

**Intel Developer Forum San Francisco Keynote  
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**Sean Maloney**

**Female Voice:** Ladies and gentlemen, please welcome Sean Maloney.

Sean Maloney: Well, hi, everybody, and welcome back to IDF. I have the easiest job in the room here today because I have the most amazing stuff up on stage that I'm going to be showing you in the next 45 minutes or so. But I'm going to start with the most famous slide in IDF, all of you have this memorized, and I'm sure it's all up in your bedrooms at home, tick-tock. Tick-tock, of course, is about innovate, integrate, innovate, integrate. But we tend to focus on the innovate side of that. I mean, nobody writes books about the integrator's dilemma or anything like that.

But integration, itself, of course, is very much a part of this. And as this is the year that we begin that transition to the second-generation high-k metal gate 32 nanometers, I am going to be spending a pretty considerable period of time looking at integration. And of course in our industry it has always been thus, taking you back to these two pictures up on the screen here. On your left-hand side, that black and white picture of ENIAC, some 26 tons of stuff, 680 square feet. Let the record state -- I think that's a man you can see there -- let the record state that the first programmers were all women.

But, anyway, if you wind the clock forward to 1965, the picture on the right-hand side there, maybe it's 1967, that's the IBM 360. A lot of that was about integration. Don't be confused by the boxes at the back. They are tape readers. The actual CPU was much, much smaller, and it was much more highly integrated. The IBM 36065, by the way, was the first computer that I programmed on. I was 18 months old at the time. They had a creche thing in them. Not.

Anyway, that was the history of integration. If you go look at the microprocessor, you can look at integration in the microprocessor a number of different ways. I actually quite like to look at it through the instruction set. You can look at it the size of the die and so forth, but the instruction set is also revealing.

Back there the 4004 was about 70 different instructions, where we are now, give or take a few, is around about 700. You see that little blip as we popped up through the 8086, 8088, a little bit more with the integration of memory management with the 286, which turned out to be a really big deal because it gave consistent memory management on an operating system implementation. Then, of course, integration of floating point when the 486 came out. And almost everything since then, all of the rest of that, has been integrating natural media types, support of natural media types, and of course the Internet. And the Internet in many ways has driven many of these new features all through the last ten years.

Paralleling that, of course, has been this tremendous, tremendous growth rate. Now, behind all of this has been integration as well as innovation. And if -- if we'd have stopped the clock back there at the levels of integration of the 386, the world would look a very different place. This is what I-7 would be. It would be a lot larger. Now, maybe you could squeeze that into a really, really big computer, but the trouble is it would've consumed 1,753 watts, which is enough to keep 70 laptops going, and, worse, it would've run at 25 megahertz. That's 120 times slower. You wouldn't want too many of these.

If you look at Atom -- here is our favorite new baby, Atom. We got 1,000 of them in this little glass tube. If we had stopped the clock back there, this would've been the size of Atom, but more importantly it would've been about 130-odd watts, enough to power 65-odd different notebooks.

So, integration has always been a huge piece of what we collectively as an industry are doing. And so I'm going to spend today looking at that transition to 32 nanometers in both server and in client. And I'm probably going to spend more time talking about server, and then Dadi and Mooly and some of the others will be filling in the details a lot more on the client side.

So, what's going on in the datacenter? The reality is that there is something of a transformation underway. Three previously discrete segments of compute, storage, and networking are beginning to integrate together. We are seeing the same compute technology that's been in the compute segment moving rapidly into networking.

This year if you look at the stand-alone SAN and NAS marketplace, 70 percent of those units are powered by IA. That is a very rapid transition in SAN and NAS. If you look at the networking space, about a decade ago we made the transition to one GigE. Ten GigE we've been working on for some time. Ten GigE has just rapidly accelerated in the last few months. A lot of that has been driven by Nehalem. And also, more importantly, the interoperable, the networking standards, the technology standards, power, integration -- all of these things between these three elements of the datacenter are beginning to overlap. And you can't solve one problem without looking at another one.

Now, the datacenter itself, as Paul said earlier on, doesn't look any more similar. It's not as if all of these elements are beginning to look identical. It's actually in some ways getting more diverse all the way, through SMB, the communications area for the 3G, 4G infrastructure systems, out through the Internet cloud that we've all talked about, conventional infrastructure out to HPC. Physically, the demands are different, but the underlying technical challenges

are very similar: performance, energy efficiency, virtualization. In every one of these segments in the server space, those are critical issues.

