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THE STATE OF THE MOBILE ECONOMY: INNOVATION, INVESTMENT, AND ECONOMIC IMPACT AROUND THE WORLD

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PARTICIPANTS:

Moderator:

DARRELL WEST
Vice President and Director, Governance Studies
The Brookings Institution

Panelists:

DERRICK BRENT
Associate General Counsel
Masimo

TODD DICKINSON
Former Executive Director
American Intellectual Property Law Association

KEITH MALLINSON
Founder
WiseHarbor

DEANNA TANNER OKUN
Partner
Adduci, Mastriani & Schaumberg LLP

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P R O C E E D I N G S

MR. WEST: Good morning.—. I'm Darrell West, Vice President and Director of the Center for Technology Innovation at the Brookings Institution and we would like to welcome you to our forum today on The State of the Mobile Economy.—. And we are webcasting this event live so we'd like to welcome our viewers from around the country and around the world.—. We will be archiving the video for this so anyone who wishes to look at it after today will have an opportunity to do so.—. You can do that by going to our website Brookings.edu.—. We also have a Twitter feed that is set up, #TechCTI, that's #TechCTI.—. So if you wish to post any comments during the event, pose questions, or make your own observations feel free to do that, either people who are here or people who are watching the webcast.

So today we are putting out a report on the state of the ~~mobile~~ Mobile ~~economy~~ Economy and what we did was to review data on a variety of different aspects and found that mobile technology is a growing part of the economy.—. Right now the global mobile economy is estimated at $1.6 trillion and is projected to reach $2 trillion by 2017.—. Economists estimate that mobile technology adds up to .39 percent to GDP and creates hundreds of thousands of jobs.—. There are new developments in consumer goods and commerce.—. Yesterday we all heard the big Apple announcement about its new products.—. We're seeing the growth of smart cars, watches, and appliances.—. Personally I'm worried that my refrigerator is getting smarter than I am but, you know, maybe that's just me.—. We're seeing the expansion of mobile payment systems.—. But I think all these things show the vibrancy of this sector and the new businesses and consumer products that are coming on-line.—. But despite the importance of mobile technology there's considerable variation from country to country in innovation,

investment, and invention~~.—~~. And we will be getting into some of these international aspects during our discussion in a moment~~.—~~. Some places are further along than others~~.~~ . Businesses and governments in most places are investing a higher percentage of GDP in research and development~~.—~~. That makes a big difference in what happens in that country~~.—~~. There are big differences in terms of infrastructure, development, and the opportunities to build businesses~~.—~~. Intellectual property rules vary quite a bit from country to country and inventors we know respond to incentives, and it matters how many benefits that they're able to derive from new ideas~~.—~~. In the paper I also looked at some of the public opinion data ~~relative~~ relevant for this topic~~.—~~. In 2013, *Time* magazine conducted a survey in conjunction with Qualcomm on the attitudes of over 6,000 consumers in 17 different countries~~.—~~. And there were lots of interesting findings that came out of them~~.—~~. But the one thing that really struck me was the value that people placed on invention and believing that innovation is crucial to the long term economic success of their particular country~~.—~~. That's true really regardless of where people live.

So we closed the paper by making several recommendations~~.—~~. We think it's very important to build out the mobile infrastructure. ~~globally. B~~Globally by 2016, it's estimated that 80 percent of the broadband subscriptions are going to be through mobile devices~~.—~~. I was in Barcelona for the World Mobile Congress a couple of years ago and this mobile revolution is proceeding at a much more rapid pace than people would have thought even five years ago~~.—~~. So, I actually have a book coming out in December entitled *Going Mobile* which kind of talks about the mobile revolution, what's happening in education, healthcare, entrepreneurship, disaster relief, and other things~~.—~~. Nothing like giving you a few months advance notice on the book, but~~.—~~. We need networks that allow people to undertake transactions and take advantage of video graphics and data usages

that are coming on-line.—. There are new applications in education and healthcare, and combating corruption, and trying to improve government performance.—. I also argue that it's crucial to reach underserved populations.—. People in rural areas, as well as people in some urban cores, lack access to high speed networks and that prevents them from getting the benefit of the mobile revolution.

So to help us understand these developments we have put together an outstanding group of experts.—. Keith Mallinson is the founder of WiseHarbor.—. That firm provides expert services in wireless, mobile, and telecommunications.—. He was the Executive Vice President of the Yankee Group's global ~~wireless~~ Wireless/ ~~mobile~~ Mobile research and consulting team from 2000 to 2006 and he's published numerous reports on next generation mobile networks, fixed mobile convergence, handset technologies, and emerging markets in developing nations.

Deanna Tanner Okun is a partner at Adduci, ~~Mastrianai~~ Mastriani & Schaumberg.—. She is an international trade lawyer who provides legal and strategic advice.—. She served two terms as Chairperson during her 12 years of service as a member of the U.S. International Trade Commission.—. And before her appointment to the ITC, she served as counsel to U.S. Senator Frank Murkowski.

Derrick Brent is the Associate General Counsel for Masimo.—. He handles legal matters related to intellectual property, employment compliance, and public policy.—. And previously he served in the Federal government for 12 years.—. He was a senior trial attorney in the Department of Justice and also served as senior counsel to Senator Barbara Boxer.

And Todd Dickinson is a consultant.—. He has over 30 years of experience in all aspects of IP strategy and management.—. Most recently he served as

Executive Director of the American Intellectual Property Law Association, which is an association that has over 15,000 members and focuses on intellectual property. Prior to that service he worked as Undersecretary of Commerce for Intellectual Property and Director of the U.S. Patent and Trademark Office.

So I'm going to start with Keith. So you focus on mobile technology platforms which make a range of applications possible. What are the opportunities that you see in the mobile sector?

MR. MALLINSON: Well, the mobile sector has been phenomenally successful already. Probably about as fast growing and successful in many regards as any consumer technology or any product and service category that the world has seen. And it's a truly global phenomenon, and I've been tracking it for many years. What I found particularly remarkable about mobile is in the 2000s, it developed from being something that was used in developed countries to diffusing very rapidly into developing nations as well. So by the mid-2000s for example, you could get a mobile phone for as low as $50 U.S. dollars and that was causing penetration to the masses in all parts of the world. So today we actually have more mobile connections in the world than there are people, so over 7 billion. And the number of people who are using these devices -- and bear in mind we have young children who don't have mobile devices yet -- it's still about 3.5 billion people who are actually using mobile devices and some have multiple devices, of course. And until the mid-2000s, that was really mainly about voice and text communication. And of course in the developed countries we had our regular land-line phones so we were already in communication. But the transformation for the developing countries was -- for the first time, it was bringing connectivity to people and it was helping in their personal lives but also in terms of doing business. So that was the

start of it—. And then the remarkable thing that began in the 2000s was the introduction of the third generation technologies which enabled data communication and fast data communication, what is now called mobile broadband—. And then there was the development of the smart phone type devices—. They were around from the early 2000s, but in a very niche kind of manner—. The big transformation was around 2007 with the iPhone and then that put into the hands of people a device, a mobile computing device that could support all kinds of applications and services—. And so what has happened since then is we're beginning to do more and more on these devices that hither to we did perhaps on-line—. That's again in the developed countries—. In the developing countries, where they had no fixed internet access the mobile device is becoming the means of access to the internet, and for this wide variety of services as described in the report that Darrell introduced—. So mobile health, mobile learning, mobile government, mobile payments; there's whole raft of applications and services that are becoming possible and they've become possible because of the power of the platform that is underpinning those capabilities and that platform is available to not just us sitting here in developed countries, but also in the developing nations—. So smart phone devices now are available for as low as $100 unsubsidized, which means that we're going through a kind of echo of what happened a decade or so ago—. Initially it was basic phone devices that were going into people's hands with voice and text and now everyone in the world, or a very large proportion of people in the world, have got access to a mobile internet device that can support all these rich applications—. And I think it's very significant that we have this and it's easy to focus or to see the most tangible things, the new, cool applications and services and such like, but it should also be borne in mind that there is a phenomenal amount of innovation, product development, service development in the

basic platforms that bring this about~~.—~~. The radio technologies, for example, have moved leaps and bounds~~.—~~. I mean initially, the analog technologies had challenges in terms of capacity~~.—~~. They were unable to support the majority of the people in a country, certainly with the amount of spectrum available~~.—~~. So the introduction of the second generation digital services increased the capacity enormously~~.—~~. So that provides the most economical means of extracting what you can out of the radio spectrum.

