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SHARING SPECTRUM: A SOLUTION FOR ASIA'S MOBILE BOTTLENECK?

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>> JIM FOSTER: Good afternoon. I'm sure everybody had a great lunch and you're wide awake. I feel pretty good because we're sort of the kickoff workshop. A couple days from now it would be kind of the finish‑off workshop and everybody might be a little tired of slides and presentations. But everybody now is eager. Everybody's looking for a good show. And I hope that we can provide that to you.

I'd like to call the panelists to the stage, so please come up.

I found in my many centuries as a moderator that I always make mistakes and embarrass myself and my panelists when I introduce them, so I'm going to go ahead with self‑introductions and then I will ask them to pass me the ball and we will start the process.

For me, my name is Jim Foster. I'm from Japan. I teach at Keio University. But I've had kind of an unusual career in the sense that I spent many years working for the U.S. Department of State and then fewer years but much more enjoyable years, in some respects, working for Microsoft. So very eager to work with this group of panelists. In putting this together, I've been surprised ‑‑ not surprised but pleased how smart, how focused and how knowledgeable this group is about an area ‑‑ and I'll talk about this a little bit later ‑‑ that most of you probably think is boring with a big B. Why are we talking about spectrum? And why do we care about spectrum? And yet I will argue and hopefully it will come out in the discussions in the panel that, really, the question of spectrum is sort of at the heart of Internet Governance. When you think about it, that's why governments got involved.

But first let me do a quick first round of introductions. I encourage my panelists to be full some and not reticent about their outstanding accomplishments because I think that weighs heavily on the credibility of what they have to say.

>> Thanks, Jim, I am a few years younger than Jim. I work for Microsoft in a group called Technology Policy which is part of our CTO office. What we do is try our best looking a bit further into the future, you know, examine the technology change that are more or less disruptive down the road in coming our way and really try to inform both our internal business as well as our government clients and our Internet on what the impacts might be. One part of the spectrum Microsoft cares so much, many of you might ask why does a software company care about spectrum? Hopefully I will explain that later but I would like to go to my co‑panelists to introduce themselves.

>> ANDREW JUN: Thanks, Jeff. My name is Andrew Jun working for KT, Korea Telecom. Basically I'm responsible for setting up spectrum strategies and policies within KT. And then we recently got on the spectrum auction for new LT spectrum last week and we got what we wanted to. So mostly our interest in spectrum is licensed‑based in spectrum spaces. So TB white spaces is a little bit new to us as service providers, but definitely this could be a new way of doing technology innovations as well as visions model innovations. So we are very much interested in TB white space activities. And then I'm very happy to join this kind of activities here, as well. Thank you.

>> HIROSHI HARADA: My name is Hiroshi Harada from National Institute of communication technology, NICT. So I joined NICT in 1995. So this means that I'm currently doing the almost 18 years wireless communication research and development. Especially I'm doing the several standard work for the next generation, so wireless LAN and wireless personal area network and wireless regional area networks. Also currently I'm doing some of the research and development over spectrum management for the future broadband communication systems. So that's why one of the application on the frequency band is wide space. So that's judge I'm very happy to ‑‑ why I'm very happy to join this meeting for the current state of TB white space and we need to discuss what kind of business model or what kind of equisystem. So I like to discuss these type of topics in this panel. So thank you very much. Back to Jim.

>> JIM FOSTER: Okay, thank you very much. I think you will all agree that I think we've got the right people here in the room. The important thing will be for the moderator to stay out of the way as these guys discuss.

But I just want to call your attention a little bit to the title of this because the word spectrum and sharing don't usually occur in the same sentence. We talk about spectrum licensing. We talk about spectrum allocation. We talk about how limited spectrum is and how important it is to manage it effectively. And if you think of the telecom regulatory framework and the role that governments played in the development of communications, the development of broadcasting, for that matter, it all really was about spectrum.

And also ‑‑ but these days, you know, in some respects, the Internet, increasingly, is all about spectrum because that mobility, that you bike which at this that is kind of characteristic of the explosion of usage, particularly through the advent of smart phones that we've seen over the past five to six years has fundamentally rested on the availability of spectrum that could be used for mobile communications. That's the bedrock. It's not the poles and the lines anymore; it's really the frequencies, the waves in the air and how they're used and managed.

And yet the way in which we use and manage spectrum across‑the‑board is very much out of the 1950s or the 1940s or the 1920s. The thinking about it really hasn't evolved all that far. In fact, one of the hot topics still is auction. It used to be simply allocated or awarded and used by the monopoly carrier. We have now seen the introduction, through the whole process of, you know, introducing competition to that sector, we've seen emergence of new carriers, and that's certainly produced a lot of competition. It's certainly produced a lot of innovation. But the model, the fact that spectrum is awarded to certain carriers. They have a license to use it for purposes stated in some respects kind of goes against the real thrust that, the real forces that have been driving the Internet, which is innovation, competition, openness, access. And so those are the kind of things I'm going to challenge the panel to talk a little bit about today, to talk about not how to use spectrum, how to manage spectrum or license it, but how to share it and share it in a very, very dynamic and rapidly evolving environment. So spectrum can be used and reused.

And when you walk out of the room, I want you to walk away with the idea and with the one concept that spectrum is no longer limited. We're no longer limited by spectrum. The fact is that we have technologies that will allow us to use, reuse, splice and dice spectrum in ways that can provide enormous amount of functionality to the kinds of technologies and the kinds of tech services that people are bringing to use today.

But a lot of it comes down to governance. And that's why I was very pleased when the organisers allowed me to come here and talk about spectrum governance, which is also the flip side of spectrum sharing. Because if you're going to share, you need to have a framework for governance.

So let me stop right there. I'm going to jump queue here and immediately go to Andrew and have him talk a little bit about what the hell we're talking about. In other words, it's all good for me to talk about spectrum and sharing and this and that but what exactly are the technical characteristics of the area in which we're dealing? What are the limits? Where are we going? What's in the future? And Andrew is with Korea Telecom, as he mentioned, and will offer some insight into how spectrum is being used, managed and where it might be going in the case of Korea. So, Andrew, three slides, right?

>> DR. ANDREW JUN: I just wanted to be very brief. I'm not going to provide like data and information here about devices. But very brief introduction about TB white space and then that activity within Korea.

