Justin Rattner; Intel Chief Tech. Officer

[Start of recorded material]

[Video playing.]

Female Voice: Ladies and gentlemen, please welcome Justin Rattner.

Justin Rattner: Thanks, everyone. Great to see you again, and I really appreciate you sticking around for the last keynote, the third day of IDF.

Well, I think you can see from that, TV isn't TV anymore. It's out of the box. It's off the wall. And it's not going back anytime soon. TV will be everywhere, on all your devices, whenever and wherever you want to watch it. And TV isn't about this show or about that movie. It's about personal content. It's about professional content. And it's about games, as you just saw. And it's about applications of all kinds. TV will be whatever you want it to be. You, the developers, are going to define the future of TV. And that's what we're here today to talk about.

If you look at the trends of TV, it's growing exponentially. By 2015 -- get ready for these numbers -- 500 billion hours of content, truly a humanly unknowable amount of entertainment, but available to anyone. And it's about 12 billion devices with a broadband connection to all of that content. That's more than one TV-capable device for every man, woman, and child on the planet in 2015. Amazing. There's no question that TV will remain at the center of our lives.

To help us get a sense of these trends, I'm going to bring out someone who lives and breathes television. Please welcome Comcast Fellow Mark Francisco. Come on out, Mark.

[Applause]

Mark Francisco: Morning.

Justin Rattner: Great to have you here.

Mark Francisco: Likewise.

Justin Rattner: I want to know one thing. What does it feel like to have a whole city named after you?

Mark Francisco: I tell you, it's really strange when they check in at hotels, and they look twice, if you mark Francisco -- you got the address right here?

Justin Rattner: That's great. I'm sure it's not the first time you've looked at the numbers I just showed. So, what do they really tell us? I mean, at Comcast, what do you think about when you see numbers like that?

Mark Francisco: Well, I certainly think that television's future is in good hands. Each advance in technology, whether it's process or algorithm or integration or material, just helps to blur the lines of distinction between the various families of devices.

Justin Rattner: So, you know, how is TV going to change to respond to all of that?

Mark Francisco: What we're seeing is platform-independent development where standards are taking hold and developers are gravitating towards a standard development environment. As a result, television is changing from being a device to an application. This is going to allow us to create a much more highly personalized and social experience for television.

Justin Rattner: Well, there's no question that experience is at the heart of that. I mean, I think -- you know, we heard that in Eric's keynote. You've mentioned it again. You know, when we talk about experiences, I think about things like 3D TV. What can you tell us about that?

Mark Francisco: Yes. Certainly. So, television can scale, as an application, its fidelity between small battery-operated handheld devices and large immersive multidimensional experiences. So, what you're seeing now is the ability to take stereoscopic 3D TV and pass it through existing broadcast channels.

The cable industry is promoting the use of what is shown behind us as the over-under spatial multiplexing method. This allows you to take the left eye and collapse it in a vertical dimension, place it over the right eye, collapsed in a vertical dimension, and fit within an existing frame, so it can be broadcast over the cable networks.

Justin Rattner: Wow. I'm really impressed. You guys are moving at light speed with 3D technology. So, you know, it's not done, but it sounds like you're making good progress. You know, what really excites you? What gets you up in the morning?

Mark Francisco: Well, it's certainly things like 3D. As we can prepare our networks to handle things like 3D and the standards take hold, the consumer devices will start to standardize, and people can make the choices, bring them into their house, and enable us to bring such experiences to the home. Then what we want to do is take entertainment and fit to the personal interest and the social settings of the viewer.

TV is going to be more interactive, yet it won't require more activity to enjoy. Interactivity is going to be an integral part of the experience. It's clear that content is still the most important part of television, yet that content needs to be -- it should be matched to the personal interests.

Justin Rattner: Right. Okay. Hey, thank you, Mark. You know, it's just great to have you here. I can't thank you too much. Give it up for Mark Francisco, please.

Mark Francisco: Thank you very much.

[Applause]

Justin Rattner: All right. I'll take that. Well, Mark just talked about highly personalized social TV experiences being -- you know, being fundamental. But how do you actually go about the design process? How do you create? How do you engineer such experiences? And more importantly, how do you know after you've created the experience that people really like, that people really relate to it, and most importantly, that people are willing to pay for it?

Well, at Intel, we ask exactly those questions using teams of social scientists, cultural anthropologists, and ethnographers to really, you know, explore these kinds of issues in great depth. Let me show you a short video of what these people do.

[Video playing]

Justin Rattner: Well, let me bring him out live here onstage, Brian David Johnson, User Experience Architect at Intel's Digital Home Group. Come on out, Brian.