But on the data side from the millennium, there was the beginning of the data service, but really they didn't actually work terribly well~~.—~~. We had these technologies such as WAP which was a little micro browser on your phone~~.—~~; y~~Y~~ou may remember having this around the millennium~~.—~~. There was a lot of hype and it didn't really work very well; it was a bit of a curiosity~~.—~~. What we found from the mid- 2000s onwards, is the speeds have increased, the capabilities have improved, so we've had a kind of virtual circle of capabilities that have really made these capabilities now very meaningful, very powerful~~.—~~. So just taking the data speeds for example, the technology that was used for mobile data communication around the millennium or shortly after was called GPRS and it provided 50 kilobits per second approximately~~.—~~. Now on the fourth generation LTE networks you can have speeds of 50 megabits per second, that's 1000 fold increase~~.—~~. That's very significant~~.—~~. And if that's what you need certainly multi-~~-~~megabit speeds, mobile broadband speeds to support the kind of applications that we require~~.—~~. But there's been a lot of work that's been required in doing that development, and it's ongoing~~.—~~. So I just mentioned fourth generation~~.—~~. There is also work in progress now on a fifth generation set of capabilities and ~~, you know,~~ whereas with fourth generation it's about increasing speed and performance and capacity as more and more people are on the mobile internet and they're ingesting and disseminating more data, they want to use

more data themselves, with the fifth generation capabilities there are all sorts of things that might be possible~~.—~~. In fact with fifth generation it's really at the moment at the phase of where they're just trying to figure out what the requirements are~~.—~~. So the ITU, the International Telecommunications Union, is in the process of figuring out what those requirements will be, what the use cases will be~~.—~~. And the possibilities are really limitless~~.—~~. So we're beginning to have for example connected cars~~.—~~. The next step will be driverless cars~~.—~~. And I think a major part of that will be the kind of communication (inaudible)functions that are required~~.—~~. So, you know, one of the technical challenges for example is not just increasing speeds but reducing what we call latency which is the time it takes for a packet ~~a day~~of data to get from one end of the network to the other~~.—~~. And if you're going to have some kind of real time capability that -- for example, associated with driving a car automatically and you're using the network to do that, you need that kind of performance that you don't really have in today's networks~~.—~~. So there's a lot of ongoing investment, a lot of work, a lot of R & D~~.—~~. So for example, there's about $40 billion a year in R & D globally in the mobile ~~eco system~~ecosystem and a large proportion of that is in the fundamental platform as well as this rich variety of applications and services that are layering on top.

MR. WEST: So it's interesting that you mentioned there are more devices than people~~.—~~. And this is certainly true in my household~~.—~~. Between my wife and myself, we have eight mobile devices which I personally think is a little excessive but, hey, we like to be connected I guess~~.—~~.

So, Derrick, you --

MS. OKUN: The watch, do you have the smart watch yet?

MR. WEST: Actually I do not have a smart watch yet (laughter) but I'm

thinking about it because of the health apps.

So, Derrick, you are a former Senate staffer. I know you're particularly interested in policy aspects. We're obviously seeing lots of interesting new developments in mobile technology and I know you're also interested in the healthcare area, in the medical devices. What are the opportunities that you're seeing?

MR. BRENT: I think it's very interesting in the healthcare space. Typically when we think of the mobile economy we start thinking about smart phones and consumer devices, but mobile is becoming increasingly important in life sciences and in particular the company I work for is a medical device company. And so the things that you're going to see, and some of these are mentioned in the report, you know, things like, you know, providing tele-health, providing, you know, the ability to communicate healthcare across boundaries of states, and eventually internationally is going to become increasingly important. But also, you know, serving underserved areas, like rural areas. But in particular, you know, to for example the medical device industry, you're now going to have medical devices that communicate with each other and then you're also going to have these devices with the ability to communicate with doctors. And that's already going on. I'm just talking about the fact that the acceleration of it is becoming increasingly important. The ability to rely on for example -- the ability to rely on written records; sometimes written records get -- for patient safety purposes, written records have a tendency to, you know, they don't pass from one doctor to another necessarily whereas, you know, you have the ability with electronic records. And if you have devices that can communicate you have the ability to have better communications and better patient service. And that is certainly one of the big platforms for my particular company, Masimo is -- were heavily invested in patient safety.

I think the acceleration of mobile and its use in healthcare is not only important, but it's going to become important from a policy standpoint I think you'll see too because the trick in policy making is to design policy that is pro-growth.—. Everybody says it's pro-growth whatever their position is, but if you want to design policies that are pro-growth, but you have to have it technology neutral because we don't know what's coming down the line two years, five years, ten years.—. And so I think it was -- you know, during my Senate days it was always a test to try and design very technology neutral policy because you're looking at a framework of things that are currently in play and you're also looking at things that are on the horizon that can be discussed.—. But the trick is sort of developing that neutrality -- and I'm not talking about net neutrality, I'm talking about just neutral principles and policy so that you can allow other things to build and when the next wave of things come on, you can have a framework from which to deal with them.

And so I think, you know, to me it comes down to there are three elements and I'll just simply close with this, I think, you know, it's a general principle but it's also a principle that's important I think for the life sciences and in terms of the mobile economy.—. You need to have, you know, the network, you need to have the platform.—. You also need to have access.—. And so you have to have the access to the infrastructure so that people can build on it.—. And then the final part is having policies behind it that allow not only the building of today's technology, but tomorrow's technology. . And that's the challenge that I think we face.

MR. WEST: Deanna, so I know you're focused on intellectual property protection globally, what are you seeing in the international arena?

MS. OKUN: Well, thank you, and first let me say it's a pleasure to be here on this panel and I think the report that you've just put out is a really important part

of the conversation we should be having. And I will start with the disclaimer that I'm here in my personal capacity and not speaking on behalf of my firm or any of our clients. But I spent most of my career as an enforcer so, you know, enforcer of trade laws, enforcer of intellectual property laws. And I think that is an underpinning of the growth of the mobile economy that we're focused on here today, and I think it's an important aspect to keep in mind. But I really think this is a great conversation because it's a conversation that's looking at these issues in a global manner and how do we promote the innovation around the world as opposed to -- and I know Todd and I have spent a lot of time on the other side which is, you know, we're in Washington and we've spent the last year talking about what I think is really the other side of this which is, you know, are we protecting intellectual property too much, is there something wrong with the system where we should be focused on, you know, what's worked, what has allowed us to build both in the United States and in other countries; economies, rules of law that work. And, you know, other countries don't have to be just like the U.S., but some of the things that I think Keith and Derrick had talked about which is, you know, you do need fundamental systems in place. And I think one of the things that we should look at from an international perspective is not just thinking about litigation first, right, but really we're talking about rule of law, transparency, some other fundamental building blocks of what makes innovation around the world thrive. And I think from a U.S. perspective, innovative companies in this room and that might be listening need to be talking to their policy makers about making sure that perspective is not lost. That, you know, what they're doing here is important to what someone in China or Indonesia or, you know, a small inventor who is using their mobile phone to get information to, you know, create the next best, next great thing both has access to that technology and then protection for that