>> JIM FOSTER: Andrew, just for everybody's enlightenment, you know we talk about TB white space, et cetera. What is TB white space?

>> DR. ANDREW JUN: Maybe the definition of TB white space could be a little bit different from people to people, but the way I see is basically TV channels have been allocated to broadcasters. And then because of the frequency interferences, only certain channels are limited use for certain areas only. And then because each cell size is pretty big, there's a lot of geographical gaps in between different channels. So for certain areas, some channels are empty and not used. And then those are called TV white space. And then TV white space is especially meaningful when it is digitalized. But, anyways, so basically in Korea, basically from 470 megahertz to 690 megahertz, those are being occupied by digital broadcasters. And then when certain channels are not used in those areas, so those are called the white spaces because when channels are not broadcasted, you turn the TV on, then you see only white screen. So I think that's the background of why it is called the TV white space.

So how to utilize those not used channels in certain areas. Basically the issue of TV white space utilization.

So, in Korea, so far, those white spaces has not been used, utilized in Korea, not only Korea but across the world. And we just started looking into utilizing those not used channels. And basically they're about 40 channels available. And then in Korea, Seoul area, probably one or two white space channels available, and then if we go to rural areas, there are quite a few channels available. So people are quite interested in accessing those channels and utilizing those channels to provide certain services. And then these are kind of service categories that our government and academia and then industry people are looking into.

One could be kind of convergence service, sort of M‑to‑M, machine to machine or Internet of Things. So that is one category.

And then second category could be providing public information, you know, weather and then traffic or some sort of like emergency type of information. Could be provided.

For rural areas ‑‑ infrastructures are hard to build simply because the economy of scale is not there. So instead of like in providing wire line connectivity, TV white space channel could be utilized to provide Internet, wireless Internet connectivity for those areas.

So basically these are certain areas that we are looking into. And then I think like, you know, we could have comments from other people, what kind of information areas they are looking into.

>> JIM FOSTER: Let me throw it, then, over to Hiroshi who is with the national information communications and technology institute. It's an institute affiliated with the Japanese government. It is involved in a wide area of research into new and imaginative uses of ICT technologies and also the kind of standards and other kinds of regulatory frameworks that's required to support it. I'll throw it back to you, then. Okay. Hiroshi, maybe you can just update us a little bit on what's going on in Japan.

And particularly, I think one of the things that's going to come out of this ‑‑ and I'm not sure how successful we're going to be ‑‑ is there isn't a one size fit all or a model that we're all looking at right now in terms of where to go with this subject. The U.S. has been moving very, very aggressively, and I'm going to ask Jeff to talk about that. Singapore has, too.

Korea, as you see, is doing some important thinking on it. There's actually a lot of experimental work that Hiroshi's Smart Wireless Laboratory, which is part of the NICT structure is doing. So, Hiroshi?

>> HIROSHI HARADA: So concerning the white space communications, this is the frequency there are certainly several systems, WiFi, LT and wimax. Of course there are several vacant frequency bands. We tried to find such kind of vacancy frequency band and try to use such frequency band for the new broadband communications systems. But the point is: How much spectrum is available? So this is a database that shows current usage over TV systems in Japan. Of course, TV has so very broadband channels. Right now in Korea, 470 to 670 but in the case of Japan, 470 megahertz to 710 megahertz. But in the case of number of channels, all the channels are occupied over Japan. But in the case of 52 channels, we can see some of the press that has already assigned to the TV station. But TV station never use such kind of frequency band.

So we try to use this kind of frequency band and try to use this kind of frequency band effectively.

So the point is so we can consider how to calculate this service area of primary systems. And also we need to consider the how to use the frequency band for secondary users. So we try to consider this kind of interference. And if this interference is very low, so this person will start to use this new kind of frequency band.

This is one of the definitions of frequency sharing between different communications systems.

So in Japan, we have already this kind of thing from already 2,000. So our inner city started almost 2002‑2003 so we have already studied some of the research. And right now, this frequency band is discussing how to use this kind of frequency band. So currently we are thinking, so wireless microphone or sensor network and wireless broadband and wireless access systems for the images situations. So because we have a lot of frequency band in any places and this kind of TV channels has a very ‑‑ have a capability to extend transmission ranges in compared with current WiFi frequency band. So that's why currently we are considering several use cases; for example, sensor networks for a kind of ‑‑ all over the building and the song. And based on this kind of applications, we have developed several white space communications systems.

So one application is WiFi extension. So currently WiFi is already occupied. So that's why we need to have a more frequency band. That's why TV channel is one of the frequency bands for the WiFi to increase the number of channels for WiFi.

So currently this kind of research, the development of standardization is currently doing. So we are currently strongly involved to new 803, 80211, 802‑11‑A system. This is WiFi on white space.

Also we are doing the sensor networks on white space to increase the number of channels for sensor networks. So that name is 802‑15.4 M. So currently these kind of applications are considering as a next stage of the usage of white space in Japan.

From this year, this kind of discussion is starting; but before that, this kind of ubiquitous broadcasting system, the kind of information broadcaster, small dedicated areas, small broadcasting system is currently allowed to use on white space.

So such thing is kind of currently using the applications. Thank you.

>> JIM FOSTER: Okay. Thank you very much, Hiroshi.

Is the picture becoming a little clearer here of what we're talking about?

I mean, how many people here are having trouble getting online in this lecture room? Now, I don't want to encourage you to get online of the I want you to listen to what we're saying. But, come on, there's a limited amount of WiFi capacity here. Back at my university in Japan, it's great, but also notorious. People can't get online during my classes. Not because I block it but because they all try to get online and they block themselves.

WiFi capacity is a huge issue. Mobile telephone capacity is a huge issue. And those are the kinds of things that a more creative use of spectrum, not a massive re‑allocation of spectrum, that's politically difficult and probably, in the end, a little bit unfeasible. But within the licensing parameters of the licensing holders offers a key to mobile congestion, WiFi congestion. And then we're all talking about the Internet of Things. Well, you know, just like when we talk about electric automobiles, it all sounds great until you realise that you need electricity. And where's the electricity going to come from.

Well, the Internet of Things sounds great until you realise that all these sensors, whether they're on highways or in public buildings or in department stores or elsewhere need to run and produce and report based on radio frequencies. And where are those radio frequencies going to come from? That's the question. And increasingly, spectrum is a limited, highly prized, and if you look at some of the recent auctions, a very, very valuable item. And, yet, when spectrum becomes the most expensive part of offering a service, after a while it becomes fairly difficult for people, particularly the small startups, the guys who want to bring new stuff to the market in new ways find it very difficult to get started.

