

Intel Corporation

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Harlan Sur:

Good afternoon, and thank you for attending J.P. Morgan's 19th Annual Technology Investor Forum here at the virtual Consumer Electronics Show. My name is Harlan Sur. I'm the semiconductor and semiconductor capital equipment analyst with the firm. I'm very pleased to have Chris Walker, Corporate Vice President and General Manager of Intel's Mobile Client Platforms group: notebooks, thin-and-lights PC segment; particularly relevant given the strong demand for notebook PCs during the COVID-19 pandemic, and focus on work-from-home and remote learning. I've asked Chris to start us off with a brief description of his role and responsibilities at Intel, and provide us with an overview of what the team is showcasing at CES. I know that the Client group did a big press event yesterday. And then we can go ahead and kick off the Q&A.

We also have Ben Thom, part of the Investor Relations team at Intel here with us, as well. So gentlemen, thank you for joining us today. And Chris, let me go ahead and turn it over to you.

Christopher Walker:

Great. Thanks, Harlan, and thanks for everyone for joining in with us. So I'm Chris Walker, lifetime Intel veteran, but last four years in particular I've been leading our Mobile group, Mobile Client Platforms. And that's everything from Mobile SOCs from laptops to wired and wireless connectivity that goes across all of our PCs.

For us at Intel, even going back four years ago, we really focus in our PC category across commercial usages, education especially with Chrome, modernizing a thin and light notebook, and gaming. And those are the very areas that have seen us grow over several years in the PC category, and became just vital to us in this COVID era, as learn-from-home, work-from-home, play-and-connect from home all happened in unprecedented levels on the PC. And what we announced yesterday in our CES press conference, four new product families addressing those various segments. So we're able to extend our Evo platform with more and more partners delivering the best thin and light experience.

We then brought that to our commercial plan with Evo in vPro technology built off our 11th Generation core to deliver new levels of productivity, conferencing, collaboration, and hardware-based security for our commercial customers; expanded our education segment, brought our 10-nanometer in a new efficient core architecture to the education

segment; and then launched two new platform families for gaming; a 11th Generation new architecture core product line for desktop; and then expanded our Tiger Lake 11th Gen, using our SuperFin technology for mobile, everything from ultra-thin and light to really high-end enthusiasts in mobile workstations. So a full portfolio of Intel new products introduced to really capture where the growth and where the technology advancement has been in the category.

Harlan Sur: Great. That was a great introduction. I appreciate that. So if I step back and take a look at 2021, well, let's look at 2020 first. I mean the Client Compute group at Intel targeted to grow mid-single-digits, right, calendar year '20. Within that, we estimate that your mobile client or notebook business is up mid-to-high teens year-over-year, obviously strong growth from work-from-home, remote learning, high-end gaming. Looking in to 2021, our tech team is forecasting continued growth with notebook shipment volumes up in the mid-single-digits range. I know that Gregory Bryant, GB, Head of Client Compute at Intel, at the recent industry analyst summit back in the second half of last year, also talked about 2021 being another year of growth for the PC industry and potentially for the Client Compute group at Intel.

So my first question is, how are you and the team seeing the demand dynamics in mobile client compute, and the prospects for yet another year of growth in CCG in 2021?

Christopher Walker: Yeah, clearly as we've rounded out 2020, we continue to see very strong growth for computing overall and mobile in particular, all the things that you highlighted as there's a shift from work and learn from home. But what we found was even more than accelerating adoption, is a lot of people got reacquainted to, in some cases, to the PC and saw the need for more than a PC per household, and that trend towards a PC per person. Incredible growth in both US mature markets and in other emerging markets of education, trying to improve the quality of education with more PCs per student.

We think that those aren't just one-and-dones or pull-ins of demand. We see continued opportunity for the PC for us to replace the aging install base in Windows 10, over 100 million units over four years old. And you look at the dramatic difference between an 11th Gen core processor-based system and something from four years old, it's just night and day. Education, there's about six PCs per 100 students worldwide. A tremendous opportunity to improve that footprint to help students learn and grow, whether from home or in the classroom. And then household density, we're not even back to where we were in the peak of 2013-2014 of PCs per household. So those are all sustained opportunities that we think enable us for growth both short and long term.

