversees all aspects of the end-to-date datacenter business worldwide. Prior to Lenovo, Kirk also spent 24-years at Intel where he has a variety of leadership in Intel and he used to be the president of the Client Computing group and he oversaw chipset businesses across the PC, tablets, smartphone, and prior to that role he also acted as head of Intel's Datacenter and Connected System Group. So let's welcome Kirk and Chris who you know well, for joining our presentation.

Kirk Skaugen: Great.

Arthur Lai: So, Kirk, I think many investors want to understand more about the current PC market. So my first question will be on the PC market. How long do you think this up-stream in the enterprise and the PC market can last for and why?

Kirk Skaugen: Yes, so I think most people recognize Lenovo, regain the position per Gartner as the number one PC company in the world. We see continued growth, our estimate is that we'll grow at a five-point premium to market at roughly double the profitability of our two largest competitors. So, we think that can be sustained for the next couple of quarters certainly but right now our mix is about 65% commercial so still very strong with commercial companies still upgrading onto the ThinkPad and onto Windows 10. I think we're just crossing as an industry about 50% on Windows 10. So still a significant amount of corporate upgrades as well.

We also see a very strong demand for Gaming. We just crossed to be the number one gaming company in the world and over a billion dollars now in workstations as well. So I think we're focused certainly on the growth areas of the market, we think it can be sustained for the overall market for several more quarters at a minimum including those Windows 10 conversions.

Arthur Lai: Thank you. And compared to one month or one quarter ago, do you sense the momentum is getting strong?

Kirk Skaugen: Yeah, I would say so. I think certainly we've seen stabilization in a lot of the core

	commodities. There are still some constraints I would say in things as small as capacitors but in general, I think we're seeing stabilization and recovery which I think will continue to drive growth in the market.
Arthur Lai:	Cool. We usually see swing from two segments so I agree with you on the commercial side. But it seems like a little bit of noise from China regarding those orders from Internet Giants, for example, like BAT had to cut their order in the datacenter server. Have you noticed these things? Is it a sign for the slowdown in the whole global or is it just a selective company?
Kirk Skaugen:	You're talking hyperscale specifically?
Arthur Lai:	Yes, yes.
Kirk Skaugen:	Yeah, so I think Lenovo right now, a lot of people don't realize but we now have design wins at six of the ten largest public Cloud providers in the world with business that I run in the datacenter space and we are ramping some of those customers basically as we speak. We purposely downsized a little bit in China, the traditional BAT companies, the still strong customers of ours but we purposely tried to mix-shift a little bit to improve our profitability to go more into the Tier 2, Tier 3 hyperscalers. I think more than 40% of the public Cloud now is beyond the Top 10 public Cloud providers. So we now have aggressively ramped into the U.S. at some of the large Tier 1's as well as the Tier 2's and Tier 3's. Relative to those three companies we're still probably in the top three or four suppliers to them so we have a lot of upsides so sort of independent on how they do -- I think we'll do quite well.
Arthur Lai:	Okay, my next question as now we're in the US this is a frequent question investor like to ask, Is the tariff of trade war have any impact on your business?
Kirk Skaugen:	I think that's a huge question and I think one thing that's been unique about working at Lenovo, I'm based in our world headquarters for datacenter down in Research Triangle Park in North Carolina and we have more than seven global factories in everywhere from China to Mexico to Hungary to India to Brazil. To put it in perspective, one of our factories is building 37 notebook motherboards a minute and we're putting out about five devices a second in over 165 countries in the world. So we believe absolutely in open global trade and we're a global company. We have seven nationalities on our executive staff, just to put it in perspective, and so, so far the tariffs haven't impacted us directly but I think we're as well positioned as any company in tech to deal with it.
	Gartner now has us positioned as the Number 5 ranked supply chain in all of technology and 26th in the world of all companies even including an Amazon and Walmart. So we're going to flex according to what we need to do to support the customer demands but again, we're manufacturing in China, in Mexico, in the United States, in North Carolina, in Hungary, in India, in Brazil so we'll have to flex to meet that but today it hasn't been an inhibitor to us.
Chris Danely:	Just a follow-on with Arthur's question, does this pop up much with your customer base and are you -- are there any contingency plans that Lenovo would have for anything that would happen, good or bad, down the road, does this come up a lot at Lenovo as far as planning for tariff trade war?
Kirk Skaugen:	I think my business is, again, very well distributed. We have almost an even mix with

about 20-ish percentiles in the United States, North America, 20-some percent of our business in China, 20-some percent of our business in Europe and 20-some percent of our business in Asia Pacific. So we're constantly flexing and putting things on the ocean, putting things on trains to meet whatever requirements we have worldwide but, again, we believe in open trade and we're selling probably more distributed than any company in the world whether it's PC's, tablets, Motorola phones or Lenovo servers that we acquired from the IBM X86 Server business.

