2013 Intel Developer Forum Opening Keynote

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Brian Krzanich, Chief Executive Officer, and Renee James, President

[Beginning of recorded material.]

Male Voice: Ladies and gentlemen, please welcome Brian Krzanich.

Brian Krzanich: Good morning. Welcome to IDF 2013. I'm really excited. This is my first IDF as Intel's newest CEO. Before I get into it, I thought I'd take a second and just talk to you a little bit about what IDF means to me, and to Intel. IDF is, believe it or not, an intimate setting, where we, Intel, get to talk to our developer community, our partners, about how we see the industry, how we see the technology, what's changing, and for you to give us feedback.

I can't think of a more exciting time in our industry than right now. There's more change and more integration going on than I've ever seen in the 30-plus years I've been in this industry. Those changes, those innovations, are great news for Intel and our developer community.

What Renee and I are going to do this morning is spend a little bit of time trying to share with you really what's going on, how we see the industry, what Intel's strategy is, and how we believe we can all win in this environment.

So with that, let's just kind of get right into it. Personal and connected. That's a trend that's been going on for 40-plus years in our industry. Devices have continually become more and more personal and connected. They're with you more often. They have more computing capability. There are a couple of basic, underlying themes that have really driven this trend. At each one of these transition, the volume goes up. People want more because they're with you more. They're more useful. Not too many people want a big mainframe computer in their house, but everybody wants a PC, a tablet at home.

Power requirements go down. We want these things more often. We want to use them more. Connectivity. You want them with you, and you want to be able to access your data, your information. So you have to have connectivity everywhere you go.

Another one that's really important is that a transition has kind of occurred. Each one of these has happened more and more rapidly. It's faster. Everybody today says everything's happening so much faster. My answer is always, if you look back in five years, we'll all look at this time and say, "Wasn't it great when?" Because the transitions we have to look forward to in the future are going to happen even faster.

But I'll be honest. These are the obvious, simple, underlined ones that are occurring. There's a more important change that's been occurring underneath all this, a strand that's woven throughout these changes. There's been a shift from a CPU-based architecture to an SoC, or a system-on-chip-based architecture. You can take a look at the two drawings here. The one on the left is what the old CPU looked like. You look at it, mostly it's core and then graphics and memory. But there's everything surrounding the CPU. As this connectivity, this mobility occurs, we need to have the entire system architecture on a single piece of silicon. This has really driven innovation. So now you see the core as a shrinking percentage of the silicon. You have graphics and image processing and IO, all the other parts of the device that are required -- connectivity and comps. This is good news. This plays right into what Intel does best. We have driven Moore's Law, we have great architecture.

This is about innovation and integration. That's exactly what we do. And so we look at this, and we say this plays right into our strengths. So why am I so confident that we, as a team, Intel and our development community, can win? Because integrating in this environment and innovating in a system-centric environment requires the solutions that we all have. We have the best assets. Silicon leadership is beyond what I think anybody even believed we could get to.

Renee will actually show you what's out into the future, there’s some great opportunity here. We have the best assets in our [unintelligible] development community, we have the best developer network. We intend to use all of these assets in this environment to win. So I think what everybody's asking, what's your strategy? How are you going to do this? Our strategy is actually very simple. Our plan is to lead in every segment of computing. You've heard me say this before. I said it on our earnings call.

We will go and put our leadership and our silicon and our technology into every segment of computing. Segments that we know today. Servers -- everybody knows that. We are strong there. PCs, tablets, phones and beyond. Segments that are still being developed. People talk about wearables and the Internet-of-Things. Those are emerging areas and far-reaching opportunities for all of us in this room. Those are areas we'll show you we're going to go lead in.

Let me show you what I mean. Let's start with the first area, here. We're in the process of re-architecting the datacenter. The datacenter revolution is already going on. We talk about Big Data, [we] talk about the number of devices that are connected to datacenters, their cloud. We talk about software and software-defined systems, security. All of this requires the innovation and architecture that Intel has led for years. You saw Diane announce last week our Intel® Atom™ C2000 family, the Avoton and Rangeley. These are examples of us leading in architectural changes in the datacenter.