[Applause]

I want to come back this idea of personalized, socialized TV experiences. Mark talked about that. Can you put some meat on the bones, really give us the down and dirty about this?

Brian Johnson: Sure, sure. So, when we think about the future of TV at Intel, it really is about entertainment and theentertainment experience. And

so, again, as you said before, that's TV; that's movie; that's games and applications all --

Justin Rattner: And my own content as well --

Brian Johnson: Yeah. All personal, content user-generated content across all of your devices.

And so, when we're beginning to think about how we develop for that, we found a way to break it down. And we broke it down into these four different experiences or four different usages.

And we've used those usages to inform our technology and our platform development. So, things like informative, ubiquitous, personal and social TV are really the way that we kind of imagine the future of television. It's also today what we're going to use as a way to walk you through, and walk everybody here through, some of the visions and some technologies that we're working on.

Justin Rattner: So, can we get this out of the abstract, get down to concrete terms, and look at some hard stuff here?

Brian Johnson: Yes, please. So, what we're going to do is we're going start with informative.

Justin Rattner: Okay.

Brian Johnson: So, as you know, today, when it comes to video, you have just a little bit of information. You have a little bit of metadata, a little bit of program data that comes down with the file.

Justin Rattner: Yeah. Sometimes it's just a short sentence.

Brian Johnson: Or it's even bad grammar thaT you don't even know what it says.

Justin Rattner: Right.

Brian Johnson: So, that's not good enough. So, as we begin to look at it, we're starting to see, well, what if you could have an increased amount of information coming down so television is not only digital, entertainment is not only digital, but it's data. And that data is about kind of breaking open the video file and knowing what's inside of it.

Justin Rattner: Wow. Okay. How is that going to work?

Brian Johnson: Well, what we're doing is we're tracking objects. We're tracking almost down to a frame-by-frame basis what's in it and then generating metadata to come along with it.

Justin Rattner: So, computers are now watching this 500 billion hours of television.

Brian Johnson: Exactly. It's computer vision. It's about data. And then what we can do with that data is we begin to personalize it.

Justin Rattner: Okay.

Brian Johnson: But, again, enough hand-waving. Let's get to the proof is in the technology.

Justin Rattner: Right.

Brian Johnson: So, let's bring out [Yman Zang] --

Justin Rattner: All right.

Brian Johnson: -- from our Beijing lab who is going to really show us some foundational work that he's been doing.

Justin Rattner: I know him well. Come on out, Yman. There he is.

Brian Johnson: Welcome.

Justin Rattner: Yman Zang, everybody, all the way from Beijing.

[Applause]

Brian Johnson: So, why don't you kind of walk us through the work that you've been doing? I know we're going to have a video that we're going to play here. And talk about, really, kind of the foundational work that you've been working on.

Yman Zang: Okay. Let's see the first video.

[Video playing]

Brian Johnson: There we go.

Yman Zang: Okay. You can see that the system can position and track each player in the field, also the ball. And our system can even label the player's name and, also, the jersey number.

We are doing this by using latest the computer vision [aggregates], such as objection-detection tracking and also cast indexing. And we also can extract other kinds of information, such as play field position, replay, and the exciting speech of the commentator.. From there, we can extract the highlighted events such as goals.

Justin Rattner: Wow. And you're also tracking the ball here.

Yman Zang: Yeah.

Justin Rattner: I can see that. And that's really moving.

Yman Zang: Yes.

Justin Rattner: Okay. So, what do you do with that? You've got all that information now. What's next?

Yman Zang: Okay. So, let's see the second video. Here you can see that user can select the player and, also, the highlighted events category, and then select the clips. So, you can see hours of sports video can be reduced to just the minutes of highlights you really want to see.

Justin Rattner: So, this is like SportsCenter, my own private SportsCenter, right? I can decide what I want to watch of the game, the highlights of the game. And I can say, "Hey, I want to watch my favorite player," or, "I want to see the shots on goal."

Yman Zang: Yes.

Justin Rattner: That's really amazing.

Yman Zang: Yeah. More than that. Actually, the user can even get the information about their favorite player from the Internet in real time.

Justin Rattner: Oh, that's right because you've read the jersey number, and you've mapped that to the team roster.

Yman Zang: Yeah. We can do this in real time, a powerful computing platform.

Justin Rattner: Fantastic.

Brian Johnson: Yeah. You can begin to mash up multiple inputs of data all coming together into your TV.

Justin Rattner: Sure. Excellent.

Brian Johnson: Yeah.

Justin Rattner: Excellent. Hey, thanks, Yman.

Yman Zang: You're welcome.

Justin Rattner: I'm in Beijing next month. So, I'll see you when I get there. All right? Take care.