Harlan Sur: So on the -- I appreciate the view on the forward view and demand is certainly strong, which is actually we just had the NVIDIA team present earlier, and they were telling us that their notebook GPU segment was one of the fastest-growing segments and represents like 30% of their overall business. And it obviously hinges upon partners like Intel, to bring very high performance, thin and light SKUs to the market. So clearly there's a lot of growth there.

Kind of more near term, some of your customers are still discussing shortages, including CPUs. But increasingly, there are broader supply chain constraints within the industry. So first, how does this play into your expectations on seasonality? And second, if you do have them, when do you expect supply constraints related to your own CPU production

to ease?

Christopher Walker: Yeah. Over the course of 2020, we increased our capacity by about 25%. And especially when we were in the second half of the year, ramping our three 10 nanometer factories enabled us to meet an increasing level of un-forecasted demand, even on our Tiger Lake or 11th Gen technology, using our SuperFin 10-nanometer technology, we were able to meet increased demand from our customers. So from that standpoint, I feel good about the work that our manufacturing, Intel manufacturing did. Remember, all this unprecedented demand is in the midst of a pandemic where people are coming into the factories under enormous stress, logistic supply chains were stressed. So I'm really proud of -- and one of our advantages with our manufacturing team is the ability to respond and raise to the level of new demand.

Now as we go forward, I think there's largely we've gotten over the hump on some of the supply constraints. But as demand continues to increase in excess of what some of the third parties you remember in the broader industry, many people rely on third party forecasts that have been kind of lagging and trailing. We're going to continue to work across the whole supply chain, the whole ecosystem, to continue to drive towards higher and higher demand levels.

Harlan Sur: So in talking with investors, you know the recent concern regarding Intel and your strong market position in mobile is of course your longtime competitor AMD with its Ryzen 4000 series, and then more recently Apple has brought to market its M1 ARM-based processor for its notebook lineup. If we look 2 to 3 years out, looking at your platforms, looking at your roadmaps; what gives you confidence that Intel and the X86 architecture will sustain market leadership and that plans made by Apple to insource will end up -- potentially be more of an outlier versus the mainstream?

Christopher Walker: I think for me, I've been in and around PCs and semiconductor for my career and seen Intel -- been part of many different competitive environments at Intel. And obviously when we see the level of success that the segment and the category has had, there's a lot of competition. And we thrive on that. And for me, what I'm excited about is our basis of competition isn't grounded in just an instruction set or legacy. It's about the transition we've made to XPU's. We compete at a CPU level, at a graphics level, at an AI level, at a connectivity level. We then couple that with platform engineering and high-touch designs. The most innovative designs in the industry, Apple included, come through our work and our PC partners. Right? This is in form factor. This is in gaming performance, where you can do 4K gaming in something 16 millimeters thin, right? That's work that we do with partners like NVIDIA as well.

So I mean software work, software optimization, so things like Adobe Sensei AI. You're doing performance across multiple engines that we deliver that allow us to outperform AMD and outperform M1 in things like Premier for video editing and things like that, in the real world. And so a lot of people get caught up in synthetic benchmarks. And benchmarks have a role. But it's not reflecting how people are actually using their system in real life. And what we've done is architecting. We'll continue to architect towards that end-to-end experience, towards how people are using it. And it's not enough just to do one thing. We have to do from how you get content into your machine to how you process it, to how that looks and feels and the responsiveness, to how you get it back out and share it to the world. We're executing on all those, and we'll continue to do that at a

faster and faster pace.

So in the span of a year, we've gone to September of last year introducing our 11th Gen core processor using our SuperFin technology. Here yesterday we expanded that into commercial and gaming segments through the first half. And then in the second half of this year, we'll introduce two new: one performant, one efficiency architectures; coupled together in a new design hybrid architecture with Alder Lake. And so by no means are we standing still either. So we are rising to the challenge, so to speak, and innovating at an unprecedented level throughout the platform.

