Anand Chandrasekher

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Anand Chandrasekher

[Beginning of recorded material.]

[Video.]

Female Voice: Ladies and gentlemen, please welcome Anand Chandrasekher.
                  [Speaking Mandarin.]

Anand Chandrasekher: Good morning. It's really exciting to be here
                  again in Shanghai, China, at our IDF. A year ago it was at Beijing IDF
                  that we talked about our vision of how we unleash the Internet and
                  make possible mobile Internet devices. Today what I want to talk
                  about is this, us and the industry taking the first steps towards
                  unleashing the Internet and putting it in your pocket. So let's get going.

                  Global Internet growth is continuing unabated. Let's just take a look at
                  a few numbers: 1.3 billion Internet users were online by the end of
                  2007. Google, you can actually query Google in 36 different languages
                  today. An average Internet user spends 32 hours online per month.
                  And if that wasn't enough, Facebook, which is a social networking
                  application, gets 140 new applications on it every single day. These
                  numbers are just staggering, mind-boggling. But it's not only a U.S.
                  phenomenon or a European phenomenon or a Latin American
                  phenomenon. It's a Chinese phenomenon as well. If you look at China,
                  the total Internet users in China have quadrupled to 132 million users
                  since 2000. Fifty million people in China access the Internet on their
                  phone, and 60 percent of Internet users play online games. Again, huge
                  numbers.

It's also easy for us to think about the Internet as one homogenous set of applications, a boring webpage, http.intel.com, http.cnn.com, google.com, et cetera. And, again, that's not the case either. The Internet is changing. If you use Alexa, which tracks Internet traffic, and I'm showing you here data from Alexa 2005 and you can see the top 10 websites according to Alexa were Yahoo, Microsoft, Google, eBay, Amazon, Microsoft again, MySpace, AOL, et cetera. Look at it in 2007, and I've highlighted a few new sites. Live.com, nowhere in 2005. It's in the top 10, 2007. Youtube.com. Nowhere in 2005, in the top 5 in 2007. Facebook, Wikipedia, High Five, Orchid. You know what these five that I've highlighted in yellow have in common? These are all social networking sites. These are all sites that people like you and me are adding content into and we're blogging or adding our pictures or adding our video or doing something that is personal and we're sharing it to everybody in the world.

That's social networking. It is the fastest growing phenomenon on the Internet today, and, in fact, when you look at Internet users, that global number I talked about, there are 3 billion minutes -- I'll repeat that -- 3 billion minutes being spent every single day doing social networking. Again, a staggering number. Now, if you're a phone customer or a service provider that sells traffic on airwaves, you're looking at that and saying, man, that's a fantastic revenue opportunity. Three billion minutes. Imagine if I could monetize that.

Well, it would be a fantastic opportunity if it actually ran on airwaves and it ran on something other than a PC. Today it all happens on a PC.

It is not unleashed. You cannot get this on a mobile environment. And that was the dream we set out to go after last year, that was the vision we said we have to go conquer, making the Internet mobile. We talked about it last year at Beijing IDF. Everybody else in the industry is chasing this as well. You can see here some quotes from Economist, tech.co.uk, New York Times, Wall Street Journal, Business Week. Everybody in the industry is trying to unleash the Internet, unwire it, and make it go mobile.

But there are some challenges. Today's handheld devices don't deliver a very good Internet experience. In Japan, over 90 percent of users actually get to the Internet on their cell phone. So you would think, okay, opportunity satisfied in Japan. Wrong. Eighty-eight percent of users in Japan are dissatisfied with the experience that they get on the Internet, and that's exactly what the chart shows you up there. And if you actually go and look at the U.S. data and look at whether consumers in the U.S. are happy with the Internet experience, the data is very similar to the data in Japan. People are not satisfied with the Internet experience that they get on their handheld devices today.

And to get a satisfactory experience on those handheld devices, three things are needed. First, performance. Performance matters. Now, all of you guys in the audience there are thinking, of course I would say that, I'm an Intel executive up onstage giving a keynote. Why would I say performance -- anything other than performance matters? Well, it's true. I would say performance matters simply because I'm an Intel executive, but I would also say it because it's true. And during the

course of the next 30 minutes, I hope to prove to you performance matters.

