Intel Corporation

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Tim Arcuri:	Good afternoon. Thank you for joining us. I'm Tim Arcuri. I'm the semiconductor analyst here at UBS. And very happy to have Intel for this session. With Intel we have Gregory Bryant who's the Executive Vice President of the Client Computing Group, CCG at Intel. Almost half of the revenue. Pretty much half of the revenue of the company.
	So, before I turn it over to Gregory for a couple remarks, I just want to say that as a reminder today's event includes forward-looking statements. All statements made that are not historical facts are subject to a number of risks and uncertainties. And actual results may differ materially. Please refer to Intel's most recent earnings release, Form 10Q and 10K SEC filings available at their website intc.com, for more information on the risk factors that could cause actual results to differ.
	So, first of all, thank you Gregory. I'm going turn it over to you for a couple of comments.
Gregory Bryant:	Thanks, Tim. Thanks for joining and thanks everyone for being on. This is my first UBS fireside chat. So, I'm really excited to be here with you today to talk a little bit more on the journey that we're on at Intel and to really embrace the incredible growth opportunity that's been created by this data revolution.
	Before we got started, I just thought I'd say a few words. It's certainly, it's an exciting time in the industry. It's an exciting time for semiconductors. It's an exciting time for Intel. And it's really all rooted in the explosion of data and the need to move, process, compute, store that data, essentially to drive insights and meaning from the data. And it's growing exponentially.
	And we believe it's fundamentally leading to a new era in computing. We talked about the PC and server era, the cloud mobile era. Now we talk about this era of distributed intelligence. And the way I like to think about it is in that era of distributed intelligence computing is pervasive and intelligence is actually distributed from the cloud through the network all the way out to the edge. And that's where we see the biggest opportunity for

growth for ourselves and our customers.

And we've focused really in on three key technology inflections. I know we'll hit on some of those today. The growth in AI. The 5G network transformation. And what we call the intelligent autonomous edge. Those three key technology inflections are core to the growth and the strategy of the company.

And then as a result of these new technologies, and that pervasive computing, we're a computing company at our core, as a result of that we're dramatically expanding our TAM. And we've set ambitious goals for the company and we're focusing the company on the opportunity.

But there is also, in order to capitalize on the opportunity that exists, there's three fundamental transformations we're going through at Intel in my business. One is from a CPU to an XPU company. And just quickly, think about that as, in order to service this growth in computing, in all of its forms, you need more than one architecture to compete and to win. So, we've been working and transforming ourselves from a CPU to an XPU company. So, think CPU and the GPU and AI chips and FPGAs etcetera in order to capitalize on the opportunity.

The second is we're transforming from a silicon company, just a silicon company to a platform company. And that's really important as we have to help our customers deliver solutions so that they can take advantage of that data and create meaning. In order to do that, we have to not only lever silicon and other platform hardware, but increasingly we've got to deliver software in conjunction with developers in order to create solutions and new ecosystems.

And then lastly, obviously, we're an IDM, and we're evolving our IDM model to becoming a new modern IDM that's really focused on leading the industry based on our desegregated design capabilities, which I know we'll talk about, but also our scale, our expertise, our flexibility, our innovation. All in an effort to bring leadership products to market. And those leadership products can leverage our process packaging architecture, interconnect security software etcetera.

So, we just think, hey, we've been on this journey now for a while to transform the company, to capitalize on what is the largest opportunity in the history of the company. We're on our way. We've got more to do. And we're focused on executing to that strategy.

So, with that maybe I'll just stop there, Tim, and turn it back over to you.

Tim Arcuri: Thanks for that. I thought I would start, you've been at Intel for almost 30 years. And I think maybe only Rob Crooke has been there a bit longer than you among the executive management team. But you're really one of the longest tenured on the team. So, I guess I thought I'd start there and sort of in that light maybe you can talk about some of recent changes in the org structure and maybe how you think it makes the company more efficient to tackle some of the challenges that you had previously mentioned.