Today, you'll see us announce our Intel® Xeon® processor, just the other end of the datacenter performance, the [unintelligible] system. From the high-end to the low-end of the datacenter, from software-defined networks, networking, storage, Intel has the architecture, and we plan on leading. This is an area that we've led in for years, but we're not standing still. We're going to re-architect, we're going to keep driving innovation here. I want to take a second now and move from the datacenter to the PC.

The PC is in the process of re-inventing itself. There's more innovation in the PC than I've ever seen before. And there's some of that innovation that's relatively obvious. It's battery life, it's form factor, it's capability. But what I want to really show you is that it's not just those form factor-type things. It's really listening to the users, to the developers, to what do people want in these devices. So let me show you with just the [start] of one of these items.

You saw us announce earlier this year our 4^{th} Generation Core® product, Haswell. What I'm showing you here is our Haswell-Y device. This is an HP system, there will be more systems as we exit this year, but at 4.5 watts, these become fanless Core i5 and Core i7 devices. This provides the battery life, the width, the fit, everything that people have been asking for in a fanless device. I think looking back two years ago, if we'd all said you'd see fanless Core-based products onstage here, we'd have been surprised. They're here, they're coming to market.

The next thing I want to talk about, the silicon. I’ve got to talk about silicon. Can't have an Intel presentation without talking about Moore's Law a little bit here. I'm here to introduce the first 14-nanometer PC. This is a Broadwell-based system, it's fully operational. People have asked where we are on development of 14 nanometers. I'm here to show you a working system. I’ll go into “Cut The Rope” and play the game. But this is it, folks -- 14 nanometers is here, it's working, and we'll be [in production] by the end of this year.

You saw the performance of Haswell, fanless-based systems. That 14-nanometer product on Broadwell provides another 30 percent power improvement, and we're not done yet. That's as far as we've been able to test it, so far. In addition, we'll have the same type of performance improvements that you've seen on Haswell-type products. So 14-nanometers is absolutely a reality. It's absolutely coming to a PC near you, and you'll see it in product next year. But that's not enough.

Consumers want even more. I showed you what is more the standard form factors. What we've really been working on is what we call the 2 in 1, and the 2 in 1 really is the effort to show. It's the best of both worlds. Consumers have talked about having to carry multiple devices -- a tablet and a PC. The innovators at Intel and our partners have come up with the 2 in 1. Its' the best of both worlds. It's a PC when you want a PC, and it's a tablet when you want a tablet. It comes in many form factors. I'm showing you a Bay Trail-based one here.

Here's a Core-based system. This one's very innovative. A tablet and PC -- just [unintelligible] and then the keyboard just disconnects. But it's not just two systems. There's an industry of innovation going on around these form factors. And so I want to show you this wall here of 2 in 1s. By the end of this year, we'll have over 60 systems in market at price points as low as $400. So when people talk about having a 2 in 1 device that can truly compete in this marketplace, these are the products that are going to do it.

This is where the PC is headed. Okay. So we talked about the PC. There's an obvious question. What about tablets? Got to get to that at Intel, right? We're here. We've got Intel tablets. They're in the market. I've got here a Lenovo tablet in my hand. And yes, it's fully functional. We intend to drive leadership into this market. We have assets and technologies that nobody else can bring to this marketplace. We can provide the same form factor to an OEM, and they can choose between Windows, Android, Core, Atom. The choices and the innovation they can do with these devices are tremendous. Again, to show you that's not just one device. We've shown you a wall of devices here with systems that will be coming to market from price points below $100 this holiday. Yes, that's below the $100 system price point, for holidays. [Applause]

But we're also bringing this leadership to other devices. We talked about the datacenter, PCs, tablets. We need to talk about phones. I'm here to show you the world's first 22-nanometer phone. 22-nanometer phones provide 50 percent performance gains with even longer battery life. But wait, we’ve also got LTE. One of the things that's been holding Intel back from this portion of the industry has been our lack of LTE. This phone is working on LTE right now with Intel silicon. We are shipping data and LTE today with voice 3G. By the end of the year, for products next year, we'll be shipping true data LTE and voice LTE in our phones. We are here. [Applause]