And so I want to turn now to my friend Jeff who's based in Singapore. But Singapore and Jeff and a number of companies down there have been doing a lot of very, very kind of interesting market and basic research on how to use spectrum. So I'd like to have him talk a little bit about that.

>> DR. ANDREW JUN: Thank you, if I may, Jim, before I sort of take on that challenge you gave me, I would like to back pedal a little bit to reinforce what professor foster mentioned a little bit. Why at the core of Internet Governance of IGF that we're in here. There is a section that is not so obvious, I would argue, also the people in this room versus the other room, I would guess. And something that is really fundamental because if you think of it, starting now and then going forward for sure, majority of the people, and I would say majority of the things that are connected to Internet are going to be doing this wirelessly. Many of us probably forgot how the RJ45 cable look like by now because we always go on WiFi like you were alluding to earlier. So the wireless access to the Internet become fundamental before you can talk about Internet Governance. So for 5 billion people out there that have never been connected to Internet, talking about Internet Governance is immaterial to them because they have never been to Internet. So the first and foremost thing that we need to do as a community, as an industry, is to give those 5 billion people the access, affordable access to Internet.

And given what we just said, majority of them are going to come online wirelessly. A big part of the equation is how do we make that wireless connectivity cheap enough so that these 5 billion can come online? The main reason they are not online today is affordability.

So we at Microsoft, we really think that spectrum utilization and how do we actually make better use of the spectrum, which is a very limited resource, is at the core of making that connectivity more affordable. This morning you heard from Icon, we talked about IP addresses and domain names, those are really critical components of Internet Governance; but if you will compare the scarcity of resources, I'd argue that spectrum is even more scarce than domain names and IP addresses because one is a natural resource we cannot manufacture. The other you can just increase the number of biz, there you go, you have more address space. So I just want to reinforce that part and really call to your attention why we're discussing spectrum here.

And then thanks to my co‑panelists who actually really define what white spaces is, and I also wanted to expand a bit on that definition and call to your attention that white space is actually beyond just the TV band that we've been hearing just now. It's really, if you look at the whole spectrum band, there are, if you take a real measurement of the fiscal world in any given location a given time, the amount of spectrum resource from zero to 6 gigahertz, let's say, actually majority are not being used. And that's just a stark reality. Which really contrast to the often time you heard about the spectrum crunch notion of we're running on the spectrum; but on the other hand, we're really wasting a lot of spectrum, making it lay fallow and not used.

So what the Singapore group and many other pilot efforts that Jim was mentioning earlier was really to demonstrate to the government and then to the industry itself and general public that there are better ways of managing spectrum resources, which is scarce, which is limited. And that allows the service providers as well as communities and individual consumers to actually have a cheaper and better connectivity solution. And that not only applies to people but also apply to the Internet of Things.

You know, we heard this morning about 6 billion or 7 billion connected in 2017. I heard 50 billion things being connected at 2050.

So where would those spectrum resources come from to field the kind of growth? And, really, it has to be a more dynamic and shared basis of spectrum usage. And the Singapore group, which is comprised of 18 companies, not only in Singapore but also we have worldwide members including NICT from Japan. And we come together to really, you know, not just approve technology, because the technology, the rate of technology that was talked about earlier has really been proven. And in the U.S., it's already written into the law that allows the unlicensed usage of TV bands, TV white spaces. But in Singapore, we focus on proving the commercial viability, i.e, aside from technology innovation and policy enablement, we really need to have a business case, a business model that caters to this kind of new usage and make it work so that there is a business case for whoever come to leverage this kind of technology. And by that we show the policymakers that such a new spectrum utilization model will not only, you know, lower the cost for people to access Internet but actually open up whole slew of innovation possibilities, new business models and new application transforming vertical industries like education, healthcare, agriculture, whatever you can think of that can utilize a better and cheaper wireless connectivity. I hope that give an overview.

>> JIM FOSTER: Okay. So let me step back a little bit. I want to do a bit of a reality check here for everybody.

First of all, how many people here even gave the slightest bit of thought to this before coming into this room? Okay, good. We've got a couple. Well, you don't count. (laughing).

Yeah.

You know, here we are talking about what seems to be a huge pending issue, the fact that frequencies are becoming increasingly more expensive, increasingly more scarce, increasingly more difficult to manage.

And at the other hand, in parallel with that, as Andrew was saying, as Hiroshi was saying, we have some solutions here. There seems to be technological solutions. There also seems to be some simple policy steps that could be taken to kind of deal with this thing.

And so I guess what I want to throw out to the panelists a bit is: Why is this so hard?

And if you think about it a little bit, probably the most valuable thing that I could give to you and that you could will to your children is a little piece of spectrum.

Companies around the world, you know, thrive or fail based upon their ability to utilize a spectrum that they have. And increasingly spectrum is becoming the currency for the Internet. And the question, then, is how is it valued? How is it used appropriately?

And so I'd like to just throw out ‑‑ and I'd like to start with Andrew a bit because he's been doing a little bit of thinking on this over lunch is: Why is this so difficult? What is ‑‑ how is the debate going forward? And what are some of the challenges? And there are issues related, there are some practical technical reasons why this particular solution is challenging. There are some very practical business issues related to it. And there are also, of course, a lot of things related to both the history and the current state of government regulation in this area.

In some respects, too, spectrum has always been defined in national terms. I mean, yes, we've had the ITU. And what the ITU's business is to do is to be sure that all the different national regimes don't interfere with each other.

The fact is: In the Internet world, it's not a question of all the different national regimes interfering with each other; what we need to do is find out ways that they can collaborate and work together. Because the Internet's seamless, despite the physical boundaries of the different countries. Spectrum at some level is seamless, as well. It's the same across the world; it's just a question of how it's divided, managed and used effectively.

So let me throw the ball to Andrew just a bit. Challenges? Opportunities? Contradictions?

>> DR. ANDREW JUN: Thank you, Jim. I think those are complicated issues intermingled with each other. Let's try to take a look at viewpoints one by one.