Harlan Sur: So that's a good segue. So let's focus on the new products, and let's focus on the pipeline. Because in the second half of last year was your big platform launch, 11th Generation core, Tiger Lake mobile processor platform, 10 nanometers, SuperFin manufacturing technology. The team had anticipated 100 notebook SKUs in the market by year end. First of all, did you guys achieve this target? More importantly, the team has been expecting to gain share in mobile client space with Tiger Lake. Should we expect a share shift back to Intel playing out, let's say, when all is said and done and we look back on the Q4 market share statistics?

Christopher Walker: Again, I think Harlan, we started out talking about Tiger Lake kind of spring or mid-last year, we said about 50 designs. And then we updated it to a hundred. And yesterday, we talked about over a 120 11th Gen Tiger Lake-based designs shipping in market. And what's even more impressive with that is 50 systems Evo-certified. And that's just an additional layer where it's not just correct by construction. We test, verify in our labs with our partners, and again a single experience. That's something nobody else is doing in a comparative way. So from that standpoint, from a design win, what you'll see in market, the breadth of what we're doing in consumer and commercial; we feel really good about the overall 11th Gen ramp, in addition to the number of designs we saw an increased demand in Q4 in particular. And our manufacturing team was able to rally to that, and we exceeded our early ship expectations.

So we think we're poised and have the ability to gain share, and that's not just in the 11th Gen line. In the education segment, in the entry segment with consumer, institutional bought education; as we've expanding our capacity, that's an area where we pulled back a little bit from customer support to support higher-end segments. Very strong ramp in that volume as we closed out the year. And one of the other introductions that we did yesterday was a new efficient core 10-nanometer product specifically for kind of that education and chrome segment in particular that we've seen have tremendous market growth. And so that's not just a function of units. It's also we're continuing to design and innovate and apply our latest technology, both in process, but also in architecture across the whole spectrum of the market. And so we think that gives us a lot of opportunity to continue our growth.

Harlan Sur: And then as it relates to building upon the success of what appears to be strong success with Tiger Lake, I think yesterday but even before that, I think you guys were targeting to roll out your high-end mobile SKUs, called your H SKUs which are targeted for things like enthusiast-class gaming. And then yesterday you also introduced, as you mentioned, your vPro commercial line of Tiger Lake SKUs as well. Is all of this on track for a first half of this year kind of ramp?

Christopher Walker: Right, all those are on track for the first half. So in the case of bringing 11th Gen and vPro platform technologies, you'll see a series of partner announcements coming out. Those will be shipping. The systems will be shipping in Q1. We announce for ultra-thin and light, so we're talking about bringing 4K gameplay to systems 16 to 18 millimeters thin. That's incredibly thin and light, paired with discrete graphics. That's a level of gameplay that's just unheard of in those types of things.

So we did a special edition H series processor, high-frequency, great I/O attached to the CPU, specifically targeted for what mobile gaming -- the most mobile gamers want. And that's going to be frame rates that we think are unmatched. Those are shipping starting -- we'll be shipping this quarter. And then in the first half of this year, we'll extend the Tiger Lake or the 11th Gen architecture for mobile to 8 cores. Now remember, it's not about the core count, it's about what they can do, 5 gigahertz across multiple cores, but desktop caliber; wide, wide I/O that enables really fast storage, the highest capability in graphics attached to the CPU. And those will come out in the first half of the year. So all those execution on track, not just from the CPU standpoint, but from the platform-level capabilities that we're bringing in with our partners, and some really exciting design points. So I feel really good about what we're doing in the 11th Gen portfolio overall.

Harlan Sur: And then if we look at your next generation, and I think you and GB gave us a little bit of a hint of that yesterday, right, with showing us Alder Lake, which is your 12th Generation core family. I believe this is going to be using your hybrid architecture, tile-based, so you'll have the high performance core processor tiles and slower -- maybe slower but more power efficient Atom-based processor tiles, all integrated using your advanced packaging Foveros technology. I think GB mentioned yesterday the team is still on track to ramp products in the second half of the year. My question to you is, does that include mobile, number one, in the second half of next year? And then what does the hybrid architecture provide the team and customers in terms of performance and power consumption benefits?

Christopher Walker: Yes, so Harlan, while we haven't detailed all the "how" we're achieving that next (inaudible) performance with Alder Lake, what we're doing is bringing two architectures together. So we're going to do another step function in our performance-orientated core architecture and another step function in our efficient core architecture, so two new CPU architectures brought together in a hybrid design point. Those are enabled by a next-generation or next level of our SuperFin technology. So we're iterating on the process as well to make those optimal, much like you saw in Tiger Lake or 11th Gen.