So right now it's obviously out there, our supply chain team is working it but it's not an inhibitor to growth right now.

Chris Danely: And then one thing you said in your earlier remarks was double the profitability of the comps. How does that happen and what's the plan to sustain that?

Kirk Skaugen: So again our PC public position is that we think we can grow at a 5.0 premium to market, that's in terms of revenue growth and then our profitability we believe we can be double our top two competitors at about 5% PTI. So, that is a function of a very strong commercial mix, 65% continuing to grow as the number one company in extreme gaming. We just got out of a very successful show at IFA, so maintaining profitability in ultrathin moving into visuals and monitors, this kind of things beyond just the traditional consumer PC business. So I think it's as much of a mix and then keeping our focus on device as a service, premier support that we're now announcing for people that need more handholding of their PC's worldwide etc., so that I think has been good.

On the datacenter side, we've had a phenomenal recovery, I think we'll talk about that, we're now the fastest growing server company of the Top 10 worldwide for Gartner, we're growing about 50% year-on-year in units. We're growing 68% year-on-year in revenue and five consecutive quarters of profitability improvement on the datacenter side and we can talk more about that but that's got a whole other story to it beyond the PC side.

Chris Danely: Yeah, what do you think has been the key to the improvement in growth rate on the datacenter side, has it been you guys tapping more into the Cloud, has it been enterprise, a little of both?

Kirk Skaugen: Yeah, so I came into Lenovo 22 months ago and we had acquired the IBM server business in November-ish or October of 2014 and we had done some things well and we had done some things not so well after the acquisition of the IBM server business. It took us about eight years after the acquisition of the IBM PC business to become Number 1 in PC's worldwide. Our aspiration is to do something similar on the datacenter side.

I think what we did well is we integrated into the Lenovo factory system. Again, the device side of Lenovo sells five devices a second, about a hundred servers an hour and is the third largest server company in the world but I get to take advantage of something like $18 billion of Lenovo procurement power. So we're negotiating as one Lenovo which is helping on the procurement side. What we didn't do well is we had actually integrated into our sales teams with the PC side, our supply chain, our quality and that didn't work out well because we had so much focus maintaining our position as Number 1 in PC and a lot of times, two years ago, the datacenter had gotten a little bit forgotten. So in the last 18 to 24 months we now have rededicated our sales team 100% to datacenter, put 40% on profit, dedicated supply chain, dedicated quality organization and brought back a lot of the innovation that I think originally IBM had been known for. And again, as a result of that, we've had five quarters now of improving profitability. We're seeing, again, Gartner and

others recognize this as one of the fastest growing companies if not the fastest in the world and the profitability is such that we're having to pivot like a lot of people from just selling commodity hardware to things like software defined infrastructure whether that's on vSAN. I know Pat Gelsinger will be here in a few days. We're one of the fastest growing vSAN companies. We are the fastest growing mechanic's company in the world with Azure Stack, etc., we're pivoting from traditional over to software defined because Lenovo doesn't have 30-years of history of selling legacy infrastructure so we can move the IT department very, very quickly over to the new software defined products. And so our goal is to double, triple or quadruple our market share as you're going from traditional server technology over to things like mechanics.

Chris Danely: I guess how does that business server market shake out -- you have you guys and HP on one side, you have the ODM's doing their own. You have some of your customers are going direct, going to you, you've got these other startups out there like -- it seems like everybody is doing pretty well. So how do you think the market shakes out and do you think that Lenovo needs to do something different or just continue on the present course?

Kirk Skaugen: Well we acquired a great business with IBM, I think we spent $2.3 billion to acquire the IBM X86 Server business but that was really just one part of the market. The on-premise, mainly large enterprise market. And what we've done now is we brought in 18 new executives to Lenovo over the last year and a half. We hired the Chief Information Officer from Intel, we've hired one of the largest supply chain experts, one of the largest supply chains in the world with IBM, etc., and so what we've done now is we've organized our full company into kind of very high velocity sub-segments.