I think we mentioned about scarcity of spectrum resources, which is really already happening because in Korea like the LTE service is one of the fastest growing throughout the world. And we just had an auction last week simply because the amount of frequency resource dedicated for LTE is not enough, so we needed more frequencies.

And then by adding more, you could be okay for the next two years. And then we need more.

So scarcity of the frequency resources is really happening now. So it is very useful thinking about how to share preallocated resources, you know, where those resources are not really utilized in certain areas. So that's technically basic concept of spectrum sharing. So simply better utilization of resources.

And then there could be many different ways of doing that. Radio and database‑based coordination systems are being developed right now. And then there could be a way of coordinating all those resource access permits.

But when we think about ‑‑ the thing of digital divide, basically licensed‑based mobile service is expensive because we, as a service provider, have to pay a tremendous amount of money simply to get a license for that spectrum. And then in order to build the infrastructure, we need to spend a lot of money, too. So for 35 megahertz of LTE spectrum, we spent about $1 billion U.S. dollars. Which is huge money. And then we need to, you know, spend a lot more to build infrastructure.

So fundamentally based upon this kind of policy and business models, whatever services provided to customers has got to be expensive. So how do we provide cheaper and better service to the general public?

Unfortunately, not really capable of buying mobile services, the concept of a digital divide is really huge, not only in countries, but even within Korea, that's got to be an issue, as well.

So I think the way we think about the spectrum sharing, especially for the TV white spaces, let's just utilize those unused resources regionally and then let's try to use those resources to provide very cheap or free services to the general public. So that's the basic concept behind spectrum sharing to solve the digital divide issues.

But and then there could be many different ways of doing so. One of the ways thought of by Google was they wanted to provide free mobile service to everybody. And then they would like to make money out of advertisements. And then basically that concept has been failed so far. I don't know. Maybe it'll evolve more and they can come up with better ideas.

Basically building up an infrastructure takes quite a lot of money. So there has to be some way of, you know, building right business model to support, to sustain this kind of spectrum‑sharing type of policy or systems.

So far, there has been one. People are exploring many different approaches this way and that way. But we haven't been able to find any proven business model to sustain this kind of issue. But let's not lose our hope. I think if we keep trying within the next few years, we'll be able to find one.

So the way I was discussing this issue over lunch, of course this panel was, you know, we showed few application and service areas. And then I don't think TV white space solution will be able to provide all different sorts of information services we are thinking of. But certain areas can be supported, especially think about one way of providing mobile services like a license‑based, that's one extreme. And the other is unlicensed‑based just like WiFi and spectrum sharing is somewhere in the middle. And the licensed‑based service could be really good in providing quality of service‑based services, quality‑based services. And the WiFi is really good, ubiquitously used everywhere but no quality can be maintained.

So if we sort of come up with good policies for spectrum sharing, then we can support vast amount of different types of services while we can still maintain certain level of quality. But for that, somebody has to provide good network infrastructure. So that's where the key is.

So, you know, people are thinking about three‑tiered hierarchy in providing the spectrum sharing. The highest level, the first tier is the original owner of the spectrum. The TV white space case, the TV broadcasters. And the second tier would be second user of that space wherever the TV channels are unused, not used, then they can be allocated to the second users. Then they can probably build up the network infrastructure to provide services to users. And then they can just bring in some profits out of it somehow, we don't know yet how yet.

And then the third tier is general public. Anybody can access the network freely. And then they can just get some sort of like public services type of things.

So people are thinking about this kind of three tier approach. And then there could be a solution. But we don't really know yet whether they will really work or not at this moment. So I think that's really good discussion points we can make here.

>> JIM FOSTER: Okay. I think that Andrew, and we talked a bit about this over lunch, has offered kind of ‑‑ we're finally beginning to break this down a little bit. We know there's infrastructure. We know somebody has to pay for and maintain the infrastructure, but then the question is whether within that particular framework ‑‑ and this is sort of a revolutionary idea if you've been hanging around with the people that manage spectrum ‑‑ the notion is that spectrum is owned. And once spectrum is given to you, it is not taken away unless it's been misused or somehow or another you are no longer using it in terms of the terms of your license.

Suddenly creating a secondary market for unused spectrum would suddenly open the gates to a huge number of business opportunities. Now, for the people that are the original owners, there's a lot of benefit in that because presumably if there was a secondary market, they would be able to sell spectrum that they were not otherwise using.

On the other hand, there is a bit of reluctance on their part because once there is a secondary market, it really becomes clear there's much more transparency about how much that spectrum is worth.

And then this third category of just general public use, which really kind of tells any business: You can have a piece of it as long as you operate within a certain amount, a certain framework and as long as it's clearly understood that certain basic services require oversight by the government because we're talking about quality, reliability, integrity of the service, particularly in the area of public communications but also public broadcasting. But there's a huge area beyond that.

That kind of debate is beginning to take place in Japan. And I'd like Hiroshi just to comment a little bit about this.

I mean, let me put you on the spot a little bit and say ‑‑ because you're the one who's probably thinking about this and most involved in Japan on this issue. A lot of players in Japan, but some people stand out. Where are we going to be five years from now? And let's provide a perspective. The where was everybody five years ago? Where have we come over the last five years? And where might we go over the next five years?

And in that context, because then I'm going to turn to Jeff, what role can we all play in this? Because the fact is that spectrum policy, as I've tried to argue, is not national policy. In many ways, it goes to the heart of the development of the Internet. And the fact is Asia, of all the areas of the world, is going to face the spectrum crunch soonest. And that spectrum crunch is going to be a serious issue, both for growth but also for, as Jeff mentioned, the whole broader issue of digital inclusion. I mean, those of us who is it in Korea and Japan, what's the problem? Everybody's got a smartphone, right? Well, wrong. Everybody doesn't have a smartphone. There are huge numbers of people that need to be brought in. And indeed that's where the growth is going to come in Asia. We're talking about growth, growth comes from technology, but it also fundamentally comes from incorporating and using effectively new labour as an input to your economy. And so how do we do that? Hiroshi?

>> HIROSHI HARADA: It's a very, very difficult question for me because nobody knows the current achievement from last in compared with last five years. But currently the white space communication is one of the ways to change all of their conventional frequency allocation systems because white space communication is very simple systems. Right now, you are in here. If you will not listen any other person's signals, in that case, you can use any kind of signal in this room. So any channel, any bandwidth, any broadband width you can use it. So I think completely different frequency allocation mechanism in previous things. Previous cases all the time assigned this frequency band this company, this frequency band this company. But right now we are starting to say: You can use these frequency bands, but you can consider how to use this band by your service. This means you can use frequency as you like. As you like means you need to control. You need to manage all of the spectrum. But you can use as you wish.

