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>> KEVIN RHEE: Welcome, everyone. We are about to start the workshop on the Broader World Network, the Internet as a part of the year 2013 APrIGF. And I'm the presider and will be the panel moderator in the afternoon. And my name is Kevin Rhee from KAIST. You can call me Kevin if you have comments or questions during the session.

(Applause)

>> I am the head of the network planning division from the Ministry of Science ICT Internet Future Planning. Thank you for attending the Gigabyte Internet session of 2013 APrIGF, despite your busy schedule. For the first time, the developed countries in terms of the government Internet gather together in today's session to share their policies and experiences and discuss cooperation. I would like to extend my sincere thanks to Professor Rhee from KAIST, Dr. Larson and Mr. Daniel Ho from Singapore and Mr. Bahlman Mr. Yoshihara, and Mr. Park.

Internet is like water and electricity in many countries. In 1969 the U.S. Pentagon created ARPANET and Internet has its roots in the ARPANET. Since 1990 we became familiar with Netscape and Internet Explorer since then.

In 2000 we passed through the Web 2.0 era, which represents openness engagement and sharing. And since then, Internet became an important part of our daily lives and rapidly spread throughout the world. With the emergence of Smartphone, the Internet has an explosive influence on many areas, including economic, society, politics, and culture.

Of course, there are some side effects such as cyber hacking, theft of personal information and harmful information, also digital divide. Internet has no physical boundary. It has no natural border. It made the older world be united with each other and Internet has also made a great contribution to the world peace, leading the communication for the peace, for example, the peace on the Middle East.

As such, the evolution of the Internet wouldn't have been achieved if it were not for the wired and wireless network infrastructure. We have such a great interest in Gigabyte Internet because we expect that the Gigabyte Internet will make a great change in the world, Gigabyte Internet such as U.S. GTV and WiFi and other services. It will also become a core infrastructure in education, medical sector and other businesses and public safety sectors, and also Internet work creates new jobs. From now on, we're going to enjoy the superconnected world where everything is networked, including Cloud and Internet things.

In order to truly enjoy the benefits, it is very important for all the countries around the world to share their policies and service experiences.

From 1995 Korea achieved the two high speed communication network from 2004, the world band network at 50 bps. We also achieved the ultra-broadband network at maximum 1 gigabyte. However, with the explosive use of wired and wireless network, Internet traffic has rapidly increased. In order to respond to such increase in traffic and in order to create sustainable ecosystem, the Korean government decided to spread the Giga Internet by 2012 and also developing technologies for future Internet. And Singapore, Hong Kong, Japan, and the U.S., are also making efforts to establish broadband Internet and especially have already put a lot of influence on the other countries around the world.

I hope today's Giga Internet session will be the beginning point of all countries to create the ecosystem for Giga Internet and spread the service of Giga Internet. I hope you're going to share various case examples and have active discussion to contribute to the growth of Giga Internet. I would like to thank all of you for attending this session. I wish all of you luck and health. Thank you very much.

(Applause)

(Off microphone)

>>....... permission at Fulbright in Korea, and he has been ‑‑ he has served the many positions around the Korean Internet development. So today he will be more focused on discussions at the U.S. Internet developments. We welcome Dr. James Larson for the speech.

(Applause)

>> DR. LARSON: Thank you, Professor Rhee. If I can work the technology here. Today I've got three parts to this brief presentation to try to squeeze it in to 20 minutes. First, a little bit about the recent history of broadband policy in the U.S., and then I'll talk a little bit about the National Broadband plan, which came out in 2010 and the Giga city challenge that followed. Finally, I've got some slides to look at current patterns of broadband and focusing on fiber to the home and Giga adoption in the United States.

I was in the third grade when the Internet project under President Eisenhower started in the United States and it was probably one of the big projects of the industrial age. And 14 years later, in Korea, under Pock Chung He, the expressway began. And this photograph or picture at the right was published in 1970 in the Dongailbo. It shows expressways. And notice Korea is unified. It's got airports, expressways, everything. Remarkable picture.