So, what are we going to do with integration to address the areas of performance, energy efficiency, and virtualization? That's what I'm going to walk through, and I'm going to start by looking at what the extensions are to the Nehalem microarchitecture that we can use to address some of these challenges. So Nehalem is coming out into an environment where we are running two architectures. We have the Itanium architecture and we have Nehalem-EX coming out and joining it.

Itanium architecture has just gone through pretty much a milestone for us. During the course of the last few months, total systems revenue from the Itanium systems line has exceeded the Spark ecosystem for the first time. It's been catching up for some time; it's now past it. This is a very healthy product line. We've announced a further three generations of products stretching out through the next few years, beginning with Tukwila which is scheduled to come out in Q1 2010.

Now, we also said that we were going to be integrating features that would give commonality between Itanium and Xeon. With both Tukwila and Nehalem-EX we have QPI in common. We have the

memory hubs and DDR3 technology. We have the I/O hub, and we have increasingly shared RAS capabilities.

Now, let me spend a few minutes talking about Nehalem-EX and what that means. It is really a big move forward. There are some folks out there that are saying that the industry isn't going to advance in these eight-socket-and-above configurations. We really, really don't agree.

There is a tremendous demand for applications performance in this segment. And you're going to see a lot of new energy going in there as a consequence of Nehalem-EX. In fact, we have over 15 eight-sock-plus designs right now going in from eight different OEMs. And those of you who have been following this space know that is a big change. It's a lot of momentum and energy. And they're going into scalable rack blade spaces and into HPC.

We're also seeing in the software community, they're not giving up on this segment either. They see a big opportunity. Microsoft, Red Hat, Novell, Solaris, VMWare, these RAS features, there's a lot of energy going on in the software community, too.

Now, you're looking here at an eight-socket version of Nehalem-EX. Here you're looking at the four-socket version. And it really is true to say it's a giant leap forward, up to three times the database

performance, an amazing one-terabyte of memory support in the four-socket version. One hundred twenty-eight threads, more than eight sockets supportable, and a whole series of new RAS capabilities that are going to take Xeon into a whole new space. More than 20 new different RAS capabilities.

Now, I'm going to show you one of those RAS capabilities. But before I do it, just draw your attention to a couple of great products coming out here. Here we have the IBM product disclosed today, four-socket BladeCenter-EX, a next generation X5 architecture. Underneath that we have a four-socket Nehalem-EX in a 1 U configuration. This is from Super Micro, targeted at the HPC segment. So we're seeing announcements coming out here at the event of more and more technologies around Nehalem-EX.

But I said I'd talk about the RAS features. Let me take you over here and show you. Now, what I have here is a Nehalem-EX, two Nehalem-EX systems. They're identical systems. On one of them we have the MCA feature switched on. On the other we have MCA feature disabled so you can see the difference.

Essentially, what we're doing here with this feature is when we take a machine check, the CPU will be able to do a handshake with ELS to enable this rare but occasional condition to be recovered. The machine on the left is the machine that has the MCA enabled, and

the other one isn't. And what you see is the system that doesn't have MCA enabled ultimately blue-screens. It's a rare condition, but it requires a special RAS feature.

And what you see here is that the handshake between Nehalem-EX itself and the OS is sophisticated enough to recover from this condition. Overall, we've got something like twenty different RAS features going into Xeon. The momentum behind Xeon as a consequence is going to be really, really, really strong.

Not just in the full tolerance space, but also we're seeing a pickup of interest in the HPC segment. A lot of new HPC designs coming around these feature sets and the performance. And I would draw your attention to the words from one of the leaders in this segment from Lawrence Livermore, Mark Seager, who talks about Nehalem-EX representing a new SMP-on-a-chip supernode that can help us improve our productive science and simulation capabilities without having to invest in a vast rewrite of software.

So Nehalem-EX, tremendous performance characteristics, new RAS characteristics. We think that segment is very, very healthy and it's excellent news overall for the industry. So that's looking at these new architectural features with Nehalem.

Let me now spend a few minutes looking at security and I/O. And in order to do that, I want to go to the next generation, which is Westmere-EP. So Nehalem-EP, we reached crossover in shipments from the prior generation in July of this year. That's crossover to Nehalem-EP. That was ahead of schedule. Indicates to us the desire for performance.