Brian Johnson: Take care.

Justin Rattner: All right. Yman Zang, everybody.

[Applause.]

Brian Johnson: So, as you can see, as a foundation of our thinking, it really is beginning to turn television into something that computers can really enhance.

Justin Rattner: Right. And I know something about that work. And that takes a lot of computing powe, too.

Brian Johnson: Yeah. Yeah. Iit opens up a lot of opportunities.

Justin Rattner: Exactly, exactly. Okay.

Brian Johnson: So, the next area we want to talk about we've combined together, which is ubiquitous and personal. So, now, as you know, Justin, ubiquity is not new to computing. We've been talking about ubiquity for decades.

But the ubiquity of a television experience, of your entertainment experience, that's kind of new, that idea of being able to move around and have your entertainment experience both inside the home and outside the home. But, also, if you think back to Paul's keynote, when he was talking about the continuum, it's also about your devices working together as well. So, it's getting in front of a television, your devices working together in that room.

Justin Rattner: Well, and sometimes I won't get through a particular program. And, boy, when I get to my hotel after a plane ride, I just love to be able to pick it up and keep going from where I stopped.

Brian Johnson: Right. So, you can imagine that, as you go through, as Yman showed us, you've got all this information coming down. So, much more informative.

You now have your devices going everywhere with you and working together. Well, now you can begin to personalize your experience. And you can begin to personalize it not only with the

data and the applications, but also your entertainment and sometimes even the advertising and offers.

Justin Rattner: Right. Okay. Should we take a look at an example of that?

Brian Johnson: Well, we brought out an example today. And why don't we go ahead and get that started? But we'll get that running. But, before we start, we need to get back here, and you need to get your MID.

Justin Rattner: Oh, that's right. Yeah. I've got to pick up my MID. Okay. Here we go.

Brian Johnson: Come over here.

Justin Rattner: All right.

Brian Johnson: So, what I want to do is I'd like to introduce you to [Mark Yarvason]. Mark is going to kind of walk us through some of the work that he's --

Justin Rattner: Hi, Mark. Glad you to have you here today.

Mark Yarvason: Hi, Justin. I wanted to show you a research prototype that we've been working on that personalizes your experience, your entertainment experience, across multiple devices. And you may not have realized this, but the personalization already started as you walked across the stage.

Justin Rattner: Okay. I didn't feel anything.

Mark Yarvason: Well, when you brought that MID close to the set-top box over here, the set-top box realized that you were there. And it personalized its interfaces for you.

Justin Rattner: Oh, okay.

Mark Yarvason: You probably didn't see that before.

Justin Rattner: Should we see it again?

Mark Yarvason: Let's play it back.

Brian Johnson: Let's wind it back, yeah.

Mark Yarvason: Okay. So, what you're going to see is on the very left-hand side of the screen is my content list. These are the things that I want to watch from multiple, different input sources. And then, when you came closer, it changed to your content list.

Justin Rattner: Okay. But you're not just looking at my story content. These are -- it's making recommendations about what to watch.

Mark Yarvason: It's making -- and these aren't just your favorites; these aren't just the things you like to watch. These are the things that are relevant to

what you're doing now. They're relevant to what your interests are, and they're relevant to how much time you have in your schedule to watch TV now.

Justin Rattner: Okay. So, the system makes use of this notion of soft sensors, like my calendar.

Mark Yarvason: Yes. But the MID plays a huge role in this because the MID is with you all the time. It has
your calendar in it. And --

Justin Rattner: I'm not giving up my MID.

Mark Yarvason: -- [laughs] it also knows where you've been all day long. So, it knows what kind of day you're having.

Justin Rattner: Okay.

Mark Yarvason: You want to watch some TV?

Justin Rattner: Sure.

Brian Johnson: So, what do we get on the numbers?

Mark Yarvason: Yeah, let's try numbers.

Justin Rattner: Oh, yeah. That's right. Eric recorded numbers.

Mark Yarvason: So, the idea here is what's going to happen is the set-top box is going to be getting information from your MID and some things that you've been going through and doing. And then it will begin to populate it with things that you might find of interest.

Justin Rattner: And what's this thing here? It says "guitars." How did we get "guitars" up there?

Mark Yarvason: Well, what's happening, as I said, is you've had your MID with you. And have you been researching guitars?

Justin Rattner: Oh, that's right. I was at Guitar Center over the weekend looking for a guitar for my son.

Mark Yarvason: And you had your MID with you?

Justin Rattner: I did.

Mark Yarvason: So, the idea is what's happening is your MID now, because it's spending time with you, and it's interacting with you, it's now being able to pull up information, content, and also possibly some advertising that you might find interesting and giving it to you in an appropriate way on your television.