technology because again that's -- you know, inventors everywhere -- we have, you know, many, many great examples in the United States, but all around the world that folks who have invented wonderful things and because they have protection of their intellectual property they are able to, you know, bring that to the market or others bring to the market for them. That's really important. So I think that's kind of the perspective I bring to this and also thinking about the opportunities we have through our trade negotiations, through TPP, through TTIP, to kind of bridge what -- and again I say this just -- well, I'll end with this which is, you know, I started out as an international trade lawyer and most international trade lawyers are usually thinking about goods, goods that are crossing the border and are we blocking them, are we exporting, are we importing them. And as the world has become more digitalized, we really have to rethink both through a trading perspective and the intersection of intellectual property, of the best rules and how we promote digital trade. And the International Trade Commission, where I spent a good deal of time has been preparing reports for the Senate Finance Committee on digital trade and how to think about it in a trading concept. And I think that's part of the conversation that we're having today.

MR. WEST: Okay. So, Todd, I know you're just back from Singapore, so what are we hearing from Asia?

MR. DICKINSON: Let me start first if you don't mind by reinforcing a little bit, but from a slightly different perspective, what Deanna was saying because I came at it through my experience as an administrator of the system in many ways and a policy maker in support of that administration. But seeing similar things, both as an American and an American who works globally, and a lot of the work I've done particularly recently, and that's to say that the debate we've been having recently in the United States is an

important one.—. And there's needs in the United States in our system for adjustment to make sure that the system is working optimally.—. However we've seen over time, over the long history our system in the United States that, that these kinds of issues flare up and cool down.—. And they tend to flare up at times of major innovation like we're seeing right now.—. So when we have the so--called "cell phone wars" that we're having right now, that's not unusual.—. And there's several studies -- Professor Mosoff for example over at George Mason, has pointed out that when key disruptive technologies have come along you tend to have litigation and other things that follow along and that's it important to acknowledge that's a piece of what needs to happen in guess in order for the system to thrive.—. The fact that also that we have now, globally but certainly in the United States, a knowledge based economy, almost a cliché.—. And that the need to protect those intangible assets that we developed as opposed to the tangible ones we might have developed in the past.—. And the IP is the basic way to protect them, and the need to get those systems in place is key to that protection.—. And that now there are questions in the United States are we focusing on the right aspects of this, or are we being distracted a bit by questions such as patent eligibility, which is in many ways sort of an academic kind of question, and interesting and an important one in certain ways.—. In other ways, it's kind of an academic question because it may be taking our eye off the ball of the bigger question of are we handling the growth in IP globally which tends to track innovation as the paper suggests.—. The paper shows clearly, and the statistics show clearly, that the number of patent applications filed is not slowing down at all; actually it's accelerating, and particularly the function of Chinese patent applications that have been filed.—. For the first time, more Chinese patent applications have been filed than U.S. patent applications and that's a very interesting and telling statistic for no other reason than patents are a

traditional and very useful indicator of innovation. And what does that mean relative to the United States? Secondly, as an administrator, are we equipped to deal with just processing that work? Are we able to -- for example the patent and trademark office here able to get that processed in a way that allows the access to it and the benefit of the access to it? Or are we focusing on other things in our policy making as opposed to maybe what we ought to be focusing on?

To the point though that I was asked about, and it ties into this which is interesting because when I travel globally -- and as you said, I just came back from Singapore and I was in another conference in Hong Kong they are -- it was interesting is they are genuinely focused on the whole other aspect of this which is how to use this to grow, how to monetize it, how to take it and build a business, questions that we just don't even begin to address in the United States. How to figure out the valuation of patents for example, how to stabilize that valuation, and having stabilized that valuation market like we did, I don't know 50 or 100 years ago on mortgages for examples, how to then develop a trading platform for that and how to develop markets so that you can exchange and sell intellectual property in a very organized way, with an organized valuation. The excitement that these kind of meetings generate along those lines with almost no discussion of trolls or should software be patented or anything like that, is really remarkably different. And so for me as I go to these meetings, an open question is is that the future? And in the United States are we going to get left behind? I don't think so but I -- because I know that we're smarter than that I think, and a question is are we making sure that we're being aware of that and mindful of that and paying attention to that and not being distracted or at least not giving the appropriate amount of attention to those other things.

MR. WEST: I like your optimism on that front~~.~~. (Laughter) So several of you mentioned in your various comments, you kind of brought in the international area, and in the *Time* survey we found that people who live in emerging markets say that their country does need stronger IP protection~~.~~. So I have a couple of questions~~.~~. I'll just throw it out and anybody on the panel who wants to jump in is free to do so~~.~~. You're looking at the differences across nations and especially between developed nations and emerging markets, kind of what are you seeing? Are the survey numbers reflected in reality? Like are IP protections being taken more seriously in emerging markets? And then, also if any of you could comment in particular on China~~.~~. In the paper we noted there has been a dramatic increase in Chinese patent filings just in the last five years~~.~~. What does this mean, what's the significance of that? So, I know it's several different questions but any of you want to jump in?

MR. MALLINSON: So you mentioned China, I think China's obviously very important~~.~~. It's a large and growing part of the global economy, and yes indeed they are patenting a lot and I think the innovation is going to be increasingly important for the Chinese companies~~.~~. And I mean, as China develops itself, it's going to increasingly be the creator of the intellectual property rather than just being for example, a manufacturing base for other countries around the world which maybe is its history as the economic -- the GDP per capita for example in China increases then maybe offshore manufacturing for example is going to be more competitive in other emerging nations~~.~~. So for example, you know, ~~Viet Nam~~Vietnam~~.~~. So it's very important and it's reassuring to see that that's happening~~.~~. I think what is also significant is in China at the moment there's a lot activity on the anti-trust front, and it's going to be important to see what effect that has on the IP, intellectual property side of things~~.~~. So it's all well and good to just

say yes, we're going to uphold the value of the patented IP, and you should be able to get a royalty, but if competition law is used to cram down those rates that is not going to be a healthy thing for the global economy. If the fair value is higher for that intellectual property, then that value is required because of the massive amount of investment that's needed. I mean this is not a one off game. Innovation is a long term play. So there may be industrial policy reasons for wanting to pay less in royalty charges in the short term, but in the long term it's very important that investment is continued. And as I mentioned earlier, in the mobile ecosystem there has been a massive amount of investment on core platforms historically, and that will continue. So it happens at all layers in the mobile ecosystem and in other industry sectors as well.

MR. WEST: Derrick, your thoughts on international?