Second, compatibility matters. All of that software that you know and love on that Internet, some of it which you'd rather not have your kids see, some of which you would rather not see because it's garbage, but you still know and love it because it is the Internet. All of that software is written on Intel architecture, runs best on Intel architecture, and when you try to move it, it's very, very expensive. So compatibility matters. And I'm going to talk about that a little bit.

Last but not least, wireless connectivity, specifically broadband wireless connectivity matters.

So let's step through these one by one. Performance matters. And what we're doing is delivering performance in a low-power envelope in a sustained environment through time. I'm showing you here data -- the green is Intel performance on the Intel Atom processor. Red is what our competitors are able to do on their next generation products. And we've effectively estimated what they're going to be able to do over the next 12 to 18 months. And you can see here that on their next generation products versus our products, which we're shipping now, we're going to be able to deliver a 2X improvement in performance on a geometric mean basis. That means on some applications we're actually going to be a lot better than that, lot better than that. Performance matters. I'll come back and show this, in a real-world environment, how you can take advantage of that.

Compatibility matters. If I were a game manufacturer -- I'm going to give you a real example -- and I wanted to land my game on a mobile handset. Let's say I'm Glue. Glue is the name of a real software company that makes games for mobile devices. Let's say my hit game is called Transformer, also true. Let's say I want to get Transformer on all the handsets that ship in Europe. It would require me to develop 25,000 distinct SKUs to make Transformer available on all the varieties of phones that ship in Europe -- 25,000 SKUs. The economics of that are not sustainable. If you were writing on Intel architecture, you write once, and it doesn't matter which device or which manufacturer you get that product from, you still have only one SKU of that game. Compatibility matters. And there may be a billion phones that get shipped, but those billion phones don't look the same to a software vendor. To a software vendor, that billion phones looks like 30 million chunks of phones. There is no compatibility on that ecosystem.

Because there is no compatibility, when you actually go to Internet websites and you track errors, this is the picture you get. I showed this graph last year and I'm showing it again. The data is not the same. It's simply formatted the same. On the Y-axis is the number of errors, on the X-axis are a number of different platforms, and what we did is we went to Alexa, again, that same site that tracks the top websites, and we counted errors. And you can see here that when you're on Intel architecture, you get very few errors. That's because the Internet was written on Intel architecture, runs best on Intel architecture. But when you actually move outside of Intel architecture, you get a lot of errors, and that picture of the number of errors has not changed from last year

to this year. That's a very significant point, and I want you to remember that.

So clearly for an end user, the impact here is you can't get everything you want access to on the Internet. That's why Japanese phone customers are dissatisfied, 88 percent of them are dissatisfied. Same on U.S. phone customers. Similarly, for a developer, there's a tremendous opportunity if you can actually deliver compatibility to the software developer. Adobe is one such software developer. Two-thirds of the Internet utilizes their technology, Flash, to deliver streaming content, video, audio, et cetera. Kevin Lynch is a senior vice-president at Adobe and a chief technology officer for Adobe. He's sometimes known as the grandfather of Flash. He invented it. I want you to hear in Kevin's words how compatibility matters and what the mid opportunity is. Could you roll that video, please?

[Kevin Lynch video plays.]

Anand Chandrasekher: That's pretty cool. September IDF in San Francisco, Al Ramadan from Adobe said they're going to launch Air on the desktop, the first half of this year, and he also made the promise that when it arrives on the desktop, it will arrive in MIDs at the same time. You heard the same thing reiterated by Kevin. Compatibility matters. It is exactly what enables applications that have been written for the PC ecosystem to flow through to a mobile Internet device, and that has tremendous benefits.

So our imperatives to unleash the vision of the Internet and put it in your pocket, we need to do a couple of things. We need to maintain the performance, because performance matters, we need to maintain compatibility, because compatibility matters, and at the same time, reduce the power consumption and reduce the size of our solutions so that it can actually fit into the pocket and you can take it with you. So that's exactly what we've been doing.

Our first generation products I started to talk about last year was Menlow. Menlow is a grounds-up design. Was scheduled to come out this year. Last time I said it was first half '08 that we would ship it. It's based on 45-nanometer technology. Gives a very, very responsive Internet experience. And, like I said, it's our first up -- CPU -- first designed for a grounds-up CPU and chipset design. Next generation is Moorestown, its well on track, and it's a much [higher integration] product. I will talk about it later.