Justin Rattner: Okay.

Mark Yarvason: We can take it one step further. Let's say you wanted to research these guitars further. You'd probably do it on your laptop, right? So, let's say we were interesting in some custom Steve Vai guitars. So, we did our Web search, and you'll notice that the PC has discovered that there's content on your set top box that's relevant to what you're interested in, to what you're searching for now.

And so it's telling you on the Web browser to go look at your content list again. And now if you look at your content list, that same icon that appeared in the Web browser is here showing you, "Hey, let's play that content."

Justin Rattner: Okay. So, we probably shouldn't look at that now. Is there some way we can save that?

Mark Yarvason: Sure. Why don't we just transfer that to your MID and you can watch that later.

Justin Rattner: Super. All right, fantastic. Anything else we should see?

Mark Yarvason: No, I think that's it.

Justin Rattner: All right. Thanks, Mark. Appreciate that. Mark Yarvason, everyone.

Brian Johnson: So, I think the exciting thing about that, Justin, is that it's real. So, we've been talking about ubiquity, we've been talking about personalization. But this is actual hardware and software technology

that we have running up at Intel, and it's really going to afford a whole host of new experiences for us.

Justin Rattner: Okay. So, we've explored three of the four dimensions that you talked about. What about the social dimension? A lot of the speakers have mentioned the social component.

Brian Johnson: And I think that's so important because human beings are social. So, we need to understand and appreciate that any technology we develop people are going to use to talk to each other, and we need to find ways to enhance that. So, we were going to do something a little different now. Instead of going through a technology demo, we're going to bring out somebody from Georgia Tech, because Georgia Tech is doing some really interesting work around this notion of social TV. But they call it human convergence. So, this idea of people coming together through technology.

Justin Rattner: Ooh, human convergence.

Brian Johnson: Well, that's what's great. And what a university can do that's sometimes interesting --

Justin Rattner: Is this like one world or something?

Brian Johnson: It's a very, very broad view about humans and technology working together. But we can learn some really, really interesting things

about it. So, what they've done for us is they've put together a video to kind of give us an overview of that.

Justin Rattner: Okay, let's watch that.

Brian Johnson: Let's bring that up.

[Video playing.]

Brian Johnson: And so now to tell us a little bit more about human convergence and talk about the work, I'd like to bring out Beth Mynatt, the Director of the GVU Center from Georgia Tech. Please welcome Beth.

Justin Rattner: Welcome to IDF. We're delighted you're here.

Brian Johnson: Why don't we move down here, get a little bit closer to the folks. All right. So, we can see from the video that your GVU center is really attacking these problems of the social nature of television. Can you give us a better feeling for that, a bit more of the picture?

Beth Mynatt: So, what we do at Georgia Tech is that we create multi-disciplinary teams that combine expertise in computer science and engineering with expertise in media studies, art and design, and the social sciences. Together these teams enable a human-centered approach to innovative technologies.

Justin Rattner: Okay, but it sounds like you've got a lot of academics working on this. How do you keep it real? How do you keep it relevant?

Beth Mynatt: Of course. The way we keep it real is that we partner with companies, such as Turner Broadcasting, Motorola, Steelcase, and of course Intel to understand how people are active participants in social media experiences such as television.

So, go back 20 years. People sat in their living rooms watching TV, and then they went to work and talked about it the next day. They wrote Star Trek novels. They attended conventions. They played Jeopardy, the board game. They subscribed to TV Guide.

What we want to do in our research is to understand how these social experiences around media -- around television -- are transformed in the digital age. So, what we're doing at GVU with our industrial partners is to design new social experiences around media. They may start in the living room -- perhaps with some cool reality technologies -- but they'll move to online discussions on the Web, and then maybe journey into a fantastic adventure in a virtual world, and then show up in a casual handheld game on your iPhone. Together across these technologies, people experience convergence.

Brian Johnson: That's great. One of the things I wanted to ask you about is, you have a project that I think is really quite fascinating -- the Moses Project. So, we talk about social TV and the ability of connecting people via their televisions or via their devices. But with the Moses

Project, you actually did something much bigger and I think quite important, where you actually connected a whole country.

Beth Mynatt: I'm glad you asked me about the Moses Project because it's a very daunting effort. So, in the country of Liberia, Moses kiosks travel from town to town. And people can come to the kiosk and tell their stories of the war. And they can also watch the stories from their neighbors, including people that fought on the opposing side of that brutal civil war. As the process unfolds, the nation is reconnected. People are pulled back together with a sense of reconciliation. It's a very, very powerful product of social media.

Justin Rattner: It sounds amazing.