So we have a hyperscale division working on the type hyperscaler's, we have a super computing division working in super computing, we have a software defined division, an IOT division, a telecom division, a services division. So what that's enabling us to do is operate very different business models depending on who we're talking to.

In the public Cloud space if you're going to go win one of the largest public Cloud providers you have to do full customization and what we were doing 18 to 24 months ago is we were just taking ODM motherboards and basically becoming a distributor for the ODM. This year we're going to actually take and build 33 custom designs for the Top 10 hyperscaler's in the world and we're going to put them into factories that traditionally had only made notebooks but now are going to be making server motherboards as well. So to put it in perspective, just the one factory we have in China, you could put 47 World Cup soccer stadiums inside of the factory. It's 305,000 square meters and now we're going to be building tens and tens of thousands of server boards in there per month; very, very customized for each and every hyperscaler to each and every datacenter they build.

So one of the hyperscaler's we sold to this year, we sold 70,000 servers in roughly six months into one country and we had to sell 70,000 servers into ten countries in 45 days and then we sold the next 70,000 servers into 22 countries in 30 days. That shows you the kind of ramp that you have to do here in not just customizing the motherboards but customizing the entire rack infrastructure as well. So, I think we're customizing the business whether it's hyperscale, super computing, software defined, very, very different than the market. When you're in supercomputing you're compete with a team of experts, when you're in hyperscale you're competing with an ODM. When you're a traditional business you might be competing with Dell EMC or HP or Cisco. So, actually they're quite different competitors and quite different skillsets and we're kind of adapting to each one.

Arthur Lai:	So talking about the hyperscale, I -- we noticed that actually, you know, you do a lot of transformations in the hyperscale business, can you elaborate more color to the audience?
Kirk Skaugen:	Yes, I think we wanted to kind of coin the term called ODM Plus and what we think the hyperscaler's want is they want more commodity scale than a traditional ODM can give them. So as we're walking in as a motherboard manufacturer now, we actually have roughly $18 billion of procurement scale which is larger than any ODM in the world so we can actually build the motherboards. They need global distribution, probably more than a localized system integrator could give them. So again, we're selling into 165 countries in the world as these large -- whether you're a China hyperscaler trying to outside or whether you're a U.S. hyperscaler trying to go global. So we're selling more broadly than any system integrator but they still want the multinational kind of quality that's there. So they need full customization, global support, high quality and that's sort of -- we believe we're the only company in the world that's doing that right now.
	So this is our -- almost our third consecutive quarter now of triple digit year-on-year growth in hyperscale but it's a transformation we're going through and you've seen our profitability improve because we're now building our own motherboards, putting them into our own factory, putting them into our own systems factory and using our global logistics network that last year we weren't doing any of that. So we've coined that term ODM Plus.
	The other thing I think that's interesting about Cloud is a lot of people think Cloud is just this very cheap commodity, you know, two socket very, very low end margin servers but what's happening now is some of the largest enterprise applications are now moving into the public Cloud whether you're on Amazon or Google or Alibaba or SoftLayer or this kind of things and so right now Lenovo, we believe we are the largest if not one of the largest SAP HANA companies in the world. So SAP runs their internal HANA on Lenovo servers. Lenovo internally has one of the largest HANA installations in the world and we actually run SAP's, HANA Cloud for them in China. But what's happening now is HANA is going into the public Cloud. So you can get HANA not just on-prem but you can get it in the public Cloud. That for us means that we're selling multi-hundred thousand dollar servers each into the public Cloud to support workloads that have never been available before from some of the largest public Cloud providers.
	So that's going to be true about FPGA designs, it's going to be true about GPU, base designs in the Cloud. So the Cloud is also becoming more heterogeneous, not just a standard one size fits all and that just helps improve the profitability and requires more of the expertise that Lenovo has traditionally had.
Chris Danely:	Just to follow-up on that Kirk, I mean what is kind of AI means to Lenovo? Do you have your own AI team and you'll say, hey, here's our AI box, is it a good thing, a bad thing, do you -- you'll do GPU's, FPGA's, do you see this as being a big part of your business?
Kirk Skaugen:	Yeah, so AI I think we coined a term here in New York last year that AI is augmented intelligence, not just artificial intelligence because we fundamentally believe computers should augment the human, not replace the human. But when we think about AI as Lenovo, we think of everything from the artificial intelligence on your smart speaker all of the way up to super computing. So, we've recently announced Google screens and Google speakers, smart speakers, we're putting Alexa and Cortana on millions and millions of devices but at the same time we also just became this year the largest super computer company in the world. So for the first time in 25 years, we passed HP SGI to be the largest super computer company in the world so we launched the largest Xeon system in Spain, in