In March we launched two brands. We launched the Intel Atom brand, and the Intel Atom brand is what is associated with our processor Silverthorne. And it is for Internet-centric applications, whether it is a mobile Internet device or a nettop or netbook as Dadi talked about it, or whether it's a CE device or an imbedded device, all of which [make -- want to] access the Internet, our solution is Intel Atom. We gave this product a name, a brand, because we think the growth opportunities here are substantial and we think the technology we're bringing to bear solves the problem in a dramatically different way. And we think it matters that end users be able to tell when they're getting an Atom versus when they're not getting an Atom.

We also launched another brand, Centrino Atom, and Centrino Atom is what allows you to differentiate the best Internet experience in your pocket. When you pair Intel Atom with the grounds-up chipset, . . . those two together enable you for a pocketable experience. And when it is, it's called Centrino Atom.

But enough about the branding. Let's talk about the product. Centrino Atom. We are launching Centrino Atom today. The silicon components of Centrino Atom are Silverthorne, previously known as Silverthorne, now known as Intel Atom. Chipset is called Poulsbo. And when you put the two together, that's Centrino Atom. The silicon is in production. We have started shipping products to customers for revenue already. We expect our customers to be shipping products and have them on shelves as they finish up their validation and finish their network qualification over the next 60 days or so. We do believe that you will see these on shelves within the next 60 days or around the tail end of May, June time frame. Meantime, there are several customers that launching with us, and I will go into that in a bit more detail.

One such customer is a local leader. We talked about Igo last year and the partnership we wanted to build with the Chinese manufacturers in building out the mobile Internet device opportunity. We've spent a lot of time working with several customers here in China, and we're building out this capability and opportunity, but rather than have me talk about what we've been doing, what I'd like to do is invite up on stage [Feng Jun]. He's the chief executive officer for Igo. Please join me in giving Feng Jun a warm welcome, please. Feng Jun? Hi there.

Feng Jung: Yeah, hi.

Anand Chandrasekher: Hi. Good to see you.

Feng Jung: [Very nice.] Yeah.

Anand Chandrasekher: So what do you think of the mobile Internet
                device opportunity, Feng Jun?

Feng Jung: [Speaking Mandarin.]

Anand Chandrasekher: Okay. So in the last year we've done a lot of
                work together, right? Can you talk a little bit about what work we've
                done together?

Feng Jung: Okay. Look at this. [Speaking Mandarin.] One plus 1 plus 1 equal to
                111. [Speaking Mandarin.]

Anand Chandrasekher: Fantastic. Thank you, Feng Jun. Is there
                anything else you wanted to show us?

Feng Jung: [Speaking Mandarin.]

Anand Chandrasekher: Very good. Thank you very much, Feng Jun.

[Video.]

Anand Chandrasekher: Let's talk about the product. Intel Atom processor. It is the smallest processor we build on the world's smallest transistors. Forty-seven million transistors on 25 square millimeters of real estate. The fastest-performing process under 3 watts. Average power, well under 200 milliwatts. Idle power quite a bit lower than that. Significant, significant improvement in terms of delivering on our promise of reducing power by a factor of 10X while not compromising the performance that we deliver. The team that built this worked very hard at it. It's based in Austin, and they were very, very excited about what they were able to pull together in this product. And their passion -- I can't speak for it. The only way you can see their passion is actually to see their passion. So could you roll that video, please?

[Video.]

Anand Chandrasekher: Could you guys feel the enthusiasm in John Tyler's voice? That's the Intel Atom processor. So what he said was 1 percent performance increase, we didn't want to get more than 1 percent power increase. So many, many techniques went into that, to make that possible. Silverthorne, Intel Atom is an in-order machine. Because it is an in-order machine, it benefits from Hyper-Threading capability. So we have Hyper-Threading included in Silverthorne. What this graph shows you on the left-hand side is the benefits of Hyper-Threading implementation in Silverthorne or Intel Atom when you're running Embassy benchmark suite or spec end-rate.

What you can see there is relative to no Hyper-Threading turned on, again, in the Silverthorne processor, you get about a 36 percent

performance increase in embassy, and about 39 percent performance increase when you're running spec end-rate. Commensurately, the power that you pay for that increase in performance is in the range of 17 to 19 percent. So a relatively small delta increase in power for a significant increase in performance. And that performance really matters.