MR. BRENT: Yeah. One of the things from an international standpoint that I think is interesting is how it is basically -- I think with the mobile economy, I think of a lot of -- there's a lot of start-ups. So one of the important points is sort of how do you take these start-ups and grown them into viable functioning companies? And in the medical device industry for example, you know, a lot of companies, a huge percentage -- I want to say it's on the order of at least 50-60 percent, are smaller companies that are starting-up and it takes an incredible amount of investment. So from a policy perspective, how do you help these companies grow? And other countries are -- you know, we're all sort of figuring it out but other countries are taking, you know, taking some leads. For example Israel, I know, has been called start-up nation. And in Israel they're doing a lot of things to try and foster companies, whether it be providing either government resources for entrepreneurs. And government resources can simply be office space just for people to be able to talk to each other, all the way up to some level of

seed money.—. But I think that's something that we have to sort of grapple with is in the United States how do we provide some level of additional push to companies.—? You know, one of the things though internationally, is that I think internationally there's more of a stomach for failures of start-ups than maybe we have here and it's something we're going to have to adjust and think about.—. I think one comparison that I saw is that, you know, for example what is it, three out of every four start-ups actually fail.—. So, you know, you have ~~a bout~~about a 25 percent, you know, success rate.—. Well, when we give out small business loans in the United States, you know, the "success rate," meaning your ability to pay back the loan, is on the order of 90 percent, 90-95 percent.—. So we don't have as much of a tolerance I don't think for that level of failure.—. But if we're going to grow this economy and grow with the smaller companies, whether it be in the medical device industry, in life sciences, whether it be in the tech or social media space, anywhere that this is going to grow, I think we do have to look for ways that we can foster that growth, you know, and help it to ramp up.—. And I'm not trying to say that we need a ton of government participation, but we do have to have policies that sort of step out of the way but also lend a helping hand when necessary.

MR. WEST: Deanna?

MS. OKUN: Yeah.—. Well, one of the things that really struck me when I was looking at the report, and again for those who might not have had a chance to see it, when they asked a question in these countries, do you believe invention is important for society, the top responder was China.—. And I think, you know, for some people I think that would be hard to say that I really would think of China.—. They've, you know, seen as copy-cats so there's not a lot of IP protection, and I think, you know, there are different way to interpret data and probably many experts in this room who would have some

thoughts on that as well, but I think the one thing that I take from it is, you know, it's a good thing obviously that you get this high percentage.—. I mean it worries me a little bit, the United States is only 80 percent and we all think -- you know, shouldn't we all believe invention is important for society? But it goes back to some of the things that Derrick was just saying which is, you know, are we thinking as an economy, as policy makers about ways in which we can foster invention in our society or has the United States, you know, gotten a little bit lazy about it, that, oh, yes we are this great country of innovators.—. That's why, you know, the Constitution, you know, protects IP and patents because the founders saw us as a nation of inventors.—. And have we lost a little bit of that? So I think it's a good question that we should ponder as we think about ways to again talk to policy makers and talk to companies about, you know, what kind of policies best encourage this innovation both here and abroad, and what are other countries doing right.—? But I think Keith makes a really important point, and I didn't raise it when I was talking about, you know, we have to think about international trade differently as much, you know, it's a much more digital economy and it's not just about goods crossing borders but it's services and it's interconnectiveness.—. Not just the internet of things it's the internet of, you know, really people being connected.—. But Keith had raised a point about the competition authorities.—. And so I think as we think about, you know, the rule of law it's not just, you know, on the trade side, it's not just the intellectual property enforcement, there is a lot of connection with how competition authorities view things because again if your competition authority is taking the role that yes we want our society to be inventors but we want to block everybody else out of there, we don't want our competition in there while we invent, I don't think that's the way we want to go and I think it's something we have to be careful of when we're thinking about what are policies around the world that

encourage innovation.

MR. MALLINSON: If I can make another point in response to the notion that perhaps the U.S. is gotten a little complacent about its innovation culture. Maybe that's the case, but I come from the United Kingdom and I tell you we would die to have the kind of innovation culture that you have for example, in Silicon Valley, in the United Kingdom. You know, there is a lot envy because of the way the system works and for the industry. But I know the mobile sector; it is quite remarkable how the center of gravity of innovation has moved massively toward the United States, certainly in the area that I've described, the platform area. Whereas, in the let's say the 2000s, the second generation system, there was this technology called GSM. Europe, I think, did a very good job through industrial policy in creating this harmonized system that fixed some problems that they had in Europe, with the previous technologies and European manufacturers, European innovators kind of led the world and really there's been massive disruption certainly with the advent of the smart phones we've seen a lot of the innovation now has moved -- a lot of it is occurring in the United States and particularly with the Silicon Valley effect. So Google, Apple and such like, and on the core platform side Qualcomm. It is a phenomenal amount that has occurred to foster innovation, and I think in a very positive way. And I think the message is to encourage other nations to recognize what systems work, and to maybe to mimic or adopt some of that kind of good practice that you see here in the United States.

MR. WEST: Todd, do you have any thoughts on the emerging nations' part, and maybe the role of China?

MR. DICKINSON: Well, just to elaborate a little further on the increase in Chinese patent filings which was a very recent phenomenon. As recently as five years

ago, it was probably one tenth what it was this past year which is amazing. We haven't even seen the first real wave of issued patents coming through yet which is startling here in the United States. There's no data yet that suggests that they're not the discreet inventions that they would normally have to be to be filed appropriately. There's no data that suggests that they're being projected as rates different than U.S. applicants might be. And so the suggested -- you may see a parallel to that traditional defense that is often the cry in the United States of stockpiling large patent portfolios as a mechanism for leverage, for defense, or for whatever other reason. And the Chinese companies are learning the lessons that others have learned here in the United States. Now that's not to say that they're not optimizing their own shareholder value, that's certainly appropriate as well, I think shareholders appreciate when they've got the protection for the innovation investment that they've made in the past. And if they happen to unfortunately go bankrupt, they probably appreciate it even more when they're able to sell off that portfolio for some value. But it's an interesting -- I think it's an interesting phenomenon and it's not clear at all what it means what's happening. It's rumored even down to the level that patent agents in China are being subsidized by the Chinese government to write patent applications. As a former bar executive director would that that was the case here in the United States. (Laughter) But that I think is a very telling thing as well. That China in particular is finally understanding the importance of making sure that they utilize their system to protect it, one for the patent walks in the room. In the Chinese office they have a huge number of patent applications filed, three quarters of which are what are called utility models, which is a level of protection which is significantly different and lessened than a so called utility patent. But my understanding is that the number of utility filings is also significantly up as well, and will probably equal

what the U.S. utility filings are at some point as well.

The other key factor that's important about this though is it creates a body of prior art which is extremely important for the quality of global patenting. Something that's very below their radar screen I think of people in general is -- but it's very important -- is that China participates in something called -- the Chinese patent office -- something called IP 5. It's the five large patent offices in the world. It just was formed four to five years, and it's basically a mechanism for exchanging data and exchanging information among the offices and setting up mechanisms for doing that in hopefully an easy way. So like for example, all the examiners in all the five offices at the same time can see the same prior art. Hopefully leading to a much higher quality patent with a lot less redundancies so that you don't have to do the same search five different times. Obviously, though, how do you make sure that the translation of Chinese and make sure that the language barrier is overcome expeditiously is a key criterion. If that is able to be achieved and the continued growth of the Chinese data bases and the Chinese prior art is available, not only for the issue of examining patent applications, but to revive what these data bases have traditionally provided, the largest source of technical data in the world, that could also be an extremely valuable component of this whole process.

MR. WEST: Okay. Why don't we open the floor to questions and comments from the audience? So raise your hand and we will get a question to you. There's a gentleman back there with his hand up. Do we have microphones? We will get you microphones. And if you can give us your name and organization, please.

MR. ALI: Syed Ali, Analytics Led Intelligence. The question I have is what do you think of a world where you have Watson as your doctor on your mobile

phone and Scanadu Scout transmitting 10 different vitals for you on your phone, collecting it every day, as well as -- or I'll ask the other one later.

MR. BRENT: I think if the question was basically the idea of having a doctor type --

MR. ALI: (Inaudible) Watson computer. (Off mic)

MR. BRENT: Right. Oh, the Watson computer? And it's relationship to healthcare if I understood the question correctly. To the extent that the -- and tell me if I'm going down a wrong path -- I sort of understand the question to be asking about the computer replacing the human element. Is that -- okay. And that's not --

MR. ALI: (off mic).