Gregory Bryant: Thanks, Tim, for reminding me of my tenure. I appreciate that.

You're right, I've been at Intel for quite a while in a number of roles. And the one thing that I'd say I still continue to be impressed by today is how this company, how Intel, when we're facing a challenge, how we rally and we get focused. And it really brings out the best inside of the company.

And obviously when you're talking about the largest growth opportunity in the history of the company, and we're talking about expanding and growing computing in these new forms, not just CPUs, but GPUs and AI chips and XPUs as I just outlined in the opening there.

You can imagine that it's, by definition, that environment is going to be more competitive and there's going to be more challenges. And to me that just has forced us to focus, that brings out the best in us. And we've got a really good strategy, but it's up to the team to execute.

And with regard to the execution, you highlighted a great point which is we've made some changes on the leadership team. And I think one of the things that's helped the most has been the flattening of the organization that Bob did that we've done on the leadership team. And really what that did is it took a level of management out, especially in the technical areas.

So, all of our five key technology leaders, manufacturing and operations, technology development, engineering, supply chain, etcetera, all on the architecture, those are all on Bob's direct staff now. And they're in our executive leadership team directly. So, now you have everybody, including all the core technologists in the room mixing it up on the key challenges and on the strategy and how we go forward. And I think that's really helping us hit things more head on, be more flexible, more nimble. And respond to challenges more quickly.

And I think, you didn't ask, but part and parcel of that has been this focus on cultural change and really acting more as one Intel to these top challenges. And I think just having us in the room, mixing that up really, really helps. For example, on our ELT, every week we meet. Every week that team meets, we meet as a team and we hit and talk about our biggest challenges and progress head on, week after week. And what we can do to help each other and move the company forward.

Tim Arcuri: Great. Thanks for that. Let's just dive into some market questions. I guess, with respect to your business, you've come in above guidance for your segment for, I think, four of the past five quarters. And CCG has been very resilient, mostly on the mobile side. Q3 was well above normal seasonal. And even off of a pretty strong Q3 comp, the Q4 guidance is only just a touch below seasonal.

So, the market's been pretty resilient and you've done very well. Obviously there's some work from home factors there, but the market still seems to have legs. Can you just talk about the different market dynamics as you see them for both mobile and desktop and maybe how that sets you up for next year?

Gregory Bryant: Sure. First, I think it's important, it's remarkable where we are as we sit here today. I

think back to 2019 and where I was in 2019 thinking about 2020. And as you guys probably remember, there was strength in the PC business, largely driven by the Windows 10 refresh. And I can remember having conversations coming into 2020 and the discussion was really around, hey, the first half looks like it would remain strong and then that refresh cycle would mature. And then the second half we were having debates about how the second half would play out and how refresh might be impacted etcetera.

And we at Intel, we came into 2020 the year with kind of a plus or minus 1% of our own internal forecast for the TAM, which was above a lot of the third party analysts at the time. And I remember discussing that with our customers. Here we are, as we sit here today with the PC TAM up kind of high single digits, maybe even double digits for the year as we prosecute Q4.

So, I just think it's amazing. Obviously as we saw COVID hit, let me just give you a little bit of context. We saw two big kind of disruptions if you will. First was just an increase in overall demand. And certainly that was driven by the need to work from home, to learn from home, across the world. Really drove a spike in demand. And then obviously, it actually maintained demand through the year as we've seen, especially in mobile as you've said.

But then the second disruption was in the mix of the demand. So, it wasn't just more demand in the current profile. It was a significant increase in consumer demand and the demand for education-based products. As well as a shift from desktop to mobile. Which had already started, but was certainly accelerated by COVID and these work from home and learn from home trends.

So, obviously we've, as we got into Q3, we said that we expected that those trends would continue into Q4, as you noted. And we talked about that. It's not, to your question on 2021, we're obviously not through Q4 yet. We haven't said anything about 2021 yet and I'm not going to update or do guidance for 2021.