Of course you can borrow this frequency band from KT to Microsoft. Such kind of ways, Microsoft may pay money to KT for spectrum sharing. So all of the mechanisms will be changed. So this means I think same as airline alliance, new alliance that will share the one spectrum will start it. So this means I think new paradigm for the allocation will be studied. That is my currently thinking. That's why from technical point of view, to do such kind of free spectrum access, we are considering how to check the interference. And also how to ‑‑ how much leverage we interfere to others. So currently we are doing the research on how to check incoming interference and outcoming interference. And if we can consider such kind of ways, so we can consider completely new frequency allocation mechanisms and also ecosystems. But I think next five years completely new frequencies outside is possible. So for KT, you can use this one. You can use LT wimax, WiFi, anything is possible. But if you use two systems in one channels, you need to consider how to share, how to share between the systems. So that's kind of thing we will discuss ‑‑ will be, I think, considered in the next five years. That's my currently thinking.

>> JIM FOSTER: Wow, did everybody listen carefully to what he's saying? That you all are going to become spectrum license holders over the next five years? It's going to be a very, very different type of world?

And I know that you say well kind of so what? How's it going to be different? It's going to be as different, I think, as it was when, you know, you first put that smartphone into your pocket and you thought to yourself, well, this is just a telephone, you know. And I bet you if we charted your usage of all the different features and functions on a smartphone, voice calls probably would be very, very, very close to the bottom even though we still call it a telephone for some reason.

Similarly, once you become if not a spectrum owner but you become someone who has the ability to decide how spectrum that happens to be available in your vicinity is going to be used, whether you're going to watch television, whether you're going to send email, whether you're going to watch a movie, whatever. And you begin to have devices that are able to kind of navigate in that kind of environment is going to produce, I think, a real business revolution.

And I'm going to turn now to Jeff because ‑‑ and maybe getting to offer a little bit more detail on this pilot project because one of the things that's happening now is I think that we're going to see a differentiation in the packet because governments that are able to embrace this, promote it and innovate on that basis are going to decisively move their economies ahead as compared with those who kind of sit with the status quo.

Singapore, I think, stands out in that area. I'm going to ask Jeff to argue. But my sense is the U.S., as complex as it is and difficult to categorize, is really beginning to come to grips with the potential there. I think the FCC has come up with a very interesting set of policies which basically say, you know, if we approve the device that you're using to access the Internet or to use the spectrum, go to it. Go to it. It doesn't matter. We're not going to license your particular activity. We're not going to give you dedicated spectrum. And that's causing a lot of big companies ‑‑ but, frankly, it's going to be the small companies that I think will benefit the most to take a really, really hard look at it.

So we're seeing now in the papers, what's the biggest business deal that's happened over the weekend? Biggest business deal is Verizon spending gobs of money, perhaps, to buy voted an phone. What are they buying from Vodaphone? They're buying some spectrum, among other things. It's a more complicated sort of deal. I won't ask Andrew to comment on it. But it's going to be a different world. I'm not sure those deals are going to quite move ahead in the same sort of way or in the same way, for example, soft bank and Sonsan are now trying to absorb sprint. But in many ways, those movements by the big boys also reflect the fact that the whole landscape is changing. And they're positioning themselves to provide both services and to allow their businesses to prosper in this new environment.

So I'm going to throw a big ball to you, Jeff. Because Singapore is, I think ‑‑ you know, I don't understand why. I know we've got a few people from Singapore in the room here. Maybe they could raise their hand and tell me. Why is Singapore now becoming a laboratory for all these great things? It's pretty interesting that, you know, in a corner of southeast Asia, depends on where you sit, you know, whether it's a corner or a centre, a lot of very, very kind of innovative thinking is going on in the regulatory area with respect to business models and then even more broadly just in the development of technology.

So, Jeff?

>> DR. ANDREW JUN: It's a red hot dot that Singapore is being referred to.

I'd like to provide some update on the Singapore and also the FCC in U.S. situation.

But again I might do a bit of what I did just now is one point that you mentioned that every one of us could actually become a spectrum holder in the future. And that is actually hard for the general public to even sort of fathom because normally you don't even consider spectrum ownership as something that you will look forward to. But if I may offer an analogy that might bring this to a very personal level, you might actually appreciate what it is that make a difference. Have any ‑‑ I'm sure a lot of you have been to vacations where you really enjoy a private beach, where exclusive access, a very nice resort and different experience of going to a public beach.

But in spectrum sense, the way the spectrum are being allocated and managed today is as if majority of the beach in the world are actually private beaches. Meaning they're only people who are allowed on the beach are the license holders. Very few of them. And majority of the public don't have a beach to go to, really. And a question I often throw to the regulators and to my audience is that can you imagine a world without public beaches? What would we send our kids to in the summer, hot summer days? That's the sort of challenge that we're actually facing with the spectrum reality today in the sense that the general public would want, would enjoy, would appreciate more allocation of public beaches as opposed to private beaches.

And in the sense that many governments are actually starting to realise that spectrum is, indeed, the currency, using Professor's term, or we are seeing spectrum, you can almost think of it as oxygen for the digital economy, given none of the digital economy transactions were to occur without Internet, wireless Internet.

So I'll start with the U.S. The U.S. government has started this realisation or ‑‑ there's kind of the U.S. government is paranoid of the fact that countries like Korea where we are right now, like Japan and Hong Kong and the really advanced Internet economy, U.S. is somewhat lagging behind in terms of the penetration of broadband, the quality of broadband that the average U.S. consumers are enjoying. And to an extent that the President's Council of Advisors for science and technology, PCAST commissioned a report last year which basically drew a conclusion to the government, to the Obama Administration, that they actually have to really actively look into releasing a large chunk of the federal spectrum resources for commercial usage in spectrum sharing mechanism. And that sort of is reinforced by the FCC, series of FCC ruling and actions that, in fact, it was signed into law the first day Obama was first elected in his first term, that actual day, the U.S. signed into law to allow access to white spaces. Which essentially means in a given location at a given time, well, in a given location, if a certain TV channel are not being utilized, there's no active broadcasting, then any commercial entity or any consumers can actually operate a certified TV white space device that utilizes that piece of spectrum without a fee, just like you do with WiFi today. The difference being WiFi is limited to very narrow band at 2.5 gig or 5.8 gig, rather high frequency band. But in allows the same concept, the same WiFi goodies that we all enjoy, we all become very dependent on, to operate on a much lower band, at a TV band which is sub1 gigahertz. And the significance of that is just pure physics. That the lower the spectrum, the frequency, the longer the distance it travels. The better the ability for it to penetrate walls and barriers.