MR. BRENT: And ubiquitous -- and privacy -- okay. And that was the second half of it of the question. The privacy component is huge. It's a huge policy question, one that, you know, Congress and, you know, my friends and former colleagues, you know, rack their brains about and then bump their heads off of a wall. And the problem is, is as you're collecting this medical data, as you're collecting this information, you know, how to do you protect it? And there's a huge privacy question now coming about whether, you know, the person has ownership in their, you know, the heart rate. It's a big question and I don't purport to have the answer for it, but I will tell you this that the idea of collecting the information and you have a body of law right now, you have HIPAA. And that's going to provide sort of a baseline I think for protecting the patient. Beyond that I think, as we look at digital movement and as records are exchanged between healthcare providers, I think there's a huge -- that's going to be a huge policy challenge, but it's a very important one. So I hope I at least recognized your question.

MR. WEST: Okay.—. We have a question up front.—. Microphone coming over to you.

MS. YOUNG: My name is Lee Young.—. I just wonder with all this technology and then communication should be good, and then public comments or complaints should be available but the problem is always obstruct and cover up.—. I just wonder if any mechanism you people can set up for the public interest so we can be assured of government transparencies, we can be assured nobody obstruct our social media communication or our social media account?

MS. OKUN: I'll start, and I think others probably have thoughts on this as well.—. But, you know, I think it goes back to kind of what are these fundamental building blocks of how we make innovation work for us, and how is it effective.—. And so transparency, the word you used, is fundamental, you know.—. It should be fundamental in the United States, it should be fundamental in other countries that there should be transparency.—. And I think it even relates to the healthcare question, in terms of a consumer understanding what is happening to the data and able to make the choices.—. Because again I think we, you know, and probably a question for another day, you know, people -- you know, my kids, my teenagers, have a much different view of privacy than I do.—. And so there's a lot of data I think I would protect that others might not.—. But I think ~~society is~~societies -- and I don't mean just the United States -- but all societies I think have to grapple with that.—. Like what protection should be in place for the individual to make these decisions as opposed to the government making the decisions, on what's happening in social medical or how to -- whether you should block it or not.—. And again I think they are really big questions you asked that relate, not just to social media or healthcare, but just to these more fundamental questions about what kind of system

we've set up.—. So you raise really important questions.—. I don't have answers, but I think that it is key to the policies we adopt in the United States and the policies we encourage other countries to adopt when we negotiate with them in any forum.

MR. MALLINSON: I think it's a really important question.—. I mean in the case of children it's -- you need to say to them -- they may have an attitude that's more open and, you know, they may be more willing to provide information.—. But they're youngsters, and we need to save them from themselves because they may regret it at some point in the future.—. I think this is the area that we do need regulation and controls as opposed to trying to regulate prices and, you know, I believe in a strong, free, competitive market and I'd like to see less intervention there.—. But certainly in terms of privacy and these issues I think it's vitally important, because it's unclear exactly what can be done.—. I mean, you can get an assurance that oh, this data is anonymized, you know, or it's only by zip code or post code that this information is collected.—. But there's some smart people out there that can get some other data sets, correlate it all together and they can figure out perhaps who you are.—. You know, it's very important that there are people who have the task of making absolutely sure that things are not going to be breached.—. I mean there's a very notable story at the moment with Apple with its iCloud, and I think it's embarrassing for Apple and it's the kind of thing the technology providers have to be one step ahead of the game.—. They need -- it's not sufficient to just decide that you've created a robust system.—. You need to hire people who are former hackers, to constantly be working your system to see what the vulnerabilities are.—. You know, the kind of approach that the military would take for example because, you know, once the stable door is open, you know, the horse ~~vaults~~ bolts and it's too late to do anything.—. It's very important that these protections are here.—. And it's very important in terms of

development of the market, otherwise confidence is going to be lost.—. You know there's a lot of talk, it's very popular, a lot of hype about the cloud and who should do the cloud.—. And there are a lot of benefits but issues, such as the one that Apple, has had I think it sets things back quite a lot.

MR. WEST: Then perhaps you shouldn't put naked pictures of yourself on it.—. There's a gentleman right here with a question.—. There's a microphone coming right over here.

MR. ULLBERG: Thanks for a very interesting presentation.—. My name is Eskil Ullberg from George Mason University.—. And I have a question to the whole panel here.—. And it's how important do you think the patent system is for global innovation compared with other policy instruments like you hinted on taxes, grants, or other risk mitigating instruments?

MR. WEST: Great question.—. Thoughts?

MR. BRENT: I'll start.—. I think it's very important.—. It's very important.—. I think you'll -- the interesting thing that you'll see -- especially it's interesting we're talking about the mobile economy right now, but something that I saw as a staffer is that you see a collision -- and I shouldn't say collision, but you see let's just say a little bit of impact coming along and that is between intellectual property laws and communications laws.—. You see the FCC increasingly starting to have to deal with intellectual property issues as, you know, as the technology advances.—. And the FCC has always had the ability to say no, no, that's not in our purview.—. And it's not technically, but all the sudden, you know, the impact of any decision they make on communications has an impact on the intellectual property.—. So, you know, in going just to patents it's very important.—. It's very important, and it's continuing to increase and grow.—. And, you know, as the report points

out, especially now that it's become a significant part of our GDP and it's going to continue to become even more an important part of our GDP, we're going to have to make the right decisions about it.

MS. OKUN: Yeah. I mean it's hard for me coming from, you know, the international trade side of it to have an answer of what's more important or is that tax regime more important or not. And, you know, there are a lot of people who have looked at all those issues. But I do think fundamentally that the patent system has been the backbone of innovation in the United States, and I think the statistics and the history of the country support that. And so, you know, when I was talking about is the U.S. losing its way, are other countries, you know, starting to leap-frog us, I think my point about that is I think other countries look at Silicon Valley, look at our start-ups and admire it and hopefully would want to adopt some of the same policies we have to foster the same innovation. But again, sometimes I -- just on the debate in Washington about whether the patent system is too strong and whether people should have the opportunity to pursue particular remedies for violation of patents or copyrights or trademarks, that's what I was trying to focus on which is I think it has been so fundamental to the innovation and growth in the United States that to walk away from it, as opposed to be out there, out front with our policy makers and our trade negotiators saying we want other countries to adopt more of our policies. You know, if you want to be innovators, if you want to foster innovation here are some of the building blocks we had in place, have in place, and that's the way to look forward, so.

MR. DICKINSON: Yeah, I think I would definitely support that. I think, in many ways we are fortunate that it's constitutionally based, that we've had it since the very beginning of the country, because I think the history definitely supports the premise

that it was -- that the innovation culture in the United States, one of the key components of it was the fact that we had a strong intellectual property system from the beginning. The challenge we've always had, the challenge you're always going to have in IP, is that it is a two sided coin. That you need to have the protection on one hand, on the other hand you don't want to feel that you're being stymied from innovating because the protection is too strong. And I think that's reflected frankly in the language of the Constitution, the provision. And it's not resolvable; it's making sure you strike the right balance going forward. And so it's one of the great debates we'll always have when we're defining the policy and administering the policy with regard to intellectual property. But it is I think key -- it is however long term key to that. I think also, the most innovative companies have borne that out over time as well. I think the usual example is in the software industry. IBM when software was first becoming a key part of their business, resisted and lobbied strongly against patenting software. They eventually change their mind. Microsoft the same. Apple that clearly changed their mind. I mean you can point to the pivot, you can point to the Steve Jobs' quote when they changed their mind, and then they developed large portfolios and moved forward. And so I think that shows how it became more important to the maturing companies, more important to their shareholders as they evolved. We've also not spoken to another type of IP, copyright, which is related to this in terms of innovation and is extremely important in the trade sense. Copyright industries is probably one of the most important, if not the most important, of our trade issues. We've probably -- what, in terms of the things like film and music, it's probably the number one of not the top five things that we export. And that is -- the IP protection there is absolutely critical because of the intangible nature of it. So I think IP is certainly in the top two or three most important policies in terms of

managing innovation.