But I could say that as we sit here today, that we've seen that trend continue in Q4. Probably better than our expectations. And I temper that a little bit just by saying obviously a lot of that strength is in mobile, consumer and education, which is accretive from a revenue point of view. It puts a little bit of pressure on the ASP obviously because the ASPs of those businesses are just a little bit lower than large enterprise for example. But overall, we've seen that demand hold up and be strong here in Q4. And we feel pretty good about the opportunities as we go forward.

And largely because some of these changes, the essentialness of the PC and its role in helping people learn from home and work from home and be productive and compute, partly it's because we've seen a lot of increase in density. It hasn't just been a refresh play. And that hasn't been talked about much. But the density has gone up. The number of PCs per household or the number of PCs per student around the world has gone up.

And then we do think even as we get into 2021 there's an opportunity for a refresh of those initial Windows 10 systems which are now four and five years old. And then as you can imagine, the experience delivered for today's needs on a new Tiger Lake system for example, versus something that was four or five years old, pretty dramatically

different.

Tim Arcuri: Got it. I guess as you step back and maybe do some planning for your business and sort of how, what the right three to five year growth rate is. Do you still think it's sort of like plus or minus 1% as you thought that the TAM would be coming into this year? Obviously, you're running above that. But at some point we're going to see some diversion in the market. Do you still think plus or minus 1% is the right longer term growth rate?

Gregory Bryant: Well, when I said plus or minus 1% I was talking about our forecast for 2020 when we were sitting back in 2019. I mean, again, I'm not going to give guidance like that for 2021 here today. But I would say, some of these trends, and this is what I found interesting, some of these trends are going to continue.

The essentialness of the PC and, you and I talked actually at the very beginning before we got on the phone about working from home. And even post-COVID I think we've seen a lot of companies discuss how they're going to approach things in a post-COVID world. And I don't think the answer is we stay extremely mobile and everyone works from the home office every day going forward. On the other hand, I don't think we go back to the way things were totally pre-COVID. I think it's really something in between.

So, I think we feel like hey there's still an opportunity for density in the consumer segment. We think there's certainly an opportunity for density in the student segment as we look around world and that trend to get more devices in students' hands I think won't go away. We still think there's a significant refresh opportunity, as I've said.

And then you look at the innovation that we're bringing to market. In the mobile space, you guys know, we're shipping our 11th gen core Tiger Lake systems today. We launched a brand new platform brand project Evo where we're actually validating the experiences on those systems to make sure they respond to what people want in their PC. And then we're collaborating with our OEM partners and with Microsoft and Google and others to bring innovation and new experiences to market. Whether that's in the CPU, better graphics, better connectivity, better security.

So, if you think about this Tiger Lake today, going to in the very first part of the year, Rocket Lake on desktop. Our high end Tiger Lake into mobile. Gaming and content creation segment and then onto Alder Lake in the second half of the year. We feel pretty good that the combination of density, refresh, some of these trends, the maintenance of some of these trends that had started in COVID continuing. And then obviously the new innovation that we bring, I think says hey there's a decent opportunity out there for the PC business as we go forward.

Tim Arcuri: So, I just wanted to double check on the Tiger Lake. So, (inaudible) your demand's been very strong, up 30% or 30% better in the back half than what you thought. That's of course one of the things that hitting the corporate margins.

But I get the question all the time, and you kind of talked about this already, if everyone just upgraded their notebook because they work from home, who's going to buy Tiger Lake? Can you talk through how sustainable demand is for Tiger Lake? And the

notebook upgrade that we've seen? I guess I asked because that's a very important aspect for you to hold off the competition that is making some gains, at least from an overall share point of view.

Gregory Bryant: That's great. And it's a great question. You're right. The demand for 11th generation core for Tiger Lake has been incredibly strong. We're up 30% already in the second half versus what our expectations were. And we're kind of just getting started.

One of the things that I like to say is we come out in the first part of next year with our Tiger Lake age platform. And our vPro platform for business in Q1, as a matter of fact for business, our stable skews for the enterprise environment.