Brian Johnson: Incredible, yeah.

Justin Rattner: All right. Well, Beth, thank you so much for coming out. We really appreciate it.

Beth Mynatt: Enjoyed it, thank you.

Justin Rattner: We look forward to your work in the future.

Beth Mynatt: Thank you, Justin.

Brian Johnson: Beth, delighted you came. Appreciate it. Beth Mynatt.

Justin Rattner: Okay, Brian, so one thing I think is clear -- now that I understand the multiple dimensions of the future TV experience -- it's going to take a lot of computing power to do that. How do you see Intel architecture relating to that?

Brian Johnson: Well, all of these platforms are on IA. And we're going to be able to use our developer community and have our developer community work on being able to build out these experiences. I think one of the things that I think is probably the most awesome thing we could talk about right now is, it's not a matter of if this is going to happen. I think you've shown with Mark from Comcast and from your stats, we know what's going to happen. It's coming.

And it's not even a matter of when because from the demos that you saw today, it's happening right now. It's happening in the labs. The real question we need to look into is how, and how it's going to happen. The reason why the how is so important here is that it's all about the developers. It's everybody in this room, is going to help us bring about the future of television. It's something that I'm completely excited about.

Justin Rattner: All right. Well, I'm excited about it too. I really appreciate you helping us understand what the future of television is going to look like.

Brian Johnson: Wait, you forgot something.

Justin Rattner: I forgot the remote? Oh, the book. Yes, I forgot about the book. Okay.

Brian Johnson: The book you were going to write the introduction for? Yeah.

Justin Rattner: Yeah, yeah. The book I'm writing the introduction for. Okay, tell everybody about the book.

Brian Johnson: What we've done is we've pulled together a lot of the work that we've been doing over the past few years into a book called "Screen Future," that's going to be released in the beginning of 2010. What we've done is we've put a few chapters up, and you can go to the Web site. There's also a deal on the Web site. If you keep a look out for these cards, you can actually get 40 percent off. You can register, and then when it comes out you'll get the discount. So, have a look.

Justin Rattner: You're a regular Ron Popeil here. All right, thanks, Brian.

Brian Johnson: Thanks, Justin.

Justin Rattner: Appreciate it. Do I get the coupon now?

Brian Johnson: Yeah, you can have the coupon.

Justin Rattner: Okay, I get the coupon. Thanks again.

Brian Johnson: Thanks a lot, everybody.

[Applause]

Justin Rattner: Brian David Johnson, everyone. Thank you, Brian. Well, I think Brian has shared with us really a tremendous vision for the future of television. And I think it's clear that it's all about the user experience. And one thing about that experience, as we look to the future, is we know it's going to be immersive. People use that term all the time. What does that really mean, "immersive?" I'm in the middle of what? Well, let me give you an example. Take a listen.

[Sound plays]

Well, you all know that sound. You've been immersed in that sound for many years now. It used to be just in the theater, but the technology advanced with things like Dolby Digital, and THX, and AC3, and all these technologies that are now part of really the home theater experience. I'm sure Erik's theater over here, home theater, has that THX sound that we all know so well.

I think we've got the sonic immersion down to a pretty good science. But what isn't here yet is this notion of immersive video, immersive pictures. And the reason for that is that the technology just hasn't been quite ready for that.

So, if you attend conferences like the Consumer Electronics Show, like last year, and I'm sure at the upcoming one, the 2010 CES, a lot of buzz, a lot of noise about 3D televisions coming to the home. It seems like there's an announcement every week.

Sony just made a major announcement. Panasonic is there. Many other companies are working to bring that 3D experience out of the theater into the home, just as we did with Dolby Digital Sound and the other motion picture sound formats.

I was going to show you a 3D LDC TV. In fact, it's sitting right over there. But I was actually down in the Bay area last week, as I seem to be every week these days -- I guess it's part of the job -- and I saw a spot come up on the TV in the hotel about a new 3D technology.

I was so excited about this development that we got a hold of the folks who are creating it at a company called HDI, and we invited them to be here today to see the technology. So, I think this is kind of a coming-out party for them. Let me introduce Chris Stuart and Ed Sandberg from HDI.

[Applause]

Edmund Sandberg: Hi.

Justin Rattner: Chris?

Chris Stuart: Hey, good morning, Justin.

Justin Rattner: Hey, glad you're here.

Chris Stuart: Thank you.

Justin Rattner: I just happened to catch that item on ABC, and I saw all the folks really digging this big display that you guys are building. So, why don't you maybe tell us what's the difference between what we were going to show here with this LCD 3D TV, and what you guys are working on?

Chris Stuart: Okay.