But following up close behind it, in the first half of next year we will have Westmere-EP. What's different -- what's new about Westmere-EP? Second generation high-K metal gate, of course; higher performance as you would expect; improved energy efficiency; super-optimized for this 10-Gig transition; and, of course, enhanced security.

Let me talk for a little minute about the enhanced security. A number of features, but two I would draw your attention to. The Trusted Execution Technology, Intel TXT, that's a critical feature that is going into Westmere. We are working with the software ecosystem for that to be enabled out through the next two years. And then, of course, we have AES acceleration.

Earlier on, Paul showed AES acceleration on the client. I'm going to show you now AES acceleration across the Internet more broadly. Why do we need it? Because we know there are plenty of folks who are trying to crack transactions on the Internet. There is a

large community of people who are looking to do bad stuff. And we need to build into our architectures a way of making our customers more able to defend themselves.

So along comes Westmere. What we have here are two Westmere systems. They're pretty much identical systems. The bottom system is simulating 5,000 clients generating secure transactions to this Westmere system here on the top. They have AES-NI in them, and they're connected together by the 10-Gig card.

You always see something interesting when you go to the back of computers. When you go to the back of computers now, you're starting to see these optical links. They are 850 nanometer links on cards like this 10-Gig card that we have, Niantic card from Intel.

But basically, what you're doing then is there's massive amount of traffic flowing in, and then the Westmere server with AES is handling it. If you zoom in on this screen, what you can see is that the legacy RSA features with the software optimizations we have are running about 40 percent faster. And then AES itself with that instruction set optimization is running a little bit around about 12 times faster.

So as Westmere moves in, and we are expecting a pretty rapid transition, the infrastructure will be there for us to do more secure

transactions across the Internet, more secure transactions on the client, more secure transactions on the server. And that means that technologies like https, which are really, really important, are going to be deployable. Because there will be enough compute power to do that -- encrypt, decrypt -- that Paul talked about earlier on this morning.

Okay, so significant increase in security capabilities. We think this is going to make a good improvement to the base infrastructure. What about power and density? Power and density is as big an issue, as you folks all know, as security. Up to 25 percent of the cost of the data center is going on power.

So back at the last IDF we announced the Intel Node Manager Initiatives. I'm delighted to say that we've picked up a lot of momentum on Node Manager. It's very much now an industry effort. You see a whole series of folks here that are swinging in to support it to enable this fine-grained control of server and rack-level power. What I'd like to do is to hear from some folks in the industry about what this means.

[Video Presentation]

Sean Maloney: So this power issue, of course, gets bigger and bigger and bigger as the compute requirement goes up, and the energy issues get to be

larger for everybody. So what you can see up on the screen here is a few shots of some of the ways that the industry has been pushing back on this for the last few years: denser blades, denser packages, optimized racks, containers and so on.

But we do think the time is right to push ahead into another new segment and create another new segment. So we are delighted today to make a few announcements. Firstly, we are introducing a couple of new Xeon skews. These skews are really, really pushing the envelope in terms of density and power. Two new Xeon 3400 skews, 45 watts available now and 30 watts quad-core available in the first quarter of 2010. It wasn't so long ago people were trying to squeeze 30 watts into ugly notebooks. Thirty watts going into this new category of servers is an amazing, amazing thing.

I want to draw attention to the announcement from SGI of the new cloud rack. This is using these new ultra low power Xeons. If you look at this guy it fits six of them on cloud rack into a 1U space so you can get 228 servers per cabin. This is just announced from SGI.

We're also announcing a reference design today for the micro server segment. Here you see it down here. It's a fantastic piece of technology. What we have is a series of these modules that can fit into a 5U kind of space; 16 modules, 30 watt power, Xeon 3400 with hot swap capabilities. This reference design we are

announcing because we see very much the need to create this new category. It won't replace these other categories; it will augment them.

I'd like now to ask someone's opinion on this, and who better to ask than someone who has played a huge role the last fifteen, twenty years in the evolution of the computer industry; someone who doesn't need any introduction for his contributions to the computer industry. I'd like to call up on stage Andy Bechtolsheim. Andy, come on up.

[Applause]

Sean Maloney: Hey Andy, how you doing?

Andy Bechtolsheim: Pretty good.

Sean Maloney: I know you're super-involved right now out there on the leading edge on high speed IL and networking. What are you seeing happening in this micro-server segment?