We're just getting started so I think there's a lot of room to run in Tiger Lake. We're well north of a hundred designs as you know. And we're more and more ramping and launching as we get into Q4 and into Q1.

But to your point, as I said, I think one of the biggest factors is it's not just about refresh, it's also about density. And a very small move in the household density rate, the number of PCs in a household, you can make a tens of millions of units different on the TAM. And I think that's really instructed to look at. And the same thing in terms of, I think the worldwide, the penetration of number of devices, all devices, number of devices per student worldwide on average I think now is somewhere around 7 out of 100.

So, I think there's a lot of room to grow. We're obviously seeing that accelerate in a COVID, post-COVID world. It's certainly much higher than that in the United States. But the global opportunity is significant. So, I think it's up to us to continue to drive the experience, the essentialness of the PC to increase density.

And then we are partnering with our OEMS and Microsoft and Google to continue to drive refresh. It's not to say refresh isn't important, as I said. There are hundreds of millions of older systems, three, four, five years that we can go target, where the performance, the collaboration capability, the intelligence, the security of a new system is dramatically better.

That's how I think about it. And if you look at, the other thing in terms of competition, just to hit on a little bit briefly. You've seen the demand for Tiger Lake and for the Evo platform as well. We've seen strong demand for that vis a vis competition. And we've been focused on this transition to really focusing on real world experience.

I haven't talked about this much publicly at all, but we lead our platform development, our architectural development with understanding the workloads on a client and how people use systems, doing deep primary research. And then we translate that into usage models and then we kind of break that down into architectures and capabilities that we need in the platform.

So, the journey we're on is hey it's not just about synthetic benchmarks. Let's drive the real experience to be good. And you see Tiger Lake versus somebody like AMD, 24%, 25% better in productivity, twice the gaming performance, two times the frames per second for entertainment. You see the pay off and the work that we've done and I think

that'll also, we feel obviously very good about how that platform competes in the marketplace.

Tim Arcuri: Great. I just wanted to double check on two things you said. The first is people see the ASPs and CCG and mobile and they see that the ASP has come down and you talked about the mix. How you had more mix shift to the lower end of the stack, consumer and ed.

But looking at the mercury data, people also say well, AMD started to gain some share. So, can you sort of just aggregate the two? And maybe hold people's hand and say that the two are not really linked? That pricing is coming down more because of the mix and you're not beginning to cut pricing like for like because of the competition.

Gregory Bryant: Thank you and thanks for brining that up because I do think with the disruption and mix and demand that we've seen I think it's important to consider that as well as the comps from a year ago. One, obviously it's a competitive environment. We've always said it's a competitive environment and I think through three quarters of the year it's played out pretty much in line with how we thought the year would play out to date, with the exception of maybe the TAM being a little stronger.

So, that said, there's a couple of key dynamics that are playing that I should probably hit on. First, as you can remember as we were back a year ago, we were a little bit constrained especially in our ability to meet demand, in kind of that education and low end of consumer. And obviously we've improved our capacity and supply. We added 25% more capacity year-on-year in order to drive the business. But we lost some share earlier in the year because we were constrained and we think we're largely over that constraint now.

The other thing in terms of ASP is we have these mix shifts, and you're right. Now that we are supplying the education segment fully and consumer and we've seen some mix from desktop to notebook that does have some pressure on ASP. Obviously it's accretive to a revenue point of view, but it puts some pressure on our ASP.

The third I think to understand, to your point, is it's a skew compare. Because a year ago, if you do the compare, our ASPs were artificially, or kind of were high and looked higher than normal because that low end wasn't in the mix. So, it kind of skews the compare with where we are now. So, those were, to me the ASP dynamics now are far more about the mix, the compare, us getting back into the low end, the shift towards consumer and education from large enterprise, the shift a little bit from desktop to notebook. That's way more of the dynamics overall.