So today everybody experiences same problem of once you were, you walk away from a building or from your house or just a couple walls behind the router, you lose your signal. And we all have experienced this trying to move to a space where the signal is better, right?

So that's what the TV white space signal is often sometimes being referred to as a super WiFi signal.

And the U.S. government is very conscious on enabling this kind of unlicensed access which spurs innovation just like the WiFi ecosystem have gone from what it used to be called a junk band or garbage band to now a multibillion dollars ecosystem and still growing. And we really believe ‑‑ and the U.S. government is also conscious about enabling this kind of innovation and this kind of ecosystem building.

Now on to Singapore, you're right that Singapore, precisely because it is a very, very small market, so it's always paranoid of the market itself will not sustain any new technology if it's just particular to the market itself. So Singapore has always ‑‑ has a vested interest in making sure of being in a leadership position to actually stimulate some level of, you know, regional, if not global, harmonization of certain new technology when it particularly when it comes to spectrum utilization. It has to be regionally harmonized and to the extent possible globally harmonized so as to bring economies of scale.

And Singapore is also, you know, given ‑‑ despite its size has always been on the forefront and from the regulatory perspective to the extent it's kind of a lighthouse to the Asian countries and to the larger APEC regions argue oftentimes, and they really don't consider themselves very much of the pioneer, but they are minimally saying they're the fast followers. So they are really after FCC and after Occom‑‑ Singapore is probably the front runner compared with the rest of the world in enabling TV white space regulation. As we speak, they have a public out just two months ago and Singapore has actually publicly announced that they will put in TV white space regulation in place by 2014, which is next year. It is just around the corner. And they have been encouraging the industry like the white space pilot group where 18 companies are represented to actually conduct commercial trials, commercial pilots. One is to prove that there is a demand from industry, from the market. And also to prove that there is a, you know, sufficiently mature technology and solution to satisfy the kind of demand and not give the regulators the justification to move forward with regulation. I hope that's enough?

>> JIM FOSTER: No, thank you very much.

I know everybody when he started mentioning the beach started thinking that maybe there's a better place to be than here, I don't think so.

The notion ‑‑ and this is interesting, too. If you go back, some people in the room may go back, certainly Adam does, to the days when this whole Internet Governance movement was kind of defined and put together. Certainly YJ Pock, who was the person who made it possible for us to be here in SUNY New York, was the first person said we need to have a Forum where civil society can start beginning to assert these issues both vis‑a‑vis companies, which at that time were very dominant in the Internet field, and governments, which were beginning to become interested.

And of course they had a very, very powerful institution in that respect in the form of ICANN. Which was in charge of IP addresses and domain names. And these were considered to be really the core of what the Internet was all about. And there were and there continues to be ferocious discussions as there's a lot of jockeying of companies and others in the way in which this important Internet resource is governed.

We think, actually, that we may be on the verge of that kind of discussion with respect to spectrum.

And I guess what I want to throw out here to the panelists, and I'll turn first to Andrew, but then quickly to Hiroshi, and then maybe to some of you, Adam, hopefully, where should people talk about this? You know, obviously there's discussions going on nationally. Some governments are going to move quickly on this for a variety of reasons. Some are going to move much more slowly on this.

What if you're in the much more slowly country and you have a business model or an opportunity and you want to move ahead, but it doesn't look like spectrum is going to move very soon or fast given, you know, the established license holders and others like that. Where do you go, for example, does it make sense for one country to move rapidly ahead on this and yet find that as they're developing devices and business models to take advantage of this enormous resource find that there isn't any market elsewhere in the world because you haven't seen the same kind of movement. In fact, one of the big discussions we had over lunch was: If this thing is going to move, it has to move globally. We can't leave these things up to national decisions. In many ways, for a period of time there will be national decisions, but there needs to be some platforms, some organisation, some place that these kind of things can be discussed.

That's why we thought we would take these particular discussions to IGF and just throw out the notion of spectrum and spectrum sharing because it seems to us that this particular issue is very, very pregnant. I think you can see that there are big companies like Korea Telecom and Microsoft that are thinking very seriously and are very, very reflective of that. And there are government standards laboratories in places like Japan that are thinking about this quite a bit.

And so I think, indeed, you know, I implore that civil society stand up a bit and start thinking a little bit about this subject. You know, whether you want to have your private beach or you're happy to have the public beach, it seems to me that this is really a crux of a very, very important issue with respect to innovation.

But, Andrew, let me turn to you because you had some interesting thoughts over lunch as to how you structure this thing in kind of a super national or beyond national context. Because up until now, that's the reason you had a ministry of communications was to regulate spectrum. That's what it was all about.

>> DR. ANDREW JUN: Actually let me get into, before getting into that topic, let me just ask you. I have a background in electrical engineering myself. I'm just wondering how many of you have background in electrical engineering or telecommunications in mobile services and type of things? None of you.

The reason why I just wanted to bring up is in the telecommunications theory, I think you know the notion of circuit switching and packet switching type of things? Yeah? Package switching is always more efficient than circuit switching because it's more utilized. So there is a concept of statistical multiplexing type of things.

I think the spectrum sharing is pretty much the same thing. As opposed to licensed‑based business models. Spectrum sharing is basically allows opportunistic access for the frequencies and also for the business opportunities. So it's pretty sure that spectrum sharing paradigm will be much more efficient compared to licensed‑based paradigm, that's for sure.

Now let me just get back to my, the slide No. 2. You know, if Korea, we are having a lot of discussions about TV and white space. And then each stakeholder has different opinions about how to utilize TV white space. And then we mention about public usage. So government agencies and then local governments. And then the homeland security type of organizations are all interested in providing very fundamental information, delivering fundamental information to the general public. (off mic comment).