So what the expectation of benefits you can have is you continue to lead, and continue to have your best single thread with bursty (ph) performance that allows us to, with a hybrid architecture, continue to scale and efficiently in multithread. It's not just about throwing cores at it. It's the intelligence balance of performance and efficiency together where people are going to be able to gain performance, gain scalability, but still maintain efficiency of the overall design. You'll see us continue to enhance connectivity, I/Os on the platform. So it allows us an architecture to continue our performance scalability, but also bring in many of the other platform elements. And that's going to be both desktop and mobile, and we expect to be in production in the second half of this year on that exciting new architecture.

Harlan Sur: And Tiger Lake was the first product to integrate your new Xe GPU architecture, right?

And the reviews and benchmarks have actually been generally very positive. And so what type of enhancements is Intel planning to bring to market in future CPUs with integrated graphics like your next-generation Alder Lake products? For example, given the hybrid architecture, I would assume that maybe whatever next generation Xe GPU is going to be in Alder Lake that maybe it's its own separate tile. Is that kind of how the architecture is going to work out?

Christopher Walker: So we won't talk about yet what we're doing in next-generation graphics, but what was interesting on the Xe architecture for low power, is the ability not only to do the levels of 3Ds, bringing in high-quality 1080p AAA titles into very thin and light systems on the integrated graphics. But graphics is more than just at 3D render. So we were able to bring in things like AB1. So YouTube, when you stream on the AB1, you're using less of your Wi-Fi bandwidth. We were able to use DL Boost in technologies on that Xe architecture to accelerate AI workloads in things like Adobe. So there's a lot of software work we can continue to do on the Xe architecture in both AI, in media to continue to expand the capabilities.

And then in the broadest sense, and I won't detail anymore, but we will be able to extend our Xe architecture into discrete-level Silver (ph) performance. We did that first at the end of last year with our Iris Xe MAX, showing how for content creation, we can be very power-efficient and pair that with the integrated graphics and do some cool capability for content creation. We have the ability to scale our Xe architecture into higher levels of both 3D and media performance at what would be considered discrete levels this year as well, and we'll detail more of that later in the year. So we're excited about what the Xe architecture allows us to do across 3D, media, and also AI capabilities.

Harlan Sur: I'm getting a question from an investor and I think we've gotten this from multiple people on the Evo branding. So what does the Evo branding mean as it relates to first of all Intel differentiating your products, but also maybe building a stronger ecosystem with some of your customers?

Christopher Walker: Yeah. And so the Evo platform and that brand introduction has been a really important way that we work both upstream with our ecosystem partners, and delivered something that has a unique and identifiable promise to the end user. So it starts with we worked with 150 companies, hardware and software, through the ecosystem to better tune and enable their components, their capabilities for true mobile performance. The heart of what Evo does is we did a lot of research. And this isn't just surveying. We had people who live with people to learn and observe how they use their PC. What we found is for a mobile go-getter you have been thought in the past of somebody who is on the road. But it equally applies to moving from your desk to your couch to your backyard.

What people wanted was "and." They wanted a high-performance, highly mobile laptop with great performance and responsiveness. What Evo does is it guarantees your experience. It says you lift the lid. It responds in less than -- it wakes in less than a second. So you're in and productive. We do a string of key experiences. This is beyond benchmarks. This is real applications in the real world with concurrent usages of web browsing and productivity happening all at once. And we say, that responsiveness is there. That performance is there, whether you're plugged in and also on battery. What we see from some of our competitors is, they do a performance claim and they do a battery-life claim. They don't do the two together. And so it was really important for us that that

mobile experience is there, whether you're plugged in or on battery, and that battery life is true all day, 9-plus hours in the real world with brightness at real settings. We're not dimming it down so we can a 20-hour battery life plan, which we could, right? It's how you actually use the system.