Italy, the largest in Canada, we're in 117 of the worlds largest super computers. There is an AI element now of everyone of those super computers and we're doing things like cancer research, tracking viruses like the Zika virus, tracking pollution off the deserts, figuring out where to put the next wind turbines and wind farms in the world. Tracking the next hurricane and tsunami, all of this kind of things. So when we say AI we mean augmented intelligence and we're taking it from two positions; one is we think we will remain the largest super computer company in the world. You know, we're not trying to protect anyone's nuclear resources or anything like that, we're mainly off solving humanities challenges and health and weather and this kind of things. At the same time, we're selling basically five devices a second somewhere, and every one of those devices is going to have some kind of AI intelligence on them. I've got a 4-year-old and an 11-year-old at home and they're talking to their PC, they're talking to their smart speaker, they're turning their lights on and off in their rooms. They're asking the speaker homework not dad for their schoolwork and to a certain extent --

Chris Danely: -- keeping my kids from asking Alexa to do their homework for them.

Kirk Skaugen: That's right. Usually smarter than dad too so --

Chris Danely: On that note, in other recent developments, some other OEM's are doing their own CPU's, their own processors. Is that something that Lenovo is looking at, would look at potentially?

Kirk Skaugen: I think we're certainly diversifying our processor base. I mean, obviously I came after 24 years at Intel and we're a very strong Intel oriented datacenter company but we've also build arm-based Chromebooks, we've been public with Ampere which is a new arm-based datacenter startup. We had a press release with Microsoft and Oracle. We're the exclusive supplier to Ampere on the arm side. We've been up on stage with AMD around storage solutions at some of the large hyperscalers in China and then in China specifically there's a secure and controlled initiative that's going on from the government where our belief is about 75% more of the infrastructure mission critical network storage and compute in China will go to a secure and controlled process. So believe it or not there's actually nine different microprocessors in China being developed that will have some kind of security features. We've been public for example, with Intel's collaboration with Montage on a CPU they call Jintide which is a Xeon variant that is going to be sold in China for China to meet the secured and controlled requirements of things like the telecom infrastructure, financial infrastructure, state grid. So I think Lenovo is well positioned for that.

Relative to doing our own chip, I think we have -- we already have nine varieties that we can choose from and we're obviously expanding into FPGA's with Xilinx and Altera with much more GPU-centric machines for AI and other workloads. But there isn't an immediate plan for us to build our own chip unlike some of our competitors.

Chris Danely: That's interesting. So one of your competitors said a while ago that hey, you know, if AMD gains a bunch of market share we're -- we use them more so it's better for us. Do you think if AMD does gain more market share does it necessarily hurt Lenovo or can you pivot fairly quickly to adopt them?

Kirk Skaugen: We sell AMD solutions in essentially everyone of our product lines. So, we have been publically on stage with them in China selling to Baidu and others in the storage space. We have a full range of PC's with AMD and then a whole, obviously, ARM lineup as well. The co-founder of ARM is on our board of directors. So, I think we will not be affected.