So there is some people in support of TV white space and some other people opposed to TV white space. Obviously the broadcasters not in support of TV white space to be used for telecommunications services. They are worried about interference issue and blah, blah, blah. And then there are other camps in support of TV white space for communications. One side was the public use. The government agencies and those camps. And then the other camp was telecommunications providers, operators like KT. We are interested in providing some telecommunications services as a secondary service of mobile services like LTE. So especially rural areas we would like to ‑‑ instead of providing wire lined infrastructure, we use TV white space solution to provide mobile services type of things or M‑to‑M, those are kind of applications we are thinking of.

And obviously manufacturers, they just have the to sell the devices, so they are very much interested in TV white space.

And then there are some other players: Service, application providers and OTT operators, over the top, like Google. And in Korea, it could be like cat talk and then neighbor, those players. They are very much interested in getting into mobile business, but they don't have spectrum license. So they just wanted to use this type of business opportunity to expand their business.

So all of those are all interested in supporting TV white space for profit.

But so far, none of these guys found sustainable business models yet. So our ‑‑ mobile service providers' point of view is: Yes, TV white space can be used for certain areas but not across the entire nation. It's not simply not a sustainable business model.

So in thinking about synchronization across nation and global level, in my opinion, it is very, very important when we think about public information delivery because when you think about the applications of TV white space for certain areas only and for certain application services, then it doesn't really matter how to use; we are just going to find a way to do it. The choice of technologies and the choice of infrastructure, everything can be articulated by us and then we can do the business. Only very small‑scale. But if it has to be available everywhere within Korea, Japan, Singapore, USA, across the world, then there has to be many things synchronized or harmonized. And the technology of choice could be one of them. Because, you know, if the access for TV white space is based upon WiFi‑based technologies, it is widely available, especially Jeff mentioned about IEE study 811‑F. Which is based upon the 11 AC technology, so the fundamental concept of 11 AF and 11 AC is the same WiFi technology can be used not only for 2.4 and then 5.8 gigahertz spaces, but also for the TV white space services.

So if you have cell phone, smartphone and then WiFi capability built into this, then you can use the same device to access TV white space.

Then think about, you know, basically WiFi's available everywhere, all the devices nowadays, by having the harmonization of technologies, you can basically use the same device everywhere across the world. And then they don't really increase the economy of scale. Simply having the harmonized technology across the world will bring up the enough critical mass for vendors and users, for everybody, basically.

So, I think like, you know, in the sense like the harmonization of many things is very important. And technology is one of them. And then there's the spectrum. In Korea, we're using about 400 to 700 megahertz of spectrum. It pretty much harmonized everywhere. And then you don't really ‑‑ like single device, the WiFi technology and the same spectrum band can be used everywhere, right? And then the access sharing coordination technologies, so basically the concept is spectrum sharing. So there has to be a way of allowing the spectrum sharing.

So opportunistic access for the spectrum has to be coordinated somehow. One of the technologies mentioned about current TV radio, but right now we are not there yet. Is it being developed? We are not there yet. So practically speaking, a lot of people are talking about database‑based access coordination, which is pretty much happening everywhere. Korea is doing it, Japan is doing it, Singapore is doing it, USA is doing it and Europe, a lot of countries in Europe is doing it. So I think for the next few years, most of countries will probably launch TV white space solutions based upon a database‑based approach.

But the thing is: The whole framework is there. But the details has to be synchronized, as well. Because one device which will work in Korea has to be working in Japan and Singapore, as well. But if the way a client and then database communicates is different, then the device work in Korea does not really work in Singapore and Japan. So I think in order to really like facilitate this kind of service built up everywhere, a lot of synchronization and harmonization need to be done.

And then I believe ‑‑ a lot of people are already do it, IEEE, 3 GPP and then ITU‑R, and then a lot of agencies and organizations are already doing it, but hopefully IGF can take a piece and do a lot of more discussions and then we can contribute something to harmonize these kind of policies and technologies and frameworks and everything to the global level. That's what I hope.

>> JIM FOSTER: Okay. So you have your marching orders. Andrew is ready to support, but he's expecting you to lead the charge.

We have about 10 minutes left. Jeff does have a small video that he wants to show you and cap off. But as he's getting that ready, do we have any kind of questions, concerns, statements? Was this a colossal waste of your time? Or was there something that you're going to take away? Or is there something more important that you're going to do? Because listening is useful. Speaking is perhaps more useful. But doing is what we really need to be about.

So any questions or statements or ‑‑ yes. Could you please identify yourself because then I'll get to know you.

>> [Inaudible] I was very much in the mood of informality. But I appreciate very much this workshop. I think this was a great initiative. And the presenters were really brought very interesting content.

And my question is mostly a suggestion to follow‑up and if there will be workshop at the IGF in Bali because I think what is happening in this region, these particular debate can reflect and feed into wider debate. And I appreciate very much your comment about us Internet Governance whereas a few years ago at the beginning of IGF, probably a debate on the white spaces need to have a multistakeholder approach, and perhaps the IGF could be a great venue for this topic to flourish. And I would encourage all of you to take these strongly and with impetus into the global IGF coming soon in Bali.

>> JIM FOSTER: Okay. We don't need any encouragement to go to the beach. (laughing).

Any other thoughts or comments? Yes, Adam?

>> Adam Peake. Hello, thank you very much. Very interesting workshop. One question I have is: Why is all of this taking so long? For example, the U.S. national broadband plan said that we needed 500 megahertz in 10 years, we needed 300 megahertz made available by 2005. And that was three years ago, so why does this take so long? Perhaps why the broadcasters are so powerful and yet AT&T and Google and all these massive companies are not so possible. How can we make it faster, I suppose, is one question? But why are the delays occurring in the policy process and releasing spectrum and allowing these things to happen.

>> I think there are several reasons. So one reason is technical things. Still there is no standard that use white space. Of course 802 is currently doing that for four standards, right now still ongoing. Still, we need to have one and a half year to finalize. But very close to the final.

That's the reason why standardization is a kind of technical specification of United States. So United States' spectrum must pose a white space user is very severe. So it is very, very difficult to develop the actual product, especially ‑‑ so possible, in the case of WiFi, all the people would like to bring current WiFi to white space. Everybody's thinking. But the TV broadcasters say no, no, no, that spectrum must all the time interfere with our channels in some cases. That's why please fulfill this kind of mask. But that mask is quite severe. And quite severe means that regression is more severe than Japan.