But in a market like that, simply providing great silicon and getting it into LTE devices isn't enough. You have to keep innovating. Let's talk about LTE-Advanced. Consumers want data. What they want is faster data. They want to be able to get data to their devices at a much, much faster rate. What I'm showing you here -- it's on the right-hand side -- is the data rate for that phone. It's running about 35 megabytes-per-second. Our team in San Diego has been working on carrier aggregation, and in just a couple of seconds, you'll see this actual device, through a non-carrier activation, shift from 35 megabytes-per-second to approximately 70 megabytes-per-second. We know that we can continue this and get upwards of over 150 megabytes-per-second.

Hopefully it'll switch here pretty soon. A demo is a demo. Let's see if it shifts. . . Something shifted. [Laughs] Hopefully they're going to get that back up. I'll see if I can come back to that one. Oh, there it is! This is 35 to 70 megabytes-per-second [unintelligible], while the plan is to bring this -- before we bring this into production -- to get upwards of 150 megabytes-per-second. This should ship in 2014 as well. So from a phone perspective, 22-nanometer leading silicon

LTE, here already on data for 3G voice, here at the end of the year with LTE data and voice, and as I said, carrier aggregation next year. It truly does work.

So those are the areas that we know today: phones, tablets, PCs. I want to take a little bit of time now to talk about how we're going to extend this, how we're going to look at areas well beyond where the industry is thinking today. I want to talk a little bit about the Internet-of-Things, and you hear a lot about that. You hear words mixed up sometimes: Internet-of-Things, wearables, all kinds of devices. We speak of these things as actually very similar, whether you're connecting to a human on a real-time basis or connecting to a machine on a real-time basis.

There are certain things that the device needs. It needs very low power. I'm talking about power levels that are well below the devices we've talked about so far. You want this small [device] in your hands, on your body, and working all day. You don't want to have to stop halfway through your day with your watch, or whatever it is, and see it's got to recharge. It needs to be connected because there's really no value unless this thing is connected. It has to be in a very small form factor, has to fit on our body. But importantly -- think about this -- we all talk about the amount of data we're transferring over the Internet today and the security of it. But imagine when these devices are with us 24/7. With the amount of data, and information, and personal content that will be exchanged, security becomes even more important.

I have an announcement to make that I didn't read any of the pre-press, so we really keep it quiet. We're announcing today the Quark family of silicon, Intel's smallest SoC ever. This Quark [core] is roughly 1/5th the size of our Atom processor [core], and approximately 1/10th the power. It is fully synthesizable with an open architecture and an open ecosystem. It is designed for the Internet-of-Things. This is just an example of the silicon innovation that's going on inside of Intel. But again, that's not enough because if you're really going to do this, you have to understand the devices that you're going into.

Intel has already been starting work on reference designs. We have reference designs for the industrial Internet-of-Things. These are boards designed to be on the edges of the network, out on the extreme environments, to connect to machines back to the Internet. These are reference designs are ready to go for our development community and actually out in to industry already. They come with software. They come with that open architecture and that open ecosystem. Because the core is fully synthesizable, companies can customize with their global intellectual property. This is truly designed for this open environment, but that's not enough.

As I said, this is not only about industrial. I said it's about wearables. It's about people. And so, yes, we have been working on wearables. No questions, we have wearables. These are reference designs. This one's a little bit more -- I'll call it – lab oriented. But we looked at form factors actually. This is a form factor we've been playing with. The idea is not necessarily for Intel to bring these to market, because you come up with devices that partners could use to develop their own products in this open ecosystem. They can, again, write their own software, develop their own applications, and drive this product into the market themselves. What we needed to do was build things until we really knew, "What did the customer need?" "What do the developers need?" So that we can bring these products to the market with applications all ready to go. You can only do that if you have the reference designs.

Okay, so what does this mean for the future? The landscape of competing has never been bigger. I can try to show you each segment as we walk through. I'm trying to show you some real innovation that's going on. We've introduced several new products. We've talked about [Bay Trail], and its ability to get us into lower price entry points and really innovative two in one designs. We talked about 14-nanometer [Broadwell],and actually showing you functioning Broadwell silicon. And we talked about before, new silicon expanding the frontiers of where Intel Architecture really could go, lower powers and lower [unintelligible] factors than I think anybody thought Intel Architecture would reach into.