And to you point, I think if you look at how we're competing with Tiger Lake and Evo and desktop going to, we see desktop starting to recover a bit in Q3. I don't know if I mentioned it, but in Q3 our desktop volume sequentially was actually up a little bit Q2 to Q3 which was a good sign. And I think that continues.

So, you put that all together. I think we feel good about our ability to compete. And the ASP dynamic is much more weighted towards the mix, the compare and us driving growth in that consumer and education and notebook segments versus a broad

competitive price dynamic.

Tim Arcuri: Got it, thanks. I wanted to pivot and talk a little bit about ARM. And there's a lot of talk about what's happening. A big company based locally is shifting over to a captive solution. And so I guess my question is, how much of a threat do you think ARM is for your business? Or would you not extrapolate what that customer is doing given their resources and their ability to integrate hardware and software?

So I guess that's the first question. How do you view ARM sort of in terms of what that customer is doing?

Gregory Bryant: I think maybe just to give you context, I'll hit on it. You think about the PC business and how essential it's become and how important it is in the world today. And the fact that it's growing. We've grown CCG at Intel the last five years in a row. I think it's become clear to everyone that this is a great business and it's growing and it's important. I think that obviously just breeds competition.

And we've always said only the paranoid survive. I think that's alive and well inside of this company. And I take all competition, whether that's from Apple or the other ARM guys, Qualcomm, MediaTek or AMD, I take that all very seriously. And I think anytime you're in a growth business, and a healthy business, there's going to be competition.

That said, we absolutely intend to compete and to grow. And we feel good about our performance and our roadmap. Obviously I don't speculate about products from competitors that haven't arrived. But I think if you look at our performance on 11th generation core and the roadmap that we have coming immediately in 2021 in the first half with Tiger Lake H and then Alder Lake in the second half. We feel good about being able to deliver real world performance.

That was a big shift and I mentioned that in the last question, Tim. That was a big shift for us. It was like hey we need to drive performance in a way that users care about and that they can see it. In fact with Evo, we're like let's go all the way to the end user and with our OEMs and validate, actually verify that you can meet those experience specs, whether that's responsiveness or battery life or boot time.

We want to go all the way to the end to make sure that experience is great. And I think that's key to our competitiveness going forward. One, it's something that we can uniquely do because the engineering talent, massive engineering talent we have working with our customers and our partners is kind of unmatched in the industry. But B, because increasingly, that's the basis of competition.

So, we've got to go lean into that. And that's what we've done. And I think we've got great real world performance across a large range of X86 based consumer and business apps that matter to people. We've got the best support for gaming and AAA titles which matters to people. And we're doing a lot of this deep co-optimization with OEMs to drive choice in platforms, whether that's detachables or convertibles or classic notebooks or thin and light modern devices. We're driving a wide range of form factor choices.

So, it's up to us in a competitive environment, it's up to us to innovate and bring more

value to market and compete. And that's our job. And that's where I have the team focused.

Tim Arcuri: I guess just on that point, Windows on ARM only works on Snapdragon and Qualcomm has sort of been the one funding the Windows efforts. But and video is certainly cranking up the effort to build out the ARM ecosystem, whether or not that deal closes they're going to push that. They're talking about doing gaming on ARM based PCs thing like that.

                   So, now there is a large company that's going to start to push the ARM platform more broadly into the PC world. So, have you sort of thought about ARM? And maybe why hasn't the company looked at ARM more? And sort of hedge your bets a bit on ARM? Can you just sort of talk and zoom out a little bit and look at how maybe in video changes the ecosystem a couple years from now?

Gregory Bryant: I would look at, that was a complex question. I would zoom out and say, hey look in that world, if you go back all the way to my opening comments, in a world where computing is pervasive, in all these segments, data center, network, intelligent edge, the PC, we're talking a lot about the PC today thank you. In that world where you need multiple architectures to compete, I think what you see is folks are coming, companies are coming to the conclusion that you need multiple architectures at scale in order to compete and win.