Chris Danely:	But what about on the server side? How quickly could you potentially pivot and install the server systems or would that -- is that necessarily in the works?
Kirk Skaugen:	I think we're actively pursuing all processor designs on a regular basis.
Chris Danely:	Well said.
Kirk Skaugen:	And right now, again, I think as we're growing 50% year-on-year that's so much faster than market and obviously faster than the global supply of chips is going to be growing. So we're going to need to diversify suppliers in order to do that and maintain that kind of growth.
Arthur Lai:	Yeah, some investors actually emailed me a related question on the component side. So we know that actually when the component price was getting higher and higher, actually a lot of OEM is saying the margin got hurt. But now it seems like the situation actually reversed. So how do you think of the margin impact if the enterprise is getting softer and softer?
Kirk Skaugen:	Yes, so one of the things that we did when I came into Lenovo is we renegotiated the 18,000 contracts in 160 countries and we've made DCG it's own legal entity but we still negotiate close to $18 billion of commodity purchases every year as one Lenovo. So, you know, when we're looking at the Motorola phone business or we're looking at the PC business, the tablet business, the smart speaker business, the server storage networking business, we're negotiating with the large CPU suppliers, SSD suppliers, memory suppliers as one Lenovo.
	Once it gets then allocated out, we can mix and match sometimes between our different businesses unlike some of our competitors. That's a huge strategic advantage of being in the phone business, of being in the tablet business and the server business at one time. So I think in general things have stabilized. I think we still have some constraints on MLCC capacitors but things are definitely stabilizing and I think that will be good for the industry and typically because of our supply chain and procurement teams, we're doing much, much better. In fact, we're actually using AI in our procurement analysis and supply and demand forecasting to help us to do predictive analytics on where we need to be relative to forecasts.
Chris Danely:	How will that change your inventory management for you guys as these commodity prices were going bananas, were you act -- looking to build inventory because you knew the prices were going up and so now would you be looking to -- could you lower your inventory?
Kirk Skaugen:	We were building our inventory. I think we did quite well and we got a significant amount of upside because we managed our inventory I think better than most and I think you should expect our inventory to decrease.
Chris Danely:	What was the -- I guess what was the biggest component or the biggest, I guess, pressure point for you in terms of the commodity cost increases, was it memory, was it MLCC's, capacitors, what was the biggest --
Kirk Skaugen:	I think for the industry it was traditionally memory and SSD's were the two big ones over the last year or so.

Chris Danely:	So let's just say we do have some sort of memory downturn, maybe talk about the potential benefit to your margins or would you just pass it through to customers or a little of both, how could that impact the business?
Kirk Skaugen:	I think it's too early to tell. I think we're starting to see stabilization. So it depends on what the competitive environment is, right? Again, our commitment is to grow PC's at a 5% revenue premium to market at twice the profitability which has traditionally been 5% PTI to our customers. Our goal in the datacenter space is to continue in software defined to grow 2, 3 or 4 X our share as we move from traditional to software defined in flash arrays. I know a lot of you are invested in flash array companies. We've been growing the last four quarters over 100% in flash arrays at 2X the market.
	And again, the third-parties are saying we're growing now at 5% units and our public -- last quarter we were at 68% of revenue. So we're going to utilize everything to maintain the premium and obviously for phones, our focus has been on profitability, recovering profitability and we've been public that that's a core datacenter focus as well.
	Generally speaking, we're not taking negative business in the datacenter space. All of our growth has been positive gross margin business. We're not growing all of that revenue and unit share by taking negative deals which we've seen from some of our competitors in their growth scenarios.
Chris Danely:	Like you said, you're still at double the profitability of the competitors. So can you talk about how you were able to manage through these increasing component costs and still post that kind of profitability?
Kirk Skaugen:	Well, I think again, we have a supply chain group that's extremely diligent. We also have a goal of being the most trusted partner so one of the reasons I came to Lenovo as a supplier to Lenovo was always very much a win/win and it was collaboration, everybody has constraints in this industry. I was in the chip business for 24 years right, you have ebbs and flows and Lenovo treats its suppliers very fairly, always in a win/win. We don't try to necessarily game the system and over-forecast and I think that people when they build that trust and you've built those relationships over decades then you end up getting supply.
	If you're over-forecasting and double forecasting everything, when you get a constraint that might help you once but the next time people are going to start judging your numbers. So I think relatively speaking we've built up a tremendous amount of trust well before I got to Lenovo and if you look at where our people come from, a lot of times they come from the suppliers and have very strong relationships with them. So we focus on, in my division, we have a vision to do three things; number one, be most trusted. The most trusted with the customer, most trusted to our partners and suppliers. Number 2, help customers through their digital transformation journey. We're going from a world of hundreds of millions of PC's to a hundred billion IOT devices, that's a big shift, and AI and machine learning and big data we want to help them through that. As a result, our services business is growing 35% profitable and doing very well and then the last thing is we want to do something beyond just the financials. We want to solve humanities greatest challenges.
	Most of the people in today's Data Center Group get up everyday and know that there's more compute cycles out there solving cancer and helping with the next hurricane prediction and all of these things on Lenovo computers. So we are very proud that we're in 117 of the fastest computers in the world and right now we're building, what I think will be,

the largest super computer in Europe and it's actually using our warm water cooling technology which is 40% lower power than anything we've ever built before.