We're showing you from the biggest server, the E5, to the smallest SoC Intel has ever built before. It's a landscape of opportunity for Intel and its developer community. As you spend the next couple of days here, look at the innovation going on in this company. See the sea of change that's occurring. Embrace it with us. We want to be your partner, and create that future. We try to build products that consumers want, that you as developers want, that are based on an open architecture that allows you to innovate. You can put your own IP on, and produce products based on Intel silicon that are unique to you. As I said, I couldn't imagine a better, more exciting time to be a leader in this industry, but more importantly, at Intel.

So, I want to thank you for listening to me up here, for enjoying these products and this innovation. As Ulmont said, I'll be back in about 30 minutes. We're going to do something new, we've never done this before -- open Q&A. Part of that open architecture. So, it's a chance for you guys to get intimate with us and share your thoughts and questions.

But to start, to show just how far we're looking ahead, it gives me great pleasure to introduce Intel's newest president, Renee James.

[Video]

Renee James: Good morning. For 45 years, Intel's been enhancing the future. For 45 years, we've been building the foundation of this industry, which is the silicon transistor, which you just saw. And for 45 years, we have been doing the things that everybody said can't be done. Now, we're going to lead the industry into a new era of computing, an era of computing where everybody computes. And we'll transition from worrying about the form factor, or the look and feel of the device, to the real problems that computing has solved for us -- compute that's integrated into the fabric of our daily lives, and assists us in solving problems, like managing huge global cities, or finding cures through personalized healthcare.

We'll be able to solve ordinary problems in extraordinary ways, and extraordinary problems will be solved in seemingly ordinary ways. It will be from the mundane to the miraculous, when integrated computing is in our future.

For the rest of this talk, what I'm going to do is give you a glimpse of some of the projects that are started today using integrated computing to solve really tough problems that are out there, and give you a glimpse of what the world's going to look like, from our point of view. But first, I'd like to take you back to the beginning, where all good stories start. Forty-five years ago, when Intel was founded by Robert Noyce and Gordon Moore. Bob was the inventor of the silicon transition and integrated circuits, and he gave us a mandate, to go out and do something wonderful. Gordon gave us the compass for that mission with Moore's Law, and since then Intel has been on the relentless pursuit of the essential underpinnings of this industry, improving the silicon transistor.

All of you know this, because some of you have written it. Moore's Law has been declared dead at least once a decade since I've been at Intel, and as you know, you heard from Brian, we have 14 nanometers working, and we can see beyond that. I assume you, it's alive and well, and we're going to enable many, many things with it.

One of the things that Moore's Law enables is the mobility that all of you are using to tweet and surf and text while I talk. We're going to talk about that. All right, today we work in the nano-world, and for those of you that aren't big aficionados of semiconductor technology, I thought I'd take a second and just explain to you what it really is like. We build transistors atom by atom. Not long ago, we actually didn't imagine how we would build a transistor that was smaller than 22 nanometers, and now you've seen 14 working in Brian's talk this morning. So, if you don't know how small that is, consider this. A nanometer is to a yardstick -- let me get my marble -- as this marble is to the planet earth, that's how small.

And we build billions of those transistors on every chip, and hundreds of millions of those chips a year. At our scale, what we do is as complex as putting a man on the moon was in 1969, or putting a rover on Mars in the 21st century. What we do takes fundamental scientific breakthrough. Just to make a single new feature or a new product, something for example like [unintelligible] or a 3D transistor, both of which were research projects until Intel had fundamental breakthroughs that moved them into high production and scale.

These are a few of the additional technological breakthroughs that people said they were barriers. You can't overcome them, it can't be done. And the fact is, we have, and we've done it so consistently that we make it look easy. Every time you turn on your phone, your tablet, your PC, it just works. It seems easy. And behind that are tens of thousands of people fundamentally making scientific breakthrough so that works.