Justin Rattner: Chris, maybe you want to give us the big picture first?

Chris Stuart: Yeah. We've developed a very unique and highly efficient 100-inch prototype laserscopic 3D television system.

Justin Rattner: Yeah, I know. I saw those lasers on TV. It blew my mind.

Chris Stuart: What we'll show you here is our LCOS technology that we have developed. We're going to start with that.

Justin Rattner: Okay. Ed, tell us a little bit about these LCOS imagers.

Edmund Sandberg: Well, these LCOS are very, very fast. They will scan over 1,000 frames a second.

Justin Rattner: Wow. I mean, today we think a fast TV is like 240 hertz.

Edmund Sandberg: Yes. But we take advantage of that speed by producing a 3D image, so we have simultaneous high-speed 3D viewing.

Justin Rattner: Okay. And the light sources that drive these imagers?

Edmund Sandberg: The light source is laser technology. Turn it on.

Justin Rattner: Okay.

Chris Stuart: We actually developed a fiber-coupled RGB laser source --

Justin Rattner: Wow.

Chris Stuart: -- that we utilize to power the LCOS engine with.

Edmund Sandberg: So, it's fiber-optic-driven, and red, green, and blue.

Justin Rattner: Okay. How many of these -- does just one drive that whole 100-inch display?

Edmund Sandberg: Actually it's two or three modules of this type.

Chris Stuart: About three [crosstalk].

Justin Rattner: Okay. I mean, you can see how intense that white light is.

Chris Stuart: Yeah.

Justin Rattner: Chris, maybe you can tell us what are the advantages of the HDI approach over -- I hate to say "conventional" 3D LCD TV? 3D TVs are hardly conventional.

Chris Stuart: The systems that are coming out, 3D LCD or the plasma, they're based on active shutter glasses, which actually deliver alternating images per eye with a slow refresh rate, in fact. The other technology is based on a micropole technique, which you get half-resolution. Our technique is dual 1080b imagers at all times. You get full high-definition, full 360 frames per second, at all times.

Justin Rattner: Wow. And with the laser sources, the color quality just must be astonishing.

Edmund Sandberg: It is. It's the largest color gamut that you can produce.

Justin Rattner: Impressive.

Edmund Sandberg: So, you can cover every color standard that's out there.

Justin Rattner: Okay. So, what's the business plan here? When are we going to be able to buy an HDI?

Chris Stuart: Well, we're looking at limited availability in 2010, with ramping up production in 2011.

Justin Rattner: Okay. Are you taking deposits yet?

Chris Stuart: Certainly. And we invite all of you down to our Los Gatos studio for an awesome demo that we have running right now.

Justin Rattner: All right, super. Ed, appreciate it. Thanks so much, Chris.

Chris Stuart: Okay. Thanks for having us.

Justin Rattner: That's great. So, watch for that, folks, the HDI 3D television. Yeah, give it up for them. Thanks.

[Applause]

Justin Rattner: So, it looks like we're going to solve the display problem either using the LCD technologies and related technologies, or through innovative developments like you saw from HDI. I think as the opportunity for 3D begins to build out, a lot of new technologies are going to come to play. So, that's good.

As you heard from Mark Francisco earlier in the keynote, the industry is coming together to build the infrastructure for 3D TV -- you know, getting the formats down, the transmission standards, and so forth. We've also seen the creation of 3D content. If you were here last year, Jeffrey Katzenberg was here and was showing some of the DreamWorks' animated 3D movies. So, we know that kind of content.

But there's still a missing ingredient, and that's live 3D TV. All right? Well, you're going to experience it here today. If you'll reach under your seats -- this is getting to be standard practice here at IDF, you have to reach under your seats -- Dadi Perlmutter said yesterday mobile was cool. It ain't this cool, let me tell you.

All right. We'll get everybody fitted out here with your glasses. I have to tell you, those of you in the back actually are going to have a better experience, because this is the kind of display that's used in stadiums. So, those of you close up are probably in the near field. All right. If we can get powered up here, I'm going to introduce Howard Postley from 3ality Digital, Glendale-based company. We're going to see the virtual Howard Postley to begin with. Hey, Howard.

Howard Postley: Hey, Justin. How are you?

Justin Rattner: Good. Can we shake hands in virtual space here? All right, there you go. Fantastic.

So, Howard, this is just incredible. What is 3ality doing to give us that ability to capture live events on television?

Howard Postley: Well, 3ality has spent about the last decade developing technologies to enable live action 3D and maximize the quality of everything that's happening in real-time. So, correction of every aspect of matching the cameras, matching the lenses, and just making sure that throughout the entire chain everything stays in perfect alignment, so that the 3D is what you should see the experience as what was intended. And then doing it all in real-time and live.