The digital network revolution of the late 20th century changed the metaphor in terms of infrastructure. In the 1974 report, Nam June Paik, he used the term electronic superhighway. He was referring to broadband networks. This is an installation that's on exhibit at the Smithsonian Institution in Washington, DC.

In 1994, we might choose this date as the start of public and policy discussion of broadband in the United States. Vice President Al Gore gave the keynote speech on the Information Superhighway at UCLA, giving the Clinton administration's vision for the NII. The next year South Korea started a decade‑long project to actually build its networks, its fiber networks. And I had the opportunity on Monday of this week to have a meeting with Dr. Hung, who was in the years leading up the president and was actually the Ministry of Information and Communication when that began. So there's a lot that happened before 1995.

But in the United States, in 1996 the Telecommunications Act was the first revision of this law since 1934. And it was signed by President Clinton physically at the Library of Congress, but in cyberspace via a live Internet link. And the primary goal of that law was to deregulate the converging broadcasting and telecommunications market, something Korea and the whole world would come to experience.

But, as you can see here, the Information Superhighways were a long way off. Dial‑up ‑‑ broadband did not exceed dial‑up until late 2004 or 2005 in the United States. And it wasn't until 2010 that the plan mandated by Congress in 2009, the National Broadband plan Connecting America, was actually published. It was written with public and FCC input. In the preface it says, "Broadband is the great infrastructure challenge of the early 21st century."

It was in three parts. Part one of the National Broadband plan talked about the need for policies to ensure robust competition, the need for efficient allocation and management of government controlled assets, and a broadband R & D agenda.

Part 2 of the plan noted that to ensure all people have access to broadband, requires that the FCC set an availability target. I'm not going to comment on this table. But I'll tell you, I'm an American citizen and this presentation is about the U.S. But I've been living in Korea and enjoying these fast networks here. So you can sort of look and see what they're benchmarking.

Part 2 said government influence inputs needed to build broadband networks, including universal service funds, "Yet all are structured to serve priorities of the past, not the opportunities of the future." This was written in 2010, three years ago.

The recommendation was the FCC should create a Connect America Fund to replace all the old legacy high cost broadband programs. High cost, meaning rural areas and where it's high cost to build out the infrastructure.

Part 3 of the plan specified the different sectors where the plan would have an impact. And you can see, as in your countries, I think it covers ‑‑ we're talking about a general purpose technology here that's going to affect all major sectors.

The long term, meaning by 2020, goals included at least 100 million homes should have download speeds of 1 megabit and actually upload speeds of at least 50. I put in red, "Every American community should have affordable access to at least 1 gigabit per second to anchor institutions, schools, hospitals, government buildings."

Now, one year after this plan, professor Eli Noam wrote an op ed in the New York times, and he said, "The vision of the nationwide fiber infrastructure should not be replaced by merely facilitating the new generation of mobile communications, and then re-labeling it high speed broadband. If the U.S. is losing its technology lead, it is not because of a lack of private sector initiatives, but because its government is losing the ability to do big things."

That's Eli Noam.

Now, do I push the button to start the video? This is a policy speech by the ‑‑ go ahead.

I met with senior government officials and business leaders throughout the world. I can tell you that they are all focused on the broadband, whether it's Korea, China, EU, Australia, on and on. All have plans to deploy ultra-high-speed broadband on a wide scale and become a magnet for innovators and capital.

We are in a global bandwidth race. A nation's future economic security is tied to frictionless and speedy access to information. The faster we can connect our citizens, the faster our economy will grow. The more people of all walks of life that access to bandwidth, more opportunity we spread for all. Much like the space race in the 20th century, success in this race will unleash waves of innovation that will go a long way towards who will lead the global economy in the 21st century.

In his speech he went on to say that in order to win this race or to compete, we're going to need speed, capacity, and ubiquity.

The goal is removing bandwidth and location as constraints on innovation.