It says that every Evo system does fast charging. Every Evo system has premium speakers and mics calibrated and verified in our lab. And that's where it's important that we do a brand promise too, is all those are certified and verified with our partners, so that people get that experience. And that we think is -- it uses all of our technologies, all of our client engineering together in really unique ways, also the best in wired and ROS connectivity.

So we didn't talk about this in the competitive part, but Wi-Fi, we're all so dependent on our connectivity. Every 11th Gen core platform and actually even our newest entry platforms that we launched have Wi-Fi 6 built in. This is gig-plus speeds. We also announced yesterday Wi-Fi 6E or extended, clean spectrum in the US that we worked with partners and the FCC to get for Wi-Fi. It means you're going to get gig-plus speeds. And when you do things like our killer Wi-Fi experience, you can prioritize your workload in your household for the best experience. So this is levels of capability that Evo promises we do across our 11th Gen family that we think makes a real difference in how people live and experience, in especially these critical times.

- Harlan Sur: Yeah. I've got an investor question coming in here. Is the manufacturing process for 7 nanometer on track at Intel?
- Christopher Walker: We're going to let Bob talk more about our manufacturing status and process during, I think Ben, it's Q4 earnings, correct?
- Ben Thom: Earnings next week.
- Christopher Walker: So you'll hear more from Bob on that.
- Harlan Sur: Okay. Well let me try to ask something differently, which is on manufacturing that you're currently using for Tiger Lake, because I mean I think this is your third generation 10-nanometer, right, SuperFin 10-nanometer process, high volume production. Can you just give us a quick update on yields and manufacturability? Is it where you targeted it to be, I mean in terms of yields and manufacturability?
- Christopher Walker: Yeah. I think when we look at -- and I talked a little bit about through the course of Q4 we were actually able to meet upsides on Tiger Lake and 11th Gen SuperFin. We got three 10-nanometer factories running right now. We feel good about the overall ramp. We just introduced a 10-nanometer entry part into the market with our Jasper Lake platform. And Bob's talked about it, you know, we expect in 2021 we would at least for client we would cross over with 10-nanometer in our volume manufacturing. So we feel good about the ramp. We feel good about where we are today in both the product performance delivery and our overall volume on 10-nanometer.
- Harlan Sur: You guys have done a good job -- a great job actually -- moving up the stack. Your ASPs keep -- for a while kept going up. It seems like you're extending 10-nanometers into the low end. You talked about Chromebook segment of the market. Are those products

targeted to come out in the first half of the year?

Christopher Walker: Correct, yeah. So the latest Celeron and Pentium Silver products that we announced yesterday are -- we have PC (inaudible) partners who have started their shipments into their channels. So you'll see those in the first half of the year.

Harlan Sur: And then just to do a check, so you are saying that Alder Lake is going to be using an enhanced version of your 10-nanometer SuperFin technology, right? So it's like a Gen 4 10-nanometer?

Christopher Walker: We're not really doing the Gens of (inaudible) 10-nanometer, but it will be an enhanced version of the SuperFin technology, and that's one of the advantages that we do in our IDM approaches. There's a lot of -- there's obviously very strong co-optimization with the design team and the technology development team to get the most out of those enhancements. We showed that on the Willow Cove core with Tiger Lake and 11th Gen. And we'll do that again with Alder Lake.

Harlan Sur: And then one last question, because I know we're running out of time. But the team said in the last earnings call that you guys were actually sampling Alder Lake in Q4. In other words, the December quarter of last year. I think all of us has assumed it was for desktop. But did that by any chance also include sampling Alder Lake for mobile as well?

Christopher Walker: I probably wouldn't go into what the engineering has done. Both desktop and mobile Alder Lake, we expect to be in production and shipping to our customer in the second half of this year.

Harlan Sur: Perfect. Well, we're just about out of time. Chris and Ben, I appreciate you spending the time with us. 2021 is shaping up to be it looks like a pretty strong year in terms of compute adoption. And so we look forward to continuing to monitor the growth trajectory of the Intel team, as well as the execution. Thank you for participating with us today.

Christopher Walker: Thanks, Harlan. Thanks, everyone, and we look forward to delivering great products for all of you.

Harlan Sur: Thank you.

Ben Thom: Bye, Harlan. Appreciate it.

Harlan Sur: Thank you.

Christopher Walker: Bye all.