So that's why I think still technical, I think, development is needed and standardization need. But we almost reserve such kind of programmes. That means around within 1‑1/2 years, I think we can see the actual WiFi white space communication is available. This is my expectation. The time is coming. So to reduce the time, what kind of WiFi guys is doing? WiFi try to make a comment to FCC to relax all the regulations, but unfortunately that comment is not accepted. That's why now all the specifications is changing. So that is a main reason. But right now everything is currently reserved.

>> Let me add a quick thing. Maybe a different country may have different reasons, but in Korea basically when we started, talked about TV white space usage, it's a very strong opposition by broadcasters. And then obviously they're the primary user of that, they think they have full rights to do anything with those in the spectrum they're still opposing. So there is no policy that has to be made yet. Still doing the experimenting in Korea. But hopefully there can be, you know, come to an end by the end of this year or all next year. So that's one thing.

And then as obviously mentioned that technology specification for those opportunistic usage could be very challenging topic. So there is many things we have to deal with.

>> If I may just add to that, I think certainly technical challenges are there, but I would argue even, Adam, your question, which is excellent question, by the way, is that spectrum oftentimes is very politicized given it was particular TV spectrum was associated with TV broadcast which associated with politics. As I said, broadcasters are powerful all over the world.

But along the line with what co‑panel actually said, everywhere is different, if you look at the journey the U.S. went through, the broadcasters were actually strongly opposing this at the very beginning to the extent the broadcaster threatened to bring FCC to the court. But later on it dropped the case. And, in fact, there was actually quit a dramatic turn from the broadcasting society or community towards the attitude towards TV white space and this broader white space and dynamic spectrum access to the extent that actually one of the ‑‑ one of our earlier TV white space demo was actually done at the National Association of broadcaster event, NAB, in Las Vegas, where the technology actually speaks for itself. We were actually able to demonstrate that interference was very well managed even in NAB type of event where there's a host of broadcasters learning what's going on. And, really, that was one of the really motivator, one of the things that sort of really convinced the broadcasters the interference wasn't their main concern was actually under control.

The other one is the database approach that was mentioned earlier that really gives the regulators a tool that they never had before in the history of spectrum management, which has always been very static and sort of a bit of a crystal ball into the future type of approach that regulators are under a huge burden of foreseeing what technology will come up, what sort of service and applications the market will actually gain traction and then allocate that spectrum to that technology, to that service.

In the old days it works fine because technology cycle is very long. But recently the technology advancement in the surveys and market evolving is so fast that no regulator can ever keep up with that kind of speed.

In the database approach essentially give the regulator a realtime dynamic tool that basically says the database keep track of what's used in what spectrum at what time at what location. And the moment there's actually a changing need, regulators can simply change that database in a very deterministic way and very dynamic and realtime way reallocate that piece of spectrum, not for good but for a given period of time to a special usage, for example. So that give the regulators a greater flexibility and give the broadcasters a huge level of comfort knowing that when they, as the incumbent user, when they need spectrum back, they actually have ways to reclaim that.

So in the U.S. had come quit a long way from the broadcasters' attitude toward it. And if you look at the European situation, actually started off by the broadcasters, the EBU, the European broadcast union, very much in support of this. Because they know sharing spectrum is far better than losing the spectrum altogether. So the attitude towards the spectrum has a broad spectrum of changes, as well. And it's oftentimes a mixture of technology challenges but more so, I would say, the political and commercial interests that are sort of intertwined with the spectrum resource. But I agree with my co‑panelist that the time is now, actually. The governments, the industry's actually seeing more and more of agreement and technology standards are actually coming onto the horizon to make it happen.

>> JIM FOSTER: Okay, I think we reached the witching hour. It's 4:00. We can take your question maybe afterwards privately because I know others may want to run out for coffee or for other purposes. And we do want to get ‑‑ yes, please go ahead. Just one question, Jeff.

>> Jeff: I am from Bangladesh. I have one question. In Bangladesh, like developed countries like Bangladesh, we have at least 20 channels, TV channels. And they are using the frequency of different companies. So how we can implement the concept of TV white space, concept of TV white space in Bangladesh? And how we can minimize the interference level?

>> Some way this video in part answers your question because it will give an example of how it is being in Kenya. [Off‑mic comments]

>> Jeff, you want to speak into the mic because we're taping this.

>> In some way three‑minute video it answers your question in how the technology is actually in action being deployed commercially in remote area in Kenya Africa. In the same technology, same product can very well be applied to Bangladesh. And, in fact, a few pioneers of Microsoft and us together, we're actually doing a project in Bhutan, very close to you, maybe after conference I would love to talk to you with regard to Bangladesh, but, if, Jeff, I may show the video. I just thought what a great way of wrapping up the session just by giving you a sense of what we're talking about is really not just on paper. It is not theoretical. It is actually in action in the field. And this is a video about a deployment of TV white space technology in Kenya.

>> Sorry about that.

[Music.]

Sorry about that. Technical issue. Is this on? Hello?

>> Old fashioned and turn it into something unbelievably useful. In community centres, supporting government initiatives. Sharing healthcare information. Clearly the opportunity of increased education helps the country.

>> Given this opportunity, they are going to improve academic. Because of the shortage of textbooks, now they can get information from the Internet.

>> ‑‑ before. We talk about 90 seconds for them to get a sense of swiping the device and moving things around. This is the most profound thing.

>> ‑‑ the government of Kenya has actually potential of ‑‑

>> Well, apologize for the volume. But you pretty much get a sense of how this has transformed lives in a remote village where in fact in this case, this African village don't even have electricity. You saw there was solar panel involved. There was solar panel‑powered base stations and basically introduced Internet to the school and help clinics in remote village of Africa that just opened up a whole New World to them. And TV white space was very effective technology given that, like you said, there are more than 20 channels available in the world in those rural areas. And because it was a very cost‑effective was why it can bring ‑‑ this is a commercial project. The Indigo Telecom is the ISP that is rolling it out. And the subscriber cost per month is sub $5. Just imagine. The kind of cost structure that enables such a low subscription fee to the users of that nature because they were part of 5 billion I talked about earlier. So this thing, it works, it brings differences to people's life. Thank you.

[Applause.]

>> If you want to hear a real good panel, I'm doing privacy at 4:30. I welcome you all.

(End of session.)

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