What could be more concrete. First, as we said in our National Broadband plan, we need innovation hubs in the US with ultra-fast broadband, the speed measured in Giga bits, not megabits.

Shortly after that speech, this is a capture of the news release from the FCC, he issued the Giga city challenge to bring at least one ultra-fast gigabit to every state ‑‑ to one community in every state by 2015. And in that challenge he said, "American economic history teaches a clear lesson about infrastructure. If we build it, innovation will come."

Now, there have been some examples of corporate and local initiatives in the United States. You probably all heard about Google fiber. It's going to Kansas City, Austin, Texas, and Provo Utah. It's universities getting together and the city of Chattanooga Gig. I think there are only 14 states that have those communities.

This is a map that shows broadband. I think this is a very conservative adoption of broadband. You can see Texas and the southern states have lower levels. It's not even across the United States. One thing the National Broadband plan did is it used the Internet and it published tools on the Internet, including the broadband map. You can visualize various things. This first one is the fiber to the end user. And I was happy. I'm from South Dakota. North and South Dakota do pretty well in this fiber to the home. But the rest of the U.S. it's not much there.

This is all fixed line services. So this would be fiber plus cable. So you see that's doing a little better, but out west, the western U.S. doesn't have much.

This is mobile. So you see the picture. And this pie chart essentially shows the same thing. Look at the small slice up there just to the right of twelve o'clock for fiberoptics. Four percent. This is from a 2013 report by the NTIA.

There's also a digital divide. This chart shows you the nature of that divide, starting with education, the purple bars; income, the blue bars; rural versus urban; and age, and then race, the red ones.

There are divides in all of those areas. And I grabbed this from the Gig U screen because they're using Gangnam broadband style. I don't have time to show you Gangnam, but basically Gig U said we're not getting gigabit, we've got to do something.

Could we start this video?

(Music).

So the Google initiative is a good one, but only hitting a few communities. Globally, as you see in this from an industry source, but you see the Asia‑Pacific counts for 75 percent of the fiber to the home and fiber to the building or basement in the entire world. Korea and Japan are leading that race.

Now, the future challenges for the U.S. and probably more broadly for the other countries definitely involve speed, because despite progress in the U.S. in mobile networks, fiber is absolutely necessary if we're going to build these so‑called Information Super Highways that Gore was talking about way back in 1994.

Mobile is part of that picture because the future ‑‑ there have been whole books and a whole industry now looking at bimodal fiber wireless, which is going to be the future nature of Internet broadband access networks.

Capacity to work with content and big data. By the way, the FCC chairman, in referring to capacity as opposed to speed, was referring to content, different sorts of the video and the ‑‑ all different sorts of content that are that we are going to need to have the capacity to handle that content.

Governance is an issue here, because you notice the United States FCC chairman was still talking in national rather than in global terms. He was talking in a race with what? With other nations? But, in fact, many of the policy issues are more global rather than that.

I'll let President Clinton conclude this. If you could start the last video. He'll conclude my presentation for me. I think he does it more eloquently. This is at the Consumer Electronics show.

"In other places we fall off the map. We need to see the Internet as part of our global commitment to infrastructure. And I hope that there will be an infrastructure set up in the United States this year and part of its committee will be to guarantee universal access at greater speeds."

I really don't have anything more to say other than thank you to the organizers here at the National Information Agency. I'll be looking forward to the ensuing presentations and the discussions.

>> MR. RHEE: Thank you very much, Dr. Larson.

(Applause)

>> MR. RHEE: So we would have panel discussions at the end of all sessions, but at the end of every presentation I will invite one or two brief questions. So if you have any brief question to Dr. Larson, you can ask some questions or comments, make comments, too.

>> DR. LARSON: Don't be shy. (Laughter).

(Off microphone)

>> A lot of money on the Gigabit Internet services in Kansas City. Is there a special reason why they invest on the infrastructure?