                   And that's something that we've been doing. That's the path we've been on. We were a CPU company. We've added FPGAs. This year we launched our first GPU. You saw us with Havana, with an AI chip architecture. With a win at Amazon. It's the combination of the shift from hey it's no longer a one architecture game. And we're rapidly making progress going from a CPU company to an XPU company which includes those different architectures and the platform and software work at scale.

                   So, that's how I think about it at the high formal. That people are, I think it's just validating that we're on the right path. And our job is to go out there and win and execute it better and be out in front.

                   You take that down to my, to the division, to the CCG business and I think it's kind of a microcosm of that playing out where you look at how we're competing in the PC, yes it's about the CPU and we want to have a leadership CPU and different people to find that differently to make different optimization choices. And different roadmaps and different paths. We feel good about ours.

                   But then you look at what we've done, we've integrated now discrete level graphics capabilities with our XE graphics in integrated and added to discrete GPU. You know I already have a leadership position in Wi Fi and Wi Fi 6 and soon to be Wi Fi 6 extended that we've integrated in the SOC. We've got Thunderbolt 4 integrated in. And of course we have AI acceleration with DL Boost and other technologies that we're working on the roadmap to accelerate AI.

                   So, even in the PC, you see this kind of microcosm of multiple architectures, how they get integrated, then exposed in software. And to me, that's the game. That's the ballgame

and it's up to us to innovate and lead and win as we make as we go drive those architectures.

Tim Arcuri: Got it. Thanks. Since we only have about 10 minutes left, I'd be remiss if I didn't ask you some question, at least one question about manufacturing. And so, I guess when I look at the difference between your business and DCG, DCG was a fact follower on ten nanometer. You led the way on that node. And so, I guess the question is how the push out in seven nanometer is affecting your roadmap?

Gregory Bryant: Let me just back up and maybe say for us kind of first and foremost, and we've said this, it's important to remember that our customers, the thing they care about the most is that we deliver predictable cadence of leadership products. That's what they want from us. Predictable cadence leadership products means they expect high performance, differentiated capabilities on our roadmap, on schedule so that they can integrate our products and our platform into their products and their solutions that they bring to market. So, for us that is first and foremost.

And as you noted, on ten nanometer, we made some great progress in ramping three high volume factories already on ten nanometer as we talked about with Tiger Lake. We're ahead of schedule. We're kind of at or ahead of schedule on all of our internal metrics for that ramp.

And then we introduced SuperFin technology, our ten nanometer SuperFin technology. Which is the single biggest intranode innovation in a transistor that we've had ever. It's like the equivalent of all the 14 nanometer plus innovations we've made over the years in one big leap forward. It's like a whole generation leap.

So, we feel really good about not just what we did in 2020, but 2021, the roadmap we have for 2022 and the progress that we're making. So, then obviously as we think about the seven nanometer transition and capability, we feel confident that we've got to deliver on this predictable cadence of products.

Since you brought up manufacturing, maybe it's good for me to even take a step further back and just say, the IDM business model, and being an IDM, has been a core of our business model at Intel forever. And it's a core part of who we are and what we do. And we've made it clear that hey, we intend to be an IDM as we go forward. And invest in leadership process technology.

But with that said, we've also said hey in order to service this broad market for compute and these multiple architectures that require multiple IPs etcetera to compete, that we were going to be on a path toward this aggregated design.

And I'm sure, Tim, you've heard us talk about that. This aggregated design is a path that we were on that actually helps us through advanced manufacturing and packaging techniques to be able to mix and match different IPs on different nodes in a kind of chiplets or compute tiles and integrate them together to deliver a single product.

So, with that said, a lot of times these decisions then become product level decisions where you're like, okay for this product in order to guarantee a predictable cadence of

leadership products that our customers care about the most hey what are the right choices to make on these individual tiles and chiplets in order to get that product to market on time. And that's what we've been working through as a company.

But just for emphasis, delivering on that predictable cadence is job one for us.