Andy Bechtolsheim: Well in the cloud space, as you know, the traffic keeps going up. People are building these warehouse-scale datacenters that need just a massive amount of scale to handle millions and millions of

consumers. And unfortunately, or fortunately, all these services are nearly free to the consumer.

Sean Maloney: They're free so they're generating a lot of demand, I guess.

Andy Bechtolsheim: Right. And so the infrastructure behind this that needs to go into these datacenters has to be as cost-efficient and power-efficient as possible because obviously people need to scale these applications on an ongoing basis.

Sean Maloney: What are you seeing happening on the shift to 10-gig?

Andy Bechtolsheim: Well 10-gig really took off early this year with the Nehalem launch, quite frankly. So we see 10-gig shipments doubling this year compared to last year. And then we think we'll double again next year and double again in 2011 and double again in 2012. I don't know too many things that are doubling every year going forward, but 10-gig is one of those exceptions.

Sean Maloney: Maybe you could just tell us a little bit about Arista. Where do you see things shaking out there?

Andy Bechtolsheim: My latest company is building networking infrastructure for cloud networking, which is for these very large-scale datacenters. And

obviously bandwidth and cost performance is really important to those customers.

Sean Maloney: Great. Well, we're really looking forward to working with you. What do you think about this new category of microserver?

Andy Bechtolsheim: Well it's very cool. We have been talking to some of your engineers about this topic for a couple of months now, and it seems to me as long as the micro server still has ECC memory, it can do virtualization and can support a decent amount of memory, it will be a very, very successful product.

One thing to keep in mind is that a one circuit in the Nehalem is just as fast as a two circuit system a year ago. So this is essentially what used to be a two circuit system down to one circuit. It is a little bounded on memory, but for a lot of these [unintelligible] and technical applications that's just fine.

Sean Maloney: Great. We'll try and keep that performance moving ahead. Thanks very much. I'm really delighted you could come along today.

Andy Bechtolsheim: Thank you.

[Applause]

Sean Maloney: I have a feeling that you'll be hearing a lot more about this microserver segment, in addition to those other segments that we talked about earlier on. Please come take a look at this reference design; get the specs from the Intel website. We're really looking forward to tackling new problems with some of these new solutions.

Finally, let me talk for a little bit about embedded and storage. The reality is that we collectively are moving into a lot of other newer segments. We gave you a kind of heads-up a few months ago that we were working on a new CPU designed specifically for embedded and storage. I'm delighted today to announce it. It is code named Jasper Forest. It will be coming out in Q1 2010.

What we've done in Jasper Forest is we've taken a mainstream microprocessor, a Nehalem and on the CPU we've put right down integrated PCI , I/O virtualization, a non-transparent bridge, which removes the requirement for an external bridge chip, and then RAID six down on the chip.

What this means is a very high level of integration on a very, very powerful, power efficient microprocessor. Having PCI in the chip with RAID on the chip, the NTB on the chip, there is a whole series of new markets that we think are going to get changed and improved with this. Now not only hearing it from me, I'd like you

to hear it from some of the folks who are going to be using Jasper Forest.

[Video presentation]

Sean Maloney: Well, great. So that's a new product coming out in Q1 2010. Lots of opportunities for improving some of the solutions our customers talked about there. So that's really it from me on the server side for now.

What I'd like to do is to spend a little bit of time talking about the client. And Paul this morning spent some time talking about I5. We recently introduced I7. Thank you very much to those of you in the audience who wrote reviews because you all wrote good ones. Thank you very much. We've done some great work on benchmarking. And as Paul said, of course, the timing is really, really good for this transition to I7 and I5 because we have a superb new operating system coming along in Windows 7, and we've brought lots of work in with our friends at Microsoft over the last couple of years not only on performance, power management, but on start/stop, resume speed, obviously on the graphics side. And also, of course, on security and manageability.

Security and manageability is something we've been talking about for the last three, four years because as an industry if we don't

tackle it our costs are going to get out of control, and we're going to get some -- we're going to get some very unhappy customers.

So, needless to say with the shift to Westmere we're going to have another push on vPro. We have a series of new features coming in, in terms of new improvements to vPro, anti-theft technology. And we've also made a big stride in integrating KVM.

Now if you wanted to do KVM beforehand you had to have some big, clunky solution to enable that. We're building KVM, straight into the Westmere generation of vPro solutions, and that's a pretty big deal in terms of one of the next steps to addressing manageability.