These are the breakthroughs that fuel the entire industry, and they make the foundation of the compute platform that you as developers do your work on. And compute platforms and devices follow Moore's Law as well, not just silicon transistors. They continue to evolve in power and features and performance, and it's all based on that underlying progress that we make.

So, I want to give you some examples -- they'll be super fun. So, here's one. I know all of you are going to recognize this. This -- right, the [unintelligible] 8000, Motorola phone. In 1980, this phone was built using 1500-nanometer technology, which was state of the art, for 22 nanometers today, right? Some of you remember this was your first cellphone, and it was super cool -- not so much today. Today it looks like a prop from a movie. Wasn't very pocket-friendly. Battery life measured in -- anybody? -- minutes, exactly.

Okay, here's state of art today. This is an Intel-based phone, it's a Lenovo K900. And this phone is state of the art. Twelve days in standby, 12 hours in talk time. So remember, until 1990, most phones were installed in cars permanently, because they needed a power source, right? And all you could do was make a voice call.

Could you imagine buying a phone that could only do a voice call today? No one would buy that, right? Making a call is not the most extraordinary thing that this phone does.

So, let's talk about what's extraordinary about it. It has more performance than Pentium® 4. It runs at two gigahertz, that phone, which 12 years ago was the fastest desktop computer you could buy. This is the fundamental advancement of what Intel does. It's what Moore's Law brings you, and it's what we've done to make that [unintelligible] performance seem totally mundane.

We've driven three breakthroughs in computing. The first one was very much about task-based computing. And the next phase -- the one that I think we're living in today -- I call is lifestyle computing. I'll talk a little bit more about why. The next phase is very much about integrated computing.

I'll start with task-based. Task-based computing really started with origins with the mainframe. It was very much about the scarce resource, and your important task, and what you had to get done. In fact, Intel's first significant products were memory products for working in mainframes.

The PC changed that. The PC democratized computing and allowed everybody to be able to do their own tasks. It was still very task-based. But, of course, the PC evolved. It evolved into the era that we're in now, lifestyle computing. Lifestyle is very much about you, your data, wherever you want it, whenever you want it, to do what you need to get done.

I want to just pause there and think about evolutions in computing. They don't come that often. When they do, at the beginning, we think it's the next big thing. Everything that came before it, dead. But that's not true. Right? It's an evolution. Evolutions in computing don't end. What happens is they continue forward, like the mainframe does today, and they evolve, and they adapt. You should think about each new phase in computing as not an ending but the beginning of the next frontier of where we're going to go.

So the next chapter. What happens in the next chapter of computing? We think that familiar objects that occur in your everyday life get new capabilities. So I'm going to give you a pretty mundane example -- a car headlight. What has been the greatest breakthrough in the car headlight in the last decade? Not that much. But now we can add silicon-based sensors to them and make them smart so they can detect the rain. Okay. But I don't need to detect the rain. I need to actually see individual raindrops so that they can shoot the headlight beams around them.

What it allows you to do is, of course, safer driving, better clarity at night. Ordinary or extraordinary? Mundane or miraculous? Safer driving. When silicon can be made small enough, smart enough to transform a headlight, it can transform every other area of our life.

Quark -- which Brian just talked about -- is our new family of products that are targeted at integrated computing. And I use that term to be inclusive of Internet of things, of wearables, of tradition embedded. All of these new areas, and some of the older areas in embedded technology, that are getting smarter, and they're getting connected. All of them will be connected, all of it will compute.

So let me show you a few examples of what's happening today. The city of Dublin, Ireland -- not the one in the East Bay -- has a program that's called City Watch and City Sensing. And what they're doing is they put sensors into the street drainage system, which sounds pretty boring. But it allows them to monitor the flood warnings in the city of Dublin. And it alerts the crews to what's happening.

But more importantly, it sends out some other information through their cloud servers. It sends out signals to the traffic system to divert [unintelligible] away from the high water area, and it also sends out a city map so that if you live in Dublin, Ireland, you can figure out what's going on. And the citizens get to participate because, of course, there's an app for that. There's a City Watch app. And so they submit real time update reports. And they basically use all of that data together in a crowd sourcing way to put real time status as to what's going on in the city of Dublin.