MR. MALLINSON: Not everything in innovation. So for example -- I mean Darrell was saying that the mobile ecosystem is worth what, $1.5 trillion? Actually most of that is actually carrier services, like Verizon, AT&T, and such like. Those companies don't actually do so much in the way of R & D. Some of them do, but it's most of the R & D and the patented technologies coming more from the technology vendors, the equipment vendors. So a lot of innovation, good innovation, can come about. Maybe it's copyright protected, maybe it's other things. Maybe it's sometimes innovation that can't be protected. But it's very important particularly in this marketplace that we're focusing on here on the mobile side that there is strong patent protection because those technologies are actually underpinning the whole ecosystem. So there's $300 billion in handset sales, for example. And that's very important, but those handsets are what drive the service revenues for the carriers or the operators. And so there's a lot ~~of~~ in patented technology there. Some of it is the traditional way that patents are used; the patent is the right to exclude, so it gives you a head start if you'd like I using the technology. It gives you exclusivity for a certain period of time. But actually a very substantial proportion is what's called standards-essential patenting, and this is technology that's actually where the technology holders actually waive the right to be able to have exclusivity. They actually contribute it through the standards organizations to these core technologies, so for example the radio technologies like 4G LTE for example. And it's very important there's patent protection there, because there's a lot of investment. I mentioned $40 billion a year in total mobile system. Not all of that is going for standards-essential technology development, but a significant proportion is. And those developers, those technology developers, are working on a

variety of technologies.—. Some of them may not be adopted by the standards organization, so again I'd like that, you know, they're pursing a technology that -- they're drilling a dry hole if you'd like, but they still make that investment.—. And there needs to be a means of being able to recoup that.—. And the way that is done is through the licensing that occurs -- the licensing for money or cross-licensing among the different technology providers who may be manufacturing for example or they may be pure technology developers.—. So it's a very, very important underpinning of the system that fosters that innovation, that incentivizes the technology developers to be innovating and bringing about the successful development of the marketplace on an ongoing basis, as we are observing.

MS. OKUN: And so, Keith, I'm so glad you mentioned that.—. I was thinking that when were, you know, giving those answers.—. That, you know, here we are talking about, you know, the mobile economy and, you know, the fact that, you know, you can pick up your phone and call someone in another country and you can be somewhere and that we're talking about all this connectiveness and this connectiveness is all-- you know, the backbone of it are these standard-essential bodies where, you know, the companies that have invested in those type of technologies are the backbone of the ability to have this communication.—. And that, you know, one of the things that we still have to be careful of on an international context is, you know, someone trying to move away from that system so that there are competing standards and it can be very inefficient and that's something we haven't touched on.—. But a real part of this conversation of how this, you know, we continue to go down this path.

MR. WEST: So a few people have mentioned the internet of things.—. So we're seeing the rise of machine-to-machine communications, there are connective

medical ~~devices,~~devices; we talked earlier about smart cars and appliances~~.~~. I'm just curious, are there particular policy and/or legal issues that we need to think about in regard to the internet of things? Are there barriers that need to be overcome? Don't everyone speak at one~~.~~. (Laughter) That's really rude.

MR. BRENT: In the life sciences field, yeah, like I mentioned in reference to the gentleman's question, you know, there's obviously, you know, privacy concerns as we start communicating, as electronic health records start being passed a little bit more -- you know, have to be passed along more easily~~.~~. But as devices start communicating with each other there are tensions -- there's tensions between not only the patient's information, there's tensions between companies, you know, because as one company has to develop technology that communicates with another company's technology, you know, how do you do that without the companies sharing some level of information~~.~~?. And sometimes kids play nice in the sand ~~box,~~box; sometimes kids don't play nice in the ~~sand box~~sandbox~~.~~. So, you know, that's one of the issues and that's another issue that sits there with the interoperability issue in life sciences~~.~~. I do think these things can be overcome though~~.~~. I know, you know, our CEO is very passionate about patient safety, and has made commitments and discussed the fact of the need for companies to share data because it's for the good of the patient~~.~~. And so we have to figure out ways around this and he's, you know, he's preached the gospel to many, many companies, saying that we need to get together and do this for the better.

MR. WEST: Todd?

MR. DICKINSON: I'm going to make my professional ~~hot~~ hat and maybe talk as a citizen~~.~~. I heard Keith and I think he's -- I applaud his thanking the Silicon Valley for their innovative culture and sort of the free enterprise way they approach it~~.~~. I

guess I'd wonder though, is that always going to get us necessarily to the best result, or are there ways to incent the kinds of innovation that we need.—. You know, sometimes I wonder if we put all of our innovation into the -- what's the next cool thing as opposed to the next best thing -- do we need a refrigerator that can talk to us as opposed to something that might be a little more beneficial to society.—. Thethe parallel might be in the pharmaceutical industry we need orphan drugs, we need -- a lot of diseases that go unattended and yet we have many, many, many different approaches to things that affect older gentlemen, let's say.

MR. MALLINSON: I think it's fine because, you know, we have a marketplace.—. If people don't want connected refrigerators then they won't buy them.—. So somebody's put some investment in and it doesn't work out, but you can see in other markets where there has --

MR. DICKINSON: You don't (inaudible) play Angry Birds, then?.

MR. MALLINSON: -- been vibrant innovation because there is a need.—. So for example mobile payments, yesterday so Apple is announcing Apple Pay.—. In a way they're behind the curve because there's a system that came from Kenya called "M-Pesa" that's been around for quite a while, a mobile payment system, where that's innovation in a developing country because of a specific local need and because they had the capabilities to develop that.—. So in developing countries, they're typically cash economies, so it's been a very convenient platform to use mobile payments.

MR. DICKINSON: But I watched that announcement, and a good chunk of the time was devoted to what color and the material the wristband was made out of.

MR. MALLINSON: Well --

MR. DICKINSON: I guess that's marketing.—. That's what I suppose,

that's.

MR. MALLINSON: That's marketing~~.—~~. I think there is good stuff if you like that comes from all kinds of other markets and I think, you know, it's possible~~.—~~. I think that a lot of the things we've talked about today in terms of intellectual property protection, that those kind of processes and principles we encourage other nations to adopt good practice, then maybe they can do more of the kinds of things that they can home grow.

MR. DICKINSON: Well, I'll flip it on my head~~.—~~. I will say because I actually know some of the guys involved, I would have never thought to take a lot of this technology and turn it towards my thermostat~~.—~~. But when Nest comes along, and I realize what they've done and I realize it can help me lower my bill but also save energy, it just seems like this no brainer~~.—~~. And it seems -- if that's the kind of thing we're talking about when we talk about the internet of things, that seems like a pretty good thing to me.