So where is all this going? It's about tens of millions of clients, tens of millions of small businesses all the way around the world needing their computers to be rugged and to be fixed as quickly as they can. It could be a small business like this particular one where suddenly I'm working on my machine. This particular system here is a Lenovo that happens to have the latest, greatest vPro technology in it.

Just this week, we announced a significant new agreement with AT&T, and I'd like to invite Abraham Keshavarz to come up on

stage from AT&T and talk about what this will mean for a service provider doing remote maintenance. Come on up. How are you?

Ebrahim Keshavarz: Hi, Sean. How are you doing?

Sean Maloney: Great. And, congratulations on the announcement this morning.

Ebrahim Keshavarz: Thank you. Thanks for the partnership.

[Applause]

Sean Maloney: So, you are, it doesn't need any explanation, one of the world's largest service providers. You got a lot of PCs to maintain.

Ebrahim Keshavarz: Right.

Sean Maloney: Maybe you could show us what this means.

Ebrahim Keshavarz: Yeah for AT&T we obviously serve millions of small businesses today. And we have a product called Tech Support 360, which for us is our virtual IT director.

As you know about small businesses, they often don't have an IT person. So with AT&T's Tech Support we now offer the ability to support an Intel-based PC, PC operating system, and applications

today, and we do that today through Internet remote access. And we serve about 100,000 customers already in one year. So we see huge demand for servicing those customers remotely, and we're very excited about having the opportunity.

Sean Maloney: And one of the things that people tend to do is they pick up the phone and say, "My Internet connection's not working. "

Ebrahim Keshavarz: That's right.

Sean Maloney: And then things get really difficult to diagnose.

Ebrahim Keshavarz: That's right.

Sean Maloney: We've been trying to address that. Can you tell me how you think that will shake out?

Ebrahim Keshavarz: Yeah, I mean, I think what's happening now especially with this new vPro and the [ARPA] technology that we're partnering around, what we're excited about is that we can actually now reach into the computer, with customers' permissions and actually start servicing the computer. Once we know there's an Internet connection working we can go in and figure out what else is wrong with the computer.

And so today with this new technology that we're going to be working with you guys on, we really see the opportunity to say, "Hey, we know the Internet connection is working. Let us kind of reach in and help fix your computer whether it's the BIOS problem, whether it's an operating system problem, whether it's a hard drive problem. " We have many more things now that we can solve with remote technologies that we couldn't do before, before our partnership.

Sean Maloney: And the reality is that often the consumer will think the Internet connection is down because the browser's down. In reality, that's not the case.

Ebrahim Keshavarz: Exactly. And in today's technology world it's very hard to understand unless you're physically in front of the computer, right? In the AT&T-Intel world of the future, what we'll be able to do then is say, okay, the browser is not working, but we can see that, for example, we see the light's on for the DSL router. So we know the DSL router is working. You've probably had this at your house, right? You see the browser, you say "I know this thing's on, but I can't get my browser to work. " Well why is that? Well there might be malware, there might be spyware, there might be some BIOS configuration problems, and that can affect all kinds of things -- the operating system, the OS, the NIC cards. And so now with our technology partnership we can really say, "Okay, we know the

Internet's working. Even though the browser's not working, I can still service that PC remotely. ”

In today's world, I can't do that. I don't have -- if I don't have a working browser I can't use Tech Support 360 to service that PC. In 2010 when we have this new service out with RPAD and vPro, we'll be able to use the secure connection that you guys provide us to actually service that PC and get people back and running and most importantly servicing them while they're at their offices.

Small businesses don't want to leave their office. They don't want to take their PC down to a store. They want it fixed right away and they want to get back to work. And with the Intel partnership we can do that many more times than we can even today, so we're very excited about the opportunity.

Sean Maloney: Well thank you. I think that's outstanding innovation in the service provider industry, so thanks very much.

Ebrahim Keshavarz: Thanks, Sean.

Sean Maloney: Bye-bye now.

[Applause]

Sean Maloney: That's how computers are going to be maintained in the future, because we can't afford for them to go down. Consumers can't afford them. Small/medium businesses can't afford them. So collectively we've been working together on this on a number of years. This particular development, I think, is a very significant one.

But, vPro isn't only about client computers. We're also seeing developments going forward into, the embedded space. One of the cool new things about my new job is I get to play with all this amazing, amazing stuff that I wasn't allowed to play with before.

Over here we have a couple of great pieces of technology. Digital signage is a really big, growing industry. This may not have escaped your attention if you walk around airports or hospitals or almost anywhere.