Most people don't even know what's happened. They don't know that there's sensors in their street. They don't know that the traffic lights are timing or diverting them in different places, getting multiple sources of data real time, being put into a cloud service and sent out back to their smartphones.

Why is this important? Because by 2050, 70 percent of the world's population are going to live in these megacities -- Dublin not being one of the biggest ones, of course. And something as mundane as a clogged drain becomes more than an annoyance. It becomes a systemic problem that needs the ability to fix it quickly, to manage massive amounts of data, to alert a huge number of populations.

Imagine, as developers, for you, what this means. [Whole] platforms that we haven't even thought about as compute platforms. Brand new kinds of applications that can be built. And managing cities is just one of those examples.

The other really interesting example -- and there are so many that we actually had to pare it down so we could get it into this time slot -- is in healthcare. 70 percent of these people that I was talking about that are going to be living in big cities, they're going to be aging -- as am I. We have these questions that we keep asking. Are we going to have enough hospitals? Will we have enough clinics? Will we be able to train enough doctors with this aging population?

They need more than just hospitals and clinics and doctors. They need care that's affordable and is easy to administer. And the era of integrated computing allows us to offer some new answers so those old questions.

What if we moved healthcare out of the hospital? Brian talked about wearables, and you've seen kind of a glimpse of what's coming. It's going to be beyond jewelry and eyeglasses into devices like this one. Let me show you this. This is a wearable from Sotera Wireless, in trials right now. I will put it on. I'm going to see if my heart rate's really high here. What it's doing is it's taking a constant reading and transmitting reports wirelessly to a service. This is actually a real time EKG, blood pressure, and other vitals, just from a wristband. It is an amazing device and what this replaces is an entire -- on this table, on the end -- bunch of equipment that you would have to have in a medical clinic, and it gives you real time results to the doctor.

Here is another example of innovation in medicine by MC10. Through the magic of what silicon and transistor technology, in the future, this patch -- this prototype silicon-based patch – could take the wonderful innovation shown by Sotera and perhaps even do much of the same in an even smaller package. This will be directly on your skin. This patch will perform all of the same functions that that wearable does today. This is from a company called MC10, and it's a prototype right now. So why is this important? That little patch thing is like a Band-Aid. You just peel it off and stick it on. So why is it important?

Because it's a constant data stream that your doctor can see, that if something's wrong it's immediate, it's up-to-date and accurate. And it allows us to move into the most exciting phase of healthcare that I think is in this frontier for us, and that is moving into customized care. Care that's actually tailored to the things that are going on in your body. There are a tremendous number of other devices and other applications -- injectables, ingestibles -- that we've looked at. I didn't have time for all of them today. But all based on a fundamental, foundational building block of this industry, this is the silicon transistor.

Customized care, with your own genomic data, is the pinnacle of healthcare. And we first mapped the human genome using an Intel high performance computer, a Xeon-based computer. That's pretty exciting for us. And as you can imagine -- because we like to talk about Big Data -- that is one Big Data challenge.

I'd like to share how big a Big Data problem. One person's genomic map is a petabyte of data. That's 1000 terabytes for one person, enough to fill 20 filing cabinets of information. And through the work that we do, the advancements in price performance, Moore's Law, what we do every single day, we've transformed the ability to sequence. And what used to take years in 2000 is now down to two weeks, and we're working to get that down to days and hours.

But more importantly, a single sequence used to be $70 million. It's now less than $5,000 to do one sequence, and we are on route to make that $1,000, which means personalized genomic sequencing is within our reach. And it's moving faster than the rate of Moore's Law. But let's think about the benefits of that. Why are we excited? Why am I excited about that? Why do we get up every day and say, you know what, working with Intel, working at Intel, it's pretty excited because we get to change the world? Why?

One-third of all women and half of all men are going to be diagnosed with cancer, right? Early detection and treatment is the way to solve cancer in most cases, and it's customized to that individual, it makes the profoundest difference in its effectiveness. And that's where we can make a difference.

Using high-performance computers, the Knight Center for Cancer Research at the Oregon Health Sciences University is working on analyzing human genomic profiles and creating searchable DNA customized DNA map. And what I'd like to do is share directly from them with you what they're doing.