And to show you how that matters, what I want to do is -- can you bring up the demos on the two side screens, please? What I'm going to show you on the left-hand screen here will be a Hyper-Threading demo. It will be Cinebench. You've seen Cinebench. It is a pretty intense benchmark. We typically run it on our high-end systems. And we're going to start Cinebench on these two systems. One of these systems -- both of them are Intel-Atom--based or Centrino-Atom--based systems. The one on my right is single-threaded. The one on my left is Hyper-Threaded. Both in-order machines.

And you can see here that the Hyper-Threaded machine is already going a lot faster than the one on the right-hand side. I'm not going to wait for the rendering to finish. It is an intense application. And this is a sub-three-watt processor, so it's going to take a little bit of time. The one on the left would have finished in two minutes and the one on the right would have finished in three minutes. So 50 percent improvement in performance in a real application with Hyper-Threading in an in-order machine. Significant benefit. Now, if I take that and put it together with what people want to do on a mobile Internet device, which is browse webpages, well, this is the kind of performance you can expect.

This is leadership webpage rendering performance. The Y-axis is runtime in seconds, so the smaller the bar, the better the performance. The X-axis is a range of webpages you would go to, ranging from Amazon to Apple to cnn.com to Digg to Google to MySpace to Craigslist. Some of these pages are more intense. MySpace, for example. Some of these are very simple text-oriented, Craigslist. And you can see that, even so, when we compare against our competition, the performance advantage you get by utilizing Centrino Atom technologies, anywhere from 4 go 6.5X improvement in performance. That's significant. And this basically, when we did these benchmarks, we neutralized the network effects, so effectively the network is having the same impact on the competitive system as well as in our system.

So performance absolutely matters, even when you're browsing the Internet. Performance alone is not good enough. Power matters because in these small pocketable devices you want to have battery life. And for battery life, given that a lot of the time these systems are sitting on idle, when you're browsing the Internet, about 90 percent of the time is sitting in idle, so the more you can stay in idle or a lower idle state, the better off you're going to be. And we introduced a new state with the Intel Atom processor called the C6 state, and this runs at about .3 [volt] when you're in the deep sleep mode. And it consumes very little power when we're in this mode. And when you're spending most of your time in this deep sleep mode or pushing it into this deep sleep mode, in effect, we're increasing battery life. So, again, what I

want to do here is show you what's possible, so I'm going to invite up onstage Mark Parker to help me with this demo. Hi, Mark.

Mark Parker: Hey, Anand.

Anand Chandrasekher: You ready to help me put this through its paces?

Mark Parker: Absolutely.

Anand Chandrasekher: All right. So if we can get the two demo systems up on the screens.

Mark Parker: No problem. So I'd like to talk a little bit about idle power and wait states.

Anand Chandrasekher: Go ahead.

Mark Parker: What we have are two Silverthorne machines running up here onstage. On the left you see the blue is actually -- we have forced it into a C4 power state, which is what most of today's PCs are actually running. But with the new microarchitecture in Silverthorne, it actually enables a C6 power state, which will be the system over here on the other side of the stage. And most of the idle power averages in the industry are about 2 to 4 watts. We've taken a baseline of 1 watt here, just for the demonstration, and that's the black line at the top. Now, obviously we took a very aggressive number to see where we could get Silverthorne represented by the green line.

Anand Chandrasekher: That's 10X lower?

Mark Parker: This is 10X less, so about 100 milliwatts here. Now, I'm going to run a workload on the C4 system on this side of the screen, and what you should see, it's running -- basically, it's doing some rendering on the webpage. And you should see a spike.

Anand Chandrasekher: That's the blue line.

Mark Parker: Exactly.

Anand Chandrasekher: Okay.

Mark Parker: So that's coming across. Now, what I'd really like to do is go ahead and show you what the C6 power state does --

Anand Chandrasekher: Can I tell them what they're seeing, first?

Mark Parker: What's that?

Anand Chandrasekher: Let me tell them what they're seeing.

Mark Parker: Absolutely.

Anand Chandrasekher: On the two screens, what you should be seeing is the blue line -- it went away. Ah. Okay. I think we powered up both systems. The blue line is the system on the left-hand side that is C4.