A couple of years ago I saw a prototype of this thing, and what it does is it does gender recognition. So it recognizes your gender and then it targets the ad based upon your gender. And that's exactly what this thing does except this thing's actually in production. This is from Hardware Industries, with some software called Cognivision on it. This is running on Core 2 Duo with vPro inside of that.

The ad is running which could be targeted through this face recognition stuff here. But then also the consumer can interact with it, can touch the screen, in order to bring up other features.

If I'm in a mall, I've just looked at an ad, I want to find out how to go reach that product, I can do that very, very easily. This is a super-smart digital sign. It can figure out who I am, what I'm interested in, and then it can lead me to where I want to go and buy it.

That's one example, and vPro is used here for being able to remotely manage these things. If you've got thousands of them, you don't want people running around reprogramming them. That's actually what happens now. This stuff can be done remotely.

This here is a prototype. And it's a prototype for a different industry. It's the gaming industry. Like it or not, gaming is a big deal -- a lot of people do this stuff. and what we have here is a fully, on-the-fly, reprogrammable gaming machine. It happens to be set up, for -- I don't even know what the name of this game is. It's the one that goes kaching-kaching and makes tons of noise. There you go. It's like being in Las Vegas. Of course, I won. That was bound to be rigged that way. But if I don't like the game I can flip over to another game, roulette, or I could maybe order a drink. That sounds like a great idea. Beer, wine, or cocktail -- well, I'm a

Brit, so it's going to be a beer. But what's going on here, of course, is you have far more flexibility because someone could be sat somewhere at a consol, they could be seeing exactly what the demand is, they could be figuring the demand on the fly, and so forth.

So what we're seeing then is great new technologies moving in with embedded and a lot of other stuff. And this one over here -- oh, boy, I've just taken on a new job. I think this one begins with an L. It's a product that begins with an L. I can't remember the name of it. Oh, Larrabee, that's right, yeah. Is there anybody who cares about Larrabee in here, wants to know what's happening with it? Okay.

All joking aside – all joking aside – bring out my serious foil, please. We are super excited with the progress of Larrabee, both inside the labs, where we've been busy working away on silicon for some time, and outside, where you guys know we have a whole bunch of SDKs out there.

There are lots of things about this product that get us super-excited. One of them is of course the programming models. Now, rather than me telling you about that, what I'd like to do is to bring up someone who's spent his life working at the frontline of this area,

graphics and visualization, and is now senior research scientist at Intel, Bill Mark. Bill, come on up.

Bill Mark: Thanks, Sean.

Sean Maloney: So, Bill, this is the first public demo of our new baby. Maybe you can tell us a little bit about it.

Bill Mark: Yeah, so it's a great baby. I'm really excited to be able to talk about it. So what we're showing you here is an application that demonstrates some of the flexibility of Larrabee. And it's running on the Larrabee Software Development Vehicle, so this is the early silicon. And it's also got some other Intel goodness in it. It's got an Intel Golftown CPU.

So what I'd like to talk about is what makes Larrabee unique, right? So what makes Larrabee unique is you get a fully programmable rendering pipeline. So this lets you, in addition to standard DirectX, OpenGL, you can also implement customized rasterization pipelines and, maybe even more interestingly, things like voxel rendering and ray tracing.

So if you look up on the screen here -- so this is the demo running live -- and this is a ray tracing demo, right? So what we did is we took content from Splash Damage and Id Software, so the game is

called Enemy Territory: Quake Wars. We took that content, the textures and geometry, pulled it out of that game, and put it into our ray tracing engine. So ray tracing is a well-known technique but traditionally has not been used in real time, so now we've got it running in real time.

And what makes it special is that it allows you to simulate the interaction of light with matter in a way that's accurate and makes it really easy to get effects like shadows and reflection and so forth. So as an example here, if you look at the water, you'll see a nice reflection, and that's done with only ten lines of shader code. It'd be a lot more difficult to do in a conventional game engine. For programmers, what's interesting about Larrabee is not just the flexibility but also the ease of development.

And so let me just give you a specific example of that here. You see there's some moving objects in this scene. There's some helicopters -- they actually temporarily flew out of sight, but they'll be back. And that's traditionally difficult in a ray tracer. But what we've done here is we rebuild some of the key data structures, every frame, on Larrabee using a form of parallelism called task parallelism. And so what this is really showing is that you can do the same kind of things you do on a multicore CPU but with even more parallelism.