Justin Rattner: I think some of the folks in the background aren't quite sure what's going on here. We've got the janitor walking through here. Hey, it's live television, folks! Come on! Yeah, you know, the importance of alignment I think we can't stress enough. What were you telling me? I mean, you've got these two cameras for stereoscopic 3D, how closely do they have to be aligned?

Howard Postley: Well, any misalignment at all would be visible. Part of the issue is the cameras have to be aligned vertically and horizontally. And it's one thing to put the cameras somewhere and have them sit there and get it aligned once, but when you're shooting live action, especially sports, the cameras are moving, the zooms are moving, the focus is changing, and all of that not only has to be aligned at a sub pixel accurate level, both in both dimensions, also in focus and zoom, and then it has to be -- all sorts of things have to be corrected for the

mechanic elaborations such as the differences in lens grind, differences in sensor placement in the cameras. And that's a submicron level of accuracy.

Justin Rattner: Wow. Okay, well, enough tech talk. Can we see some of the stuff that you've created using the 3ality technology?

Howard Postley: Sure. Why don't we roll a little clip from U2 3D?

[Video playing.]

Justin Rattner: All right, ladies and gentlemen, the real Howard Postley. What did you think of that? Is that fantastic?

Howard Postley: I liked it better when I was much bigger than you.

Justin Rattner: Yeah, that's right. Yeah. You kind of had the height advantage on me there. Yeah, you've got a little difficulty there. Well, gee, Howard, that's just really amazing, and watching the concert video was pretty exciting. We might be able to get back to that. But I know when I visited you in Glendale, we had a great visit, but the thing I went home talking to everyone about was watching sports. And, I mean, once -- well, maybe I shouldn't give it away. Let's show some sports, and then we'll talk about sports.

Howard Postley: Right.

Justin Rattner: All right.

Howard Postley: I'll get out of the way.

[Video playing.]

Justin Rattner: All right. We okay back there? I guess that's all they're going to show us, Howard. So, I mean, I just came home and I said, you know, once you've seen sports, football, whatever it is, in 3D, you just don't want to go back. It's just amazing. So, all right, so you had to build some really amazing cameras. Can we take a look at one here? I know you've got one -- well, you certainly have one out in the foyer, so --

Howard Postley: We did. And, by the way, we have that entire game and everything else on a TV downstairs, so if people actually want to see the football --

Justin Rattner: So, if you want to see the whole thing -- okay, great. So, just take a second and tell us about the hardware. It's very impressive.

Howard Postley: So, this is one type of 3D camera. There's basically two types. One looks like this. The other has -- the camera's offset from each other --

Justin Rattner: And that's the one that's outside.

Howard Postley: And that's the one we have out in the lobby.

Justin Rattner: Okay. All right.

Howard Postley: Stereo cameras more or less work the same way. You're shooting two images, one for each eye. And these particular cameras are about as -- they're standard, very high-end broadcast cameras, but the cameras themselves are Sony cameras, nice lenses.

Justin Rattner: But this one is kind of a little bit different here.

Howard Postley: But the platform down here is sort of the magic tricks. And its job is to correct all the mechanical differences between everything and keep it perfectly aligned, no matter what you do to it.

Justin Rattner: And that's a constant process.

Howard Postley: That's absolutely constant. It's relying on two-millisecond increments.

Justin Rattner: Wow.

Howard Postley: So, the platform itself basically moves the cameras around and in the background there's image processing going on that analyzes any changes that might've occurred from, for instances, temperature variation over the course of the day.

Justin Rattner: I guess I can take these off here. I can't be cool the whole show here.

Howard Postley: I'm not going to get any more 3D.

Justin Rattner: Okay. All right. And I understand, now, if you've got a lot of cameras, like covering a football game, right, the cameras have to talk to one another too?

Howard Postley: The cameras talk to each other and they're coordinated by -- in a sporting event, they're coordinated by a computer that's actually looking at the inputs from all of the cameras, but managing a single holistic 3 space. And each one of these cameras is outputting just the camera's -- each one is outputting 3 gigabits a second. So, the stereo camera is putting out 6 gigabits. Plus, there's another about 5 gigabits of metadata coming out.

Justin Rattner: Oh my goodness. Well, maybe that explains why we've got this pile of cables down --

Howard Postley: Yeah, I actually kind of brought that hoping maybe you could help me out a little bit with that, because this is one of the problems that we ultimately haven't really been able to solve. This is kind of part of the cable harness just for one camera, and so when we rig up a broadcast with 40 cameras, we're looking at on the order of 5,000 cables.