Mark Parker: Absolutely. Now, you'll notice the red line here, it's actually well below the green, so the idle power of the C6 state system, which is Silverthorne, is well below the green. And what's really cool about this is when we did that webpage, you see this incredible burst in performance, and right back down to that wait state again. So it translates to the consumer more battery life and longer standby time in your mobile devices.

Anand Chandrasekher: Okay. Thanks.

Mark Parker: Thank you.

Anand Chandrasekher: Thank you, Mark. So what you're seeing there is effectively -- we said, several years ago, 2005, that our goal with the Intel Atom family of processors was to get the power down by a factor of 10X. You just saw that. You saw the power go down by a factor of 10X. And the way we've done that is by reducing the sleep mode idle power down significantly, but at the same time, the performance hasn't been compromised, so the combination of the two are what makes this powerful. This is an incredibly lazy processor, and if you're a processor, being lazy is a good thing, because you want to get the job done very, very quickly and then go to sleep. So you can sleep as much as possible as long as you get the job done. Now, if you or I tried to do that, we'd probably get fired, but if you're a processor, it is actually a very, very good thing, because it gives you a long battery life.

In addition to a grounds-up processor, we also did a grounds-up system controller hub. This is what has traditionally been called the chipset. Codename for this was Poulsbo. It is a grounds-up design. It is highly integrated for low power as well as small form factor. We combined the north and the south [bridge] together and we have ultra-low-power 3D graphics built into this chipset. It also delivers handheld IO while maintaining PC compatibility, because when you're talking about a pocketable device, you really want handheld IOs. It has HD video built into it, so you can get more HD content, more and more websites are moving to HD, so you can actually get HD content, high-definition content downloaded onto your mobile Internet device without technology in it. And it has the best graphics built in at these very, very low power states. Four hundred megapixels per second, peak [fill] rate, DirectX 9 support as well as open GL support.

And that allows for a great online gaming experience, as well as whatever else you may want to do. And online gaming is a huge phenomenon. In the statistics I shared with you earlier, in China, 60 percent of Internet users are online gamers as well. Today, all of that happens on a PC. You can't untether that experience and take it with you. With this kind of technology, our Centrino Atom technology, you can unleash online gaming and take it with you. That is very powerful. So let me show you what's possible with that. I have here a small demo here, and this is one of our customer [reference design] boards. This is what we learned in our labs and we tested.

This is running Half-Life on this little screen. It looks great on this little screen, but when I actually project it up there, it doesn't look as

great. But this is a classic shoot-em-up game. This is a shoot-em-up game you would expect to see on a desktop or a notebook machine. And this is a shoot-em-up game you can actually have on your handheld device. So great gaming experience, great graphics, that's what's available with Centrino Atom. A long with low-power, high-performance technology.

Beyond the silicon, we also needed to innovate at the operating system level, and as always, we partnered with Microsoft, but we also announced an initiative last year, a Linux-based initiative in order to get the form factor down, to get the cost down, and to get even low power levels beyond what was achievable. We call that initiative Moblin. Renee James is going to talk extensively about this tomorrow, about the Moblin initiative and what all we're doing here. We have an entire ecosystem behind it. We announced two partners last year as distributors for our Moblin source. Ubuntu and Red Flag. Red Flag is now part of the Asian community. And we have compelling applications and content being available now on Moblin as well as customers that are innovating, taking advantage of this Moblin Linux solution and putting it together in a platform and really optimizing it for the kind of experience consumers want in a mobile Internet device.

So to show you one other example of what's possible, I'd now like to invite up [Lao Shei]. He's the general manager of the consumer business unit at Lenovo. Lenovo is another partner of ours here in China to build out this mobile Internet device opportunity. Please give Lao Shei a warm welcome as I ask him to come on stage. Welcome.

Lao Shei: Hi, [nice to meet you].

Anand Chandrasekher: So what can you tell us about the mobile

Internet opportunity?

Lao Shei: [Speaking Mandarin.]

Anand Chandrasekher: So, Lao Shei, it's been a year since we started

working together. What have you been busy working on over the last

year? Can you talk a bit about it?

Lao Shei: Yeah. [Speaking Mandarin.] Okay.

Anand Chandrasekher: Fantastic. Can you show off a little bit of the

unique features?

Lao Shei: Okay. [Speaking Mandarin.]