So it's not only helping solve global warming and the challenges with that, but it's also -- it's self-consuming, a lot less power.

Chris Danely: Just to take a step back, like you said, we go back a long time. You know, the PC space has been, you know, called for its death many times and now we're here in the fourth consecutive quarter of flat to slightly up, enterprise doing basically the same thing. To what do you attribute the strength. Is this just like a normal kind of replacement cycle every four years and how sustainable do you think this is and have you seen -- in talking to some of the other folks out there, that seems like the sort of the developed countries, you know, North America, Western Europe, have led the increase in demand, can we start to see the bricks rise up, give us your thoughts on what's happening out there?

Kirk Skaugen: Well, I think you know, some of the people reported after our earnings announcement that this was a one-quarter blip that our PC and devices business grew 19% year-on-year. I can assure you, there's hundreds and hundreds of millions of PC's out there that are five years and older that haven't moved to Windows 10 yet. Right? I think Windows 10 transition overall, you know, we should get Microsoft to quote the exact number, but it's probably crossing 50%. I've lost track being a datacenter guy but it's not 90% anymore, right? So there's a huge amount of installations that are going to still move over to Windows 10.

Ultra thin and light, you know, when I was at Intel I helped create Ultrabook, I helped create 2-in-1, put touch screens on notebooks, all of that's now just touched -- starting to market. I mean, how many times have your kids tried to touch a notebook screen that doesn't have touch and remember three or four years ago people were saying will touch ever hit a notebook? So, our ultra thin and light market now is growing in the mid-30%'s. My kid, like every kid, is in playing Minecraft, Roblox, extreme gaming, Fortnite, those gaming machines are growing mid-30% if not higher.

Workstations, right, doing digital design versus clay modeling. The workstation business is at over a billion dollars for us. We just sold $150 million of equipment to one customer. So that thing is a billion on its path to double soon. So, I think there are a lot of growth drivers in gaming, workstation, ultra thin and light, even 2-in-1 with the convergence of tablet. You know, tablets were growing like crazy now. They're -- they flattened out but 2-in-1's are still an interesting part of the market with Yoga. And then Windows 10 migration is still a big one.

For server, I'm excited because I was just up in Redmond with our friends at Microsoft and remember Windows Server 2008 and SQL Server 2008 end of support is coming next year. There are millions and millions and millions of servers in the installed base that are going to need to get a hardware refresh because those critical Windows 2008 and SQL 2008 platforms are also coming out of support. So we are already planning close to a thousand customer visits to get customers converted over from their old hardware to their new hardware through that transition as well.

So I think that's an interesting part as well. And then on phones, you probably saw but Motorola launched the first 5G upgradable phone with Verizon a couple of weeks ago. We're now assorted at all four carriers in the U.S. We grew 92% in phones in the U.S. year-on-year. We've had seven consecutive quarters in Latin America of double-digit growth with the Motorola brand in Latin America. So you're not going to be able to

basically buy a 4G phone and with the Moto Mod you can put your 5G modem on the back and you're going to be there. So 5G is obviously going to be a huge, huge boost to the phone market as well and it's exciting to see Motorola Lenovo out with the first 5G phone exclusive with Verizon in the U.S.

Arthur Lai: Great. Before we continue we'd like to open it up to the audience if anybody has any questions.

Audience: Thanks for the presentation, I have a question on the (inaudible) to market, it's more of a market question. What do you see in terms of growth trends between the U.S. Tier 1 Cloud versus the back versus Tier 2 China -- can you talk about that and what you expect for 2019?

Kirk Skaugen: Yes, so I think mega trends in the server markets. So I think in no particular order, I think super computing is alive and well. I think the global super computing market might be a smaller part of the market but it's a critical growth factor that drives the technology down. It's kind of like the formula racecar of the automotive industry, right, everything that happens there trickles down into the marketplace. So, super computer has traditionally been operating at 2X Moore's Law and we're getting to a path to an excess scale of computing which is, you know, going to be absolutely phenomenal. I mean, it's going to basically take weather forecasting from something like a hundred square mile radius with some level of accuracy to basically a city block within the next five to ten years.