Justin Rattner: That's right. I thought lugging the camera was hard. Lugging the cable is amazing. Well, I may actually have a solution to your problem. If you want to follow me over here, I'm going to show you the Light Peak technology. We showed this for the first time yesterday, but we brought another demo , adifferent demo today, and I'd like to invite out [Jeff Demanes]. Where is Jeff?

Jeff Demanes: Hi.

Justin Rattner: Oh, there's Jeff.

Jeff Demanes: Hi, Howard.

Howard Postley: Hey, Jeff.

Justin Rattner: Howard, Jeff. Jeff, Howard. Jeff, Justin, Justin, Jeff. Okay, all right. So, I'm going to block the camera angle here a little bit. Okay, Jeff, so we've got another Light Peak demo. You want to show us the cables, give us the wash and wax?

Jeff Demanes: Sure. And what they'll bring up on the screen is a block diagram of what we actually have set up here for the demo. And we're extending what Dadi showed yesterday for Light Peak.

And what we've done is put Light Peak here into a workstation, so now we have it in a running workstation. And we've connected that over here to a couple of different devices. So, we're going to show

the capabilities of Light Peak and at what bandwidth it can run. So, we certainly want to get the demo underway, and then I'll describe that. And, Howard, what we have here is actually the Light Peak cable.

One of the features of Light Peak is hot pluggable. And since you are interested in this technology, obviously, I want to give you the honor of hot-plugging Light Peak. So, we have a board here --

Justin Rattner: We're willing to try anything for you guys. So, hot plug Light Peak. In it goes. Did you make that noise?

Jeff Demanes: Not that plug. So, what we have here on the board, just to show you, we have the Light Peak router itself, Light Peak is feeding the two optical modules, the two optical modules are feeding four ports. Each one of these ports at 10 gigabits per second, bidirectional.

Justin Rattner: So, full duplex, 10 gigabits each way.

Jeff Demanes: Uh huh.

Justin Rattner: All right.

Jeff Demanes: And what we're doing is we're routing multiple protocols over that Light Peak connection. So, you've seen the hot plug has come up. Here we are running beyond high definition on this monitor here, so

roughly two times the resolution of high definition coming from the workstation --

Justin Rattner: And what's the total data rate to the --

Jeff Demanes: Just to drive this display, it's 8 gigabits per second.

Justin Rattner: Wow, okay, Howard, we're getting up there. We're hitting your bandwidth.

Jeff Demanes: So, we have the display port coming 8 gigabits per second, so this is the one direction on Light Peak. We've decided to show an additional feature of Light Peak which is to show the bidirectional capability. So, what we're going to do here is take these two SSDs, the Intel SSDs, which are on this side of the Light Peak connectivity, and we're going to transfer files over to the workstation at the same time that the video is playing on this monitor.

Justin Rattner: So, this is like Howard moving the metadata around.

Jeff Demanes: Right. So, let me move over here. Turn this a little bit. So, you can see that we have -- my mouse cable is a little bit short here. You can see our RAID array, so I'll open that up. And we have a big file. And I take the big file, drag the big file. So, if we can see it on the screen right now, what we have over here --

Justin Rattner: Oh, you can see it over here.

Jeff Demanes: Yeah. So, the display running, coming across Light Peak. And we have the roughly 2 gigabytes of data transferring to the work station.

Justin Rattner: And no glitches in the display? Perfect simultaneous --

Jeff Demanes: No. An absolutely clean display.

Justin Rattner: All right. It looks like Light Peak is up to the task, Howard. What do you think?

Howard Postley: Sounds great. You mean I'm going to be able to replace that cable bundle with this?

Justin Rattner: Well, maybe not next week, but soon.

Jeff Demanes: Yeah. But, Howard, this is --

Howard Postley: I'll be calling you.

Jeff Demanes: Thank you.

Justin Rattner: Yeah. Thanks, Jeff.

Jeff Demanes: Thank you, Justin.

[Applause.]

Justin Rattner: So, let me just bring it to a close with that. I don't think we're going to top live 3D TV with anything else we might talk about.

You heard from our various speakers, particularly from Brian David Johnson, that the future of TV is based on those four fundamental user experiences; informative television, ubiquitous television, personalized television, and, as Beth described, social television. It's going to be an immersive experience. It's going to be across multiple devices. And it's going to open up new opportunities for Intel architecture developers all around the world.

And if you stick around, we're going to bring back our 3D display, I hope. I didn't realize it was going to go so far offstage. And we'll run another one of the U2 3D concert videos. Thanks very much.

Female Voice: Ladies and gentleman, that concludes this keynote session. Press and analysts, we invite you to join us onstage for a photo opportunity. Thanks.

[End of recorded material]