And so very easy to use, and it's actually written in C++, and you get the standard memory model that programmers are used to, a cache coherent memory model. And in contrast, to do something like this on a conventional GPU would be really quite painful. So really what we're trying to do with Larrabee is keep the simple things simple, so I'm really excited with what it's going to do for real-time rendering, and it's really great to have the hardware up and running.

Sean Maloney: Great. Okay, Bill. Thanks very much for our first demo. Thank you.

Bill Mark: Thanks, Sean.

Sean Maloney: And we will be incorporating this into a future CPU at some point. Okay, now it is worth mentioning, as Bill said, that we were showing that on a new system, which will be out next year, codename Golftown, 6 cores, 12 threads, 32 nanometer high-k, coming to a store near you sometime in 2010.

Quickly walking by, we have here Sandy Bridge. Dadi's going to be talking about that lots and lots tomorrow. But what I want to do is take -- this is I think what Paul called this morning "the next after the next. " I want to end by just talking about the next, because the next itself is really, really cool, and I'm going to end by talking

about Clarkdale, which is Q1 2010, next generation desktop, common features obviously with the notebook that you'll be hearing about a little bit later on from our speakers tomorrow.

What's great about Clarkdale -- you know, a number of things kind of make me pretty excited about it. You know, you probably read about the on-package graphics. Obviously you've heard about the ASNI acceleration. But what I really, really, really like is the Turbo and hyper-threading. And Turbo and hyper-threading is going to make a big difference to the way the computer feels. And I'm going to show you in the most mundane way -- in the most mundane way I'm going to synchronize a device with an iPod with a podcast. That's all I'm going to do. Okay? And you'd say to yourself, well, that shouldn't really tax the CPU. The reality is that the average user now has something around -- 40 percent of people have five windows open.

And the average user is having more and more windows open. You can see here at the bottom here -- I think I have six, seven different -- eight different browser windows open. That's how we behave. We have browser windows open. We don't want to shut applications down all the time. And so we leave stuff open. Three, four, five years ago, what that meant is you just had some HTML somewhere. That's not how it is anymore because those browser windows are running JavaScript or they've got a video running or

they've got Macromedia Flash or something like that. And so when you then went to do a task, a simple, mundane task, like what I'm going to do here -- I'm going to synchronize these two -- before we do that, on the left-hand side, I've got a Wolfdale high-end 3 gig 1333 front side bus, right-hand side here I've got the Clarkdale. So very, very similar systems. But this guy has got the enhanced multithreading and Turbo.

And if we apply -- and so what I'm doing now, leaving those windows open, we're not shutting down what we're doing on the Internet, but we're just going to go sync our -- there we go. And you can see our Clarkdale -- have we got a demo error here? Chuck, Chuck, Chuck. This is where I fail the test. I can't even sync an iPod. The right is finished. I'm sorry. Okay. Now, I thought I had a demo error there. I didn't have a demo error, which is just as well because it's the last demo.

So one year ago high-end desktop, core 2 duo, this with the enhanced threading, and you see a dramatic difference in the most mundane tasks. You know, a dramatic difference just in synchronizing a couple of iPods.

Why is that important? Because people want to have flexibility, they want to have the system to feel responsive, they don't want to shut their windows down, they don't want to get out of the Internet

when they want to do something that's urgent and important. And multithreading and Turbo over the next two to three years is just going to make machines feel more responsive, more flexible, better at doing ordinary tasks, and that's what will be arriving in Q1 2010.

It's the next thing; it's not the next after next. And the average user is going to see a significant difference in the responsiveness in how that machine feels. Okay.

So that's pretty much it for me. I spent a lot of time talking about servers, little bit of time talking about clients. The client technology is fantastic. You're going to hear a lot about it from Dadi tomorrow. All in all, if I look at this path of integration, we've come a long way from the 4004. We will be integrating new instructions, taking it further over the next two to three years . . .

We've come a long way from the 4004. We will be integrating new instructions, taking it further over the next two to three years. Dadi will be talking about that through the Sandy Bridge generation. But we've come a long way. We think the technology in the next 12 to 18 months is very much post-recessionary technology. We believe collectively we're going to have a really tremendous next 12 months, as Paul said.

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Thanks very much for coming along to IDF. We're looking forward to a great next three days. Thank you.

[Applause]

[End of session.]