[Video plays.]

Renee James: [Unintelligible] said, in this next era, you're moving the biologic problem to a computational problem in the treatment of cancer. Computing doesn't get any more personal than when it saves your life, so I'd like to share another story with you. And it's the story about an Intel employee, in fact, one of our fellows, who's here with us at IDF. He fought a 24-year battle with cancer. When he was a young man in college, he was diagnosed with kidney cancer, and he was given a few years to live.

And he went through dozens and dozens of debilitating cancer therapies, and he was very brave, and he defined all his doctors' odds with his longevity, but in the end, the cancer never went away, and his kidneys did eventually fail. Recently, in his work that he's been doing, he was visiting a genomic company, and they asked if they could sequence his tumor. And he said yes. He allowed them to do it. And what they did is they shared that data with all of his doctors. I'm not going to tell you the end of this story. I would like you to help me welcome Intel fellow Eric Fishman to tell his story.

Eric Dishman: Thank you. Alive and well. I think I've had more predictions of my death than maybe even Moore's Law.

Renee James: [Moore's Law, alive and well, ladies and gentlemen.]

Eric Dishman: [Unintelligible.]

Renee James: [Unintelligible] why don't you tell everybody what happened the day that you showed up to your doctors and they had your tumor sequence?

Eric Dishman: It was just miraculous. At that point, I was so sick, I was going to the doctor twice a week. So it was my Thursday appointment, and I walk in, and they've got some of my East Coast physicians on

Skype and some doctors on the phone, and all my doctors are working together, and I'm like, uh oh. And then they basically tell me that 90 percent of the drugs that they've put me on were never going to work because this genomic map had revealed this to them. And they basically admitted that they had mischaracterized and sort of misunderstood my cancer for over two decades.

Renee James: And then what happened?

Eric Dishman: Well, at that point, then they had the good news, which was we think we understand enough about your cancer, and it's really Eric's cancer, it's unique, like the [physician] said, we're going to put you on this drug for completely different organs and see how it goes. Four months later, I walk into my diagnostics, the technicians, you know, looking in shock at the scans, they do them again, and they're like you're cancer free, you can start the whole kidney transplant process at this point in time.

Renee James: [Unintelligible.] And I want you to share with us how now your work at Intel is about scaling that out, so that other people can have this experience.

Eric Dishman: That is exactly true, and scale is the thing. That's one of the reasons I work at Intel. [I mean], probably less than 50,000 people on the planet have had access to the kind of whole genome sequencing that I've had, and that's generated about 2.5 petabytes of data. If we had every cancer patient today having a whole genome sequence like once every two weeks, which is what they would ultimately want to do, we'd generate 500 exabytes of data, and that's just in the U.S.

So as we think about this globally, how do we scale? So we've got our product teams in there working on the fabric, the storage, the compute, I mean, the whole system -- how's it possibly going to be done? On the policy side, we're working on how do we deal with the privacy and the security and the ethical issues of sort of scaling this?

On the R&D side, it's everything like you showed, from biochips to Big Data and solving breakthroughs there. And then, finally, on the sort of human and sort of education side, we've got to figure out how we're going to create a genome-ready workforce, train a million doctors on how to incorporate this data and move forward on getting biologists to understand programming and programmers to understand biology.

Renee James: Wow. Thank you for sharing your very personal story with the audience, and congratulations on being cancer free.

Eric Dishman: Thank you.

Renee James: Thank you. [So] 20 years of ineffective therapies [unintelligible] and certainly the worry of what Eric went through, all of that changed by the benefits of personalized medicine and cost-effective integrated computing. Affordable genomics [unintelligible] that reroute traffic and alert you to problems -- a few years ago, a lot of what I talked about seemed like science fiction, and today, we can see it's in our near future.

It's the future before us when computing becomes truly integrated into our lives. For 45 years, Intel has done the things that everybody said couldn't be done, and we've invented the future time and time again. I'd like to close by saying, in the words of Intel founder Bob Moore, I'd like to invite all of you to not be encumbered by history and to go off and do something wonderful. Thank you.

[End of presentation.]