Tim Arcuri: So, you don't have a preference for your business. You're agnostic whether something is insourced or outsourced. You care just about the predictability of the cadence. Is that right?

Gregory Bryant: I think it's a recognition to say we're an IDM. We're going to invest in leadership process technology. And when it comes to keeping our factories full absolutely I have a preference. I want to keep our factories full. And with the growth prospects that we stare at and the fact that we need multiple architectures and IPs and manufacturing in order to fulfill that demand, hey we've got to make that investment in IDM and in process technology leadership.

It's also though just a recognition that it's not one size fits all and one architecture and one process technology and only internal IPs, etcetera. We're not going to do everything ourselves. That's already the case. We don't do that today. But it's a recognition that with our aggregated design capability we can be smart about how we mix and match IPs and process technologies in order to bring them to market.

I would say one thing, the IDM model as you know in our history it's been great because not only do we invest in leadership process technology for performance and schedule in that predictable cadence, but we also get great control and capability in our supply chain. And that obviously has attracted economic returns.

It's just so fundamental. You think about the demand, the shaping, I'll just make it real for a minute. Here we are in 2020, you think about the radical disruption of the size and shape of the PC demand that we just saw. Man, as an IDM, our factory manufacturing and operations team, incredibly responsive within lead time to redirect wafer starts, change the mix, and help me grow CCG and the business which you highlighted for Q3. That's incredible.

I want that supply chain control. I want the attractive economics. I want to use our precious capacity to drive performance leadership and the IPs that matter the most. And then obviously we've got flexibility now with this aggregated design to be able to leverage other IPs and process technologies where it makes sense as well.

Tim Arcuri: Got it. Interesting point on the captive supply chain. I just wanted to make sure, so in DCG I know there are separate design teams for insource versus outsource. Is that also the case for CCG?

Gregory Bryant: I mean, it's a little bit early to be talking about design teams and how we're focused and get into that level of detail. We said, hey we're focused on making this decision about our 23 roadmap and where some of those tiles or chiplets would be manufactured. We said we'd come back with an update in January and we'll give you the update in January.

Tim Arcuri: Perfect, got it. I wanted to also go back to ARM conversation. And I wanted to ask you about RISC-V. And it's a topic that people ask more about. And I wanted to get your perspective on how much of a threat you think RISC-V is? It seems like there's not a lot of money behind it. But maybe it's a threat for Edge or IOT. So, can you just talk about RISC-V?

Gregory Bryant: I don't have a lot to add specifically about RISC-V other than to say if you kind of back up and you think about the opportunity that exists in IOT for example, which is kind of an area that you just hit on. And you think about what capabilities are required. I really do think it goes back to this it's not just the architecture, one architecture, it's not just the CPU. It's the CPU, increasingly in IOT it's a great example.

I can give you great examples of, it's the CPU, it's potentially an FPGA. It's the VPU or the AI inference capability for example. And it's having something like OpenVINO which you've seen from us. It's the software then that enables developers to create solutions in software which can kind of dynamically look at which accelerators like in an IOT space for industrial or retail or pick your example, which accelerators should be used to best service that workload out at the edge and then make the choice appropriately, make it easy for the developer to deliver solutions.

So, we've been approaching it, yes with X86, but also across this broad set of architectures and capabilities. And then the key is how do you make it easy for developer to take advantage of those with something like OpenVINO, which has worked incredibly well. And I think until the kind of recent COVID dampening, you saw tremendous growth in our IOTG business year-on, year-on, year-on-year until recently which we think is temporary obviously.

And we're excited about the growth and not only have we done OpenVINO software to help our customers and developers create solutions, we've even stood up at the ISV software marketplace that has, I think now we're around 15,000 kind of end user solutions, blueprints or recipes that are available in the IOT space. So, that's kind of how we're approaching it. That level of competition.

Tim Arcuri: I think we've run out of time. Thank you for your time. Appreciate it. Thanks to all.