Anand Chandrasekher: Lao Shei, can you show off the user interface?

Lao Shei: Okay. [Speaking Mandarin.]

[Video.]

Lao Shei: [Speaking Mandarin.]

Anand Chandrasekher: Fantastic. Thank you very much.

Lao Shei:　　　　　　　Yeah, my pleasure. Thank you.

Anand Chandrasekher:　　　　　　　Good job, thank you.

Lao Shei:　　　　　　　Okay.

[Video.]

Anand Chandrasekher:　　　　　　　As you can see, that's a beautiful product from both Lenovo and Igo. Those aren't the only two designs. There's a range of manufacturers that are going to be showing their products later on this afternoon as part of our formal technology launch. Please do take the time to come and see it. I'd like to give you a brief glimpse of these products from this illustrious group of customers. Can we get this to drop here?

I'm going to just highlight a couple of these. You've seen the Lenovo machine and you've seen the Igo machine. This gorgeous one up here is from Toshiba, this one here is from Panasonic, and this one's rather unique. I'm going to pick this up. This particular one runs Windows Vista. It's a ruggedized machine. It is targeted at mobile sales professionals. And I'm told -- you can see here -- it works -- and I'm told I can drop it, so I'm going to take a bit of a risk here and actually drop it. So it should still work, right? Yep, it still works. So this particular one is called a Panasonic ToughBook, and as you can see, it lives up to its reputation. You have a whole range of other products here. This one is here from Clarion. I'm going to not list all of them by name. Please come to the formal launch and you can take a look at it.

The ISV ecosystem on Moblin is also extremely strong and robust. We've been able to establish partnerships, very strong partnerships with a whole list of companies. You see some of the companies being listed up here, many of them here in China, many of them world-wide. Again, Renee James will go into this in a lot more detail in her keynote tomorrow and talk about the extensive support we have behind Moblin in this space. A particularly key relationship that we're announcing today is the one with Real. Real provides media solutions for mobile MIDs, for mobile and base MIDs.

And it provides a one-stop shop media solution for mobile and base MIDs. It's very powerful, it supports a whole range of media formats, and it's a very simplified business model. And, effectively, what we're able to do with this relationship is resolve some of the technical challenges associated with digital rights management. And effectively make it easier for our customers and then, ultimately, for consumers to be able to get access to premium content on mobile Internet devices. Renee James will also talk about this in more detail tomorrow in her keynote.

Today is an important day. We're formally launching Centrino Atom technology, we're formally launching Intel Atom processors. Both of these are in production shipments. We're delivering on a promise we made five years ago in Paul Ottelini's keynote in IDF. We're delivering on a promise we made a year ago on starting the first steps of building out the vision of delivering mobile Internet devices. But as a company, we're pretty restless, we tend to be impatient, we don't stop here. So

this is just the beginning. Next generation platform are what is called
Moorestown. I am not going to talk about Moorestown today. I'm
going to talk about Moorestown at fall IDF in Taipei in a lot more
detail.

But I will give you a little glimpse. Our engineers have been very hard
at work on Moorestown. The design teams have been working away
on the silicon piece of it. The platform engineering teams have been
hard at work in figuring out what's the smallest form factor they can
actually fit a complete PC motherboard into so they can deliver a great
mobile Internet experience. And the result is this. What I'm holding in
my hands is possibly the world's smallest PC motherboard. This
motherboard here will house on it the processor, the chipset, the 3G
cellular solution, Wi-Fi, Bluetooth, and GPS memory -- obviously the
chips are not populated. It's just showing the fiberglass, but it's a very
small form factor. This is what is going to be possible with
Moorestown. This is the heart of a new machine. And what we're
doing here is building the heart of a new generation of machines.

So, in conclusion, we see a very, very robust opportunity in mobile
Internet devices, this category is just getting established, it is a huge
opportunity for software developers, application developers. Atom
represents only the beginning of what we're able to do as we push the
threshold of power down, keep the performance up, and Centrino
Atom delivers the best Internet capability in your pocket. So we're
very excited about this opportunity. We have great customer support
here, great ISV support here. We're looking forward to working with
you very, very closely as we build out this opportunity. Innovation

drives growth, and there's nothing like this type of innovation to

unleash the opportunities in the marketplace. Thank you very much for

your time.

[End of recorded material.]