MR. WEST: I think there's a -- somebody had their hand up~~.—~~. Right here~~.—~~. The microphone --

MR. JOHNSON: Hi, I'm Mark Johnson, founder of Astra Capital, which is a communications~~-~~-focused investment firm here in Washington that spends ~~alto~~ a lot of time focused on globalization and mobility in particular~~.—~~. My question is more of a social one so I guess I'll take my business hat off~~.—~~. I was struck by the comment about 80 percent of Americans sort of not viewing innovation as important as many people in emerging markets might view it, and it makes me wonder if to some degree innovation has become a threat to the bottom ~~quartal~~quartile of U.S. society, because it enables so many others in the global economy to compete with American workers who are being left behind~~.—~~. And is Silicon Valley becoming a place for elites to innovate and benefit without

this technology being pushed down to the reset of the economy in a way that prevents people from being left behind? And are there ways kind of through either support of patents or through government finance, or are you seeing in the patent worlds as much innovation coming out of people from that bottom quartalquartile as you see from the upper echelon, or as you may have seen 100 years ago when, you know, Thomas Edison was in his back-yard as opposed to now you have to be in the digerati to innovate and if you aren't you're basically captive to competition from China or Africa or the rest of the world that now just intermediate the American worker?

MR. MALLINSON: Maybe we need a no innovator left behind program.. (Laughter)

MR. BRENT: One thing I've always thought, Mark, I think it's a great point.—. In a former life before I became a lawyer, I was actually an engineer for General Motors and, you know, so my office sat right over a plant where we made things and I used to work with plants.—. And I've always thought that the key with having an innovation or a, you know, service-based economy is we're moving more towards, you know, these innovative ideas is we can invent and create things, but we also still have to have the ability to make things.—. And so I think continuing to develop -- because I'm not going to act like it doesn't exist -- but continuing to develop manufacturing, you know, high tech manufacturing that is, you know, that still has a lot of people based skills to it.—. I think that's the key.—. We have to be able to, you know, not only think of the great ideas, we also have to be able to make our own -- make stuff.—. And by the way, you know, you can spread this technology out all over the word, but the idea is that, you know, that's where some of the innovation then has an impact on like you said the lower quartalquartile.—. I think if we're able to make things and create ways for other people to do things.

And the second part of it obviously is, you know, the catch word ~~stem~~ STEM education~~.—~~. You know, we've got a -- you know, we have to continue to promote science technology, engineering~~.—~~. And, you know, I can remember when I went to college, you know, the idea that, you know -- there were a smaller number of people who went into engineering~~.—~~. And it's growing, but growing it to the masses, growing it to everybody.

MR. JOHNSON: That's the thing~~.—~~. (Off mic)

MR. BRENT: That's a key~~.—~~. I know exactly what you're saying is we, you know, we've got to get more people and we've got to cast a wider net finding the next generation of engineers and innovators because people coming from, you now, people from all diverse backgrounds are going to be able to take that education and spread that education and that work back into underserved communities~~.—~~. That goes back to part of the report of spreading the mobile economy into underserved communities~~.—~~. Well, we've got to get those people in at the baseline which is, you know, through education I think.

MS. OKUN: First I want to make sure that I have left you with the right statistics, because it is the report~~.—~~. I was struck by the fact that 95 percent of those in China believe that invention is important for society In the United States it was 81 percent ~~. Believe~~ believe it is too~~.—~~. So, okay, so I want to make sure that -- well, you know, it's still a very high percentage and the world economic forum just -- I mean the U.S. just raised up again to be number three in the world on innovation~~.—~~. So there are still a number of good things going on~~.—~~. But on your point which I think is an important one I think what we're talking about can serve for those -- we're not looking to wear the most expensive Apple watch, and I think that is some of the point that, yeah, Silicon Valley can, you know, put out toys that people who are affluent can afford to buy, what

about the rest of the world.—. And I think two things.—. One, I think Darrell in his opening remarks talked about the *Time* Qaulcomm report that came out two years ago that focused on by having technologies or phones in the hands of entrepreneurs, farmers in other countries their they're able to sell their goods that they couldn't otherwise do so they're -- that's a way to connect them with a market that otherwise wouldn't exist if you didn't have this mobile technology.—. And I listened to TED talks sometimes and I'm so struck by some of those where they focused on entrepreneurs in other countries who talk about -- I think it was an African youth who was able on his phone to watch a scientist talk about chemicals and so he came up with a way to have, I think it's like a waterless soap, because in his village that's what the issue was, there was no water.—. So he wanted people to be clean and so he came up with this waterless soap.—. And I can't -- I may be confusing two stories, but he was then using something similar to crowdsourcing, you know, he kind of put it out there and got an angel to pick it up.—. And so I think those are the stories of the things that we want to see.—. You know, it's not just, you know, what the next toy is but, you know, how can you make technology available in a way that empowers people in their own country.?

SPEAKER: (off mic).—. (Laughter)

MS. OKUN: It could be a good thing.—. Maybe they can get together on their Facebook page and, you know, the low income kid can say hey, why don't we do this and that can be a great thing.—. And that's what you want to encourage and it sounds like that's what you're doing with your company, so.

MR. WEST: Okay.—. This gentleman on the aisle.—. You had a question before or not? Okay.—. We'll go with you, right there.

MR. FARRAH: Hi, Jeff Farrah from the Senate Commerce Committee.—.

One thing I haven't heard touched on but I'd be curious of the panel's thoughts is the issue of the availability of mobile spectrum, and how that's going to be able to facilitate a lot of the exciting things that we've heard about today. We're going to be having an incentive auction in this country and that will put out some very high quality, low band spectrum, but then after that we're not quite sure what's going to come next and so perhaps it's a question that Keith's got some thoughts on, but anybody else it would be great to hear your thoughts.

MR. MALLINSON: Certainly. I mean spectrum is vital for mobile communications. Just some background on the demand for it. Traffic on the network used to be generated by voice, voice and text messages. Text messages, a tiny amount of data, voice a modest amount. Then there's this mobile internet phenomenon that started, let's say in the 2000s, middle of the 2000s, and it's been a real hockey stick. By 2009, globally the traffic on the network was mostly data rather than voice. That's where kind of the crossover point came as people started to use the mobile internet. Now the data use is something 10 times more than the voice. And it continues to -- overall traffic is kind of doubling every year; it has been in recent years. But we're talking about a demand level which is something like 1,000 fold over the period of a decade or 15 years. So that puts a colossal requirement on the spectrum to actually provide that communication capability to increase the capacity on the network. You can improve the technology, but a lot of that's been done. You can increase the number of cell sites and that will be done, but there are challenges there because people don't like too many of these towers sitting around. So spectrum is a very important part of it as well. So if you're trying to get a 1,000X, you've got three things to multiply together, the improvement of the technology factor, the number of cell sites increasing, and the

amount of spectrum.—. And however you cut it, you need a lot more spectrum.—. And so it's going to be very, very important to get more spectrum and continue to do it.—. And the incentive auction process will be an important part of that.—. I was actually at the CTIA show in Las Vegas yesterday and I was surprised at a statistic that said -- that was showing that the U.S. is actually. for the fourth generation LTE technology. is actually behind the average nation and a lot of nations in having spectrum available for that technology.—. And that's quite bizarre, because the U.S. is way ahead of the rest of the world in actually implementing that technology.—. The U.S. has something like five percent of global subscribers, but it has nearly 50 percent of global LTE subscribers with fourth generation technology.—. So the spectrum need is extremely pressing.—. And it's something for the next five to ten years because this traffic growth is going to continue.—. More subscribers, more smart phones, but people want to do more with these devices.—. And it's all about video, and video is the most bandwithbandwidth-hungry service you can imagine.—. And so people want to download, they want to stream, they want to upload.—. And another statistic I picked up at the show yesterday -- I can't remember the precise percentage but the majority of people when they're streaming video on a mobile device have problems.—, You you know, the video stalls.—. We're all familiar with this.—. It's frustrating and it depends on where you are.—. And so I'm at this show yesterday, so it's the U.S. epicenter of everything to do with mobile, and I'm sitting in one of the sessions and I'm tethering my laptop with my 4G LTE device and I can't do any email, I just can't even make a connection.—. Why -- because I'm in a room full of other people trying to do the same thing.—. So, you know, it works really well some of the time, but it melts down very rapidly because the ether is actually a pretty frail and limited kind of bottleneck for the network, and there's a lot of work that needs to be done and a lot of investment that

needs to occur in it to create that capacity.—. And spectrum is a vital part of that.