So I think super computing is alive and well. Software defined infrastructure is growing phenomenally. I mean, depending on which company you talk to, 70%-plus year-on-year growth rates, we've been growing pretty consistently at around 150% growth so whether that's vSAN, Nutanix, Azure Stack. We now have an exclusive relationship with a company called Cloudistics; a set of serial entrepreneurs that have sold a number of companies around next-generation composable Cloud but that's an area where we're just consistently growing at triple digits.

Flash arrays, as you get the server-based storage, you know, the old legacy SAN arrays, just like the old mainframes are going away so again, we've been growing triple digits in flash arrays whether it's hybrid flash arrays or all flash arrays. So the storage market is exploding. If you look at the public Cloud it's interesting because IDC would say that 80% of the global enterprises are starting to repatriate data back from the public Cloud into the private Cloud but I think the reality is they're both grown. Most CIO's have a Cloud agenda, either private Cloud, hybrid Cloud or public Cloud and I think everyone is growing quite fast. The only issue is the traditional case of everyone's over forecasting potentially because workloads are going to move the Cloud and everyone is fighting over who is going to get that workload. So are you triple forecasted or not? But for us, you know, we basically came from a position where we were selling to Baidu, Alibaba, Tencent and now we're working to sell to the top 50 Cloud providers. So for us it's all upside. But I think in general we're seeing, I think IDC has about 22% CAGR on the public Cloud market. Traditional server infrastructure, you know, IDC says it's shrinking 6%. Our goal is to be growing double digits still in that because we're coming off of a smaller base as, again, we're number three everywhere in the world behind our two biggest competitors but we're growing significantly faster than our two biggest competitors.

So traditional is theoretically shrinking and then you get to [educate ways], edge servers, the hybrid edge relative to IOT, again, that's going to be an explosive mid-double digit growth I think because that's all Greenfield. They have Amazon's green grass and VMware

and everyone putting analytics at the edge of the Cloud. Someone told me it can cost $80,000 to do an ambulance run to an intersection and back, right, by the time you pay for everything, you can put a lot of analytics on the intersection to determine where you need to run that ambulance or not. So, when we see smart cities, traffic management, surveillance, all of this kind of stuff, there's going to be a lot of edge compute happening and will be a very large player in that or haven't even really announced products there yet. So for IOT edge and last, but not least, telecom infrastructure. If you look at network function virtualization, the advent of 5G and connecting a hundred billion dollar -- a hundred billion devices to the Internet with everything consuming electricity, computing, communicating, your total network infrastructure cost has to go down. The only way it's going to go down is if we have the same economics and X86 compute that we had when virtualization first came out. So that's the promise of NFV.

So, if you didn't see it, Mobile World Congress in Barcelona and Mobile World Congress in Shanghai we had China Telecom, China Mobile, in our booth showcasing NFV but that's going to be another explosive growth because all of that proprietary network equipment is going to move over to traditional X86 servers. So I laugh because in 1992 I graduated, came to work at Intel, two things happened; one is IBM announced their first X86 server and the ThinkPad brand was launched, right? Now 25 years later, people say what's changed and what hasn't changed? The one thing that hasn't changed in 25 years is when I was at Intel in 1992, three 86er's being designed on Sparc workstations. Now, 100% of workstations are X86.

I was the first server salesperson at Intel trying to call on Telecom and everything was on Sparc, our mainframe. Now the world is fully embracing network function virtualization on X86, right? So the workstation moved over then the server moved over and then storage infrastructure showed up and companies like NetApp and others built X86 storage out and took away the proprietary mainframe. And then software defined networking came out and companies like Arista and others joined up and started creating software defined networking and now you're seeing Telecom infrastructure finally with the horsepower that X86 can bring that whole proprietary telecom infrastructure, just like the old mainframe, the proprietary risk workstation, the proprietary networking, proprietary storage, so that's why I think Lenovo is best positioned because at the end of the day what Lenovo does is, you know, high volume compute and communications with Motorola and Lenovo assets where now everything in the world is going to compute, communicate and connect and we're one of the only companies in the world that has that phone asset, the PCS and the datacenter asset.

So that was a long question but it basically -- it's very hard to talk about the server market as one homogenous segment anymore.

| Arthur Lai: | Great, we're all out of time. Thanks Kirk, thanks everyone. |
| Kirk Skaugen: | Thank you very much. |