MR. WEST: If I could ask another policy question, because yesterday FCC Chair Tom Wheeler said that the Commission was considering net neutrality rules for mobile carriers similar to what already is in effect for the wired internet world.—. Is this a good idea?

MR. MALLINSON: I can certainly provide an answer on that.—. I think and we all believe that the internet should be open whether it's fixed or mobile.—. Open access and there shouldn't be skullduggery, you know, to impede another player that's trying, in earnest, just do a good competitive job.—. But the need to be able to manage these networks particularly, on the wireless side, is enormous.—. And though you can have a few people who are bandwidth hogs, they made need to throttle or regulate the amount of demand, but in the interest of enabling other people to have fair access to the internet, but doesn't clog up.—. So I think that's an important part of it.—. Also I think there are some fundamental economic questions.—. So one of the questions that always comes up, you know, is it fair to have a fast lane in the internet? And my own personal opinion is there are actually a lot of benefits in having a fast lane, allowing people to have, you know, premium.—. Like when you fly on an airplane, you know, you're sitting in coach and paying a modest amount, you're in a way being subsidized by the people flying in business class.—. And, you know, for the airline it's the totality of the revenue that's paying for the airplane.—. So it's not entirely a bad thing to have some tiering, so long as it's not done in an anti--competitive way.—. And, you know, really the over the top players have shown that they can run rings around the operating companies.—. I mean they did that on the fixed -- certainly on the telecommunications side.—. They did them the fixed internet and then the mobile side, the mobile players were trying to have whole gardens

and such like 10 years ago, and now it's all the over the top players, they seem to be doing pretty well and we need some safeguards. But, you know, I think there is also an argument for enabling the operators to have some latitude to modulate the kind of way the networks are used.

MR. BRENT: I concur with what Keith said. There's two sides to the coin. You know, in the medical device field and also life sciences, but primarily from the medical device area, you're going to have small disruptive companies that are really trying to come along and it's going to be important for them to be able to gain access. And going back a little bit to Jeff's question, too, you know, spectrum, the little guys are going to have to have access to spectrum and they're going to have to have access to the network. On the other side of it if these guys can get access to the network but it's slow and it's affecting a patient or affecting a doctor, you know, that's going to be problematic. But, you know, you basically have this wave of users that are coming along, not just consumers, but you have this wave of business users in the healthcare field that are going to eat up more so that goes to Jeff's point, the spectrum is just going to be increasingly more and more important, especially as more and more people have to have it. It's not going to be just the big players that are going to have to have it, it's going to be some smaller players are going to have to have a piece of the pie.

MR. WEST: Right here on the aisle.

MR. JAVED: Hi. So, Ema Javed, I work for Eleanor's Mobile Money Deployment in Pakistan. And one of the questions that I wanted to ask was a lot of the intellectual property, the usage of intellectual property is restricted to large firms in the developed world. So a lot of truly disruptive technology that comes through, such as M-Pesa that was referred to, in the developing world has very little intellectual property

protection.—. And similarly a lot of disruptive technology emerging within the developed world but from start-up firms also receives very little intellectual property coverage, such as let's say Uber as an example.—. On the other hand, when we talk about large established players even the covering on a Starbucks cup is covered by intellectual property.—. I hardly believe that something that's truly disruptive or worth intellectual property protection.—. So how do you actually diffuse the use of intellectual property to those other firms and how do you truly provide them with an opportunity to protect some of the invention that is coming through?

MR. DICKINSON: I'll start with one of my -- a thing that I worked on for a very long time and a pet peeve in a way which is the fact that patent systems in particular are still territorial, and that it's country by country by country by country.—. And we work to try to get what's called harmonization, substantive patent harmonization in particular, globally for decades.—. It's held up yet again, for various reasons, most recently at the World IP organization because of concerns from developing countries about the application of what's called the "development agenda" that is supposed to be applied throughout all UN agencies.—. So it's a fairly arcane question.—. If we could get past that or get to the substantive harmonization through a different mechanism I think we can make substantial progress.—. Otherwise you've got to rely on the individual intellectual property regimes in individual countries, which can vary from country to country.—. And then you've got the multiplicity of requirements for application, you've got the multiplicity of fees that have to be paid, you've got the multiplicity of attorneys in those countries which have to be engaged and paid and you get to the point where obviously decisions have to be made about where the investment should be made.—. When if you could do at some point, hopefully maybe one stop shopping or a regional -- maybe we could go to a

regional one day even or a global patent you could achieve that -- a big piece of that goal.

Another key piece of it though is making sure -- and this is an education piece that I think is incumbent on the developed countries, to make sure that the developing countries understand the value of IP. Because you make a very good point, I think developed countries, the United States is not -- but try to sort of parachute in with our rules and our experience and say isn't this great, you should adopt it too, without accounting for the culture, accounting for the circumstances of individual countries, and basically not accommodating to the environment that they find it. Obviously many developing countries don't have large research institutions that can benefit from it. They don't have the research dollars that might benefit from it. But they have indigenous types of intellectual property which could be protected in different ways and that they need to help grow those. So I think it's a combination of factors that need to work in combination one with the other.

MS. OKUN: The only thing -- a couple of little points that I would focus on. I mean one, to me it's not -- it shouldn't be about the size of the company or the territory or where it's located, right. I mean to me the protection of IP is the protection of IP. So if it's an individual inventor in the United States or an inventor in Pakistan to me it's, you know, there should be systems in place to encourage that inventor. That inventor may then sell to some large company because that's -- an inventor doesn't want to actually, you know, to produce -- doesn't want to be the maker, he wants to sell it somewhere. And so I think sometimes we get hung up on someone's business model or the size or it's only big and I just don't think -- actually history of the facts support that. I think it's research institutions, research in universities are an important part of the

United States obviously but I think that I don't want to penalize an Apple for having hired smart minds out of, you know, any country it wants.—. You know, if it can train engineers and then it comes and then it, you know, it uses them to capitalize on its next great thing, to me that's a system, but we don't want to discriminate based on those things.—. So I mean I want to encourage those entrepreneurs, those companies, those start-ups around the world and it doesn't meant that the same system has to be in place.—. And I think Todd makes a good point and that wasn't what I was stressing earlier about our negotiations.—. It's more about not harmonization, perfect harmonization, but respectful rules that are able to accommodate, you know, what's going on in a country and different things, but not necessarily about the size.

MR. WEST: Okay.—. I think we will make that the benediction on this event.—. But I really want to thank our panelists, Todd, Derrick, Deanna, and Keith.—. I think they did a great job kind of thinking about the future in terms of mobile applications, some of the barriers and ways we can overcome them.—. So thank you very much, and thank you all for coming out as well.—. (Applause)

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I, Carleton J. Anderson, III do hereby certify that the forgoing electronic file when originally transmitted was reduced to text at my direction; that said transcript is a true record of the proceedings therein referenced; that I am neither counsel for, related to, nor employed by any of the parties to the action in which these proceedings were taken; and, furthermore, that I am neither a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.

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