>> DR. LARSON: Well, first of all, I have to note that Google has grown very quickly. It's amazing to think. These two guys, the founders, were just computer science students studying on an NSF funded project at Stanford, on electronic libraries. They stumbled upon this what became the Google search algorithm. So the company started as a search and with their mission to organize the world's information. But I think my view would be that Google has already become much more than a content company, the first response to your question. Examples of that would be their work on development of the driverless car, for example.

Their technology developments. I don't know how many of you have seen Google class, but at KAIST I use the Google Glass project is glasses with built‑in computing and Internet capability. Google Fiber is another example. There are others as well. That's one part of the answer. But as to why ‑‑ very good question. (Laughter).

I've been living here in Korea. I share Eli Naum's opinion about the government's failure to do big things. I think in the United States we have kind of a crisis of government these days. It's happening in the midst of the digital network revolution that includes social media and the fact that every public official in the U.S., but worldwide ‑‑ you've got things going on in the world and satellites are watching them and every phone is a camera. And so news is flowing around. And so my answer, to get back to your question, the best answer I can give is that I think Google ‑‑ the leadership at Google probably, like other organizations, they saw the need for speed, for fast Internet. And they saw that the government ‑‑ the FCC was just somehow incapable structurally of doing it. So excellent question.

>> MR. RHEE: Thank you very much again for your nice and interesting presentation and discussions.

Please join me in thanking him again.

(applause)

 The next presentation will be from Daniel Ho from Singapore. He serves at ‑‑ Mr. Daniel Ho is a graduate from the Nangyang Technology University and also from the Oklahoma City University with MBA degree. Please welcome him for his speech

>> DR. HO: Good morning. My name is Daniel. It's a pleasure to be here to be invited by NIA to share some experience we have in Singapore. We will talk about the challenges and some of the insights we have encountered along the way.

First some demographic of the Singapore, network architecture, service offered that we have, and the status and insight to date that we have gained.

Feel free to ask me any questions if there is something you need clarified.

So in 2008 ‑‑ in fact, in 2007 there was an industry called IDA. IDA is in Singapore in planning for the future network and infrastructure in Singapore. So in 2007 they did an industry consult for over a year before they actually finally awarded network company, called Open Net. So it was all based on it was finally decided how it should be done to set out the structure, etc.

One of the requirements was how it was structured in terms of this company called OpenNet. This actually has to be structurally separated; no single licensing holder can have more than 30% ownership in this company. There are four shareholders in OpenNet, and we have a company in Singapore, part of consulting. Benefit especially of having success in the infrastructure in Singapore. It comes along with this partnership. So the other two companies are probably more cost money, investment. So it came to participate in this project. So I think it was recognized that it's going to be very difficult to ‑‑ well, to expect private sector to invest heavily in such a project. It's very huge. So public financing was something that was expected. So IDA set aside to $201 billion and up to 750 million was granted to the deployment of the fiber network grid.

And I think the finding it was necessary is because if we expect this to be a revenue, if we don't find it and it will be slow. So we want to make sure that it's fast and it's a critical part of that element.

To ensure that there's OpenNet success, OpenNet, the company that's right now maintaining the fiber network, is fully regulated. We offer our service to our interconnect offer regulated by IDA. It does not do anything but fiber service. So there is no competition with any other providers. It offers service to the end user.

Lastly we have universal service obligation add on to the license. So that started in 1 January 2013 of this year. In Singapore population, very small, 5.3 million. We have residential premises of 1.2 million in Singapore. And nonresidential buildings we have 26,000 or so. It is very small, again, 710 kilometers.

One of the key features in the housing 80% of our population resides in public housing, which is run by what we call the housing development. This is very important, because with public housing you have significantly. 94% of the households are in high rise or multi‑dwelling units. The only place to go is up.

Let me go into a bit of the network. Singapore, selected for this fiber network deployment and it's spread across the island, to make sure it's highly redundant, each central office is connected to this and to other CO's.

So from the CO, central office, we use dual ring architecture to expand from the end user or the buildings. Primary ring, a secondary ring is connected. From the secondary ring we use a point to point distribution network to reach the end buildings.

So it's about generating rings. On this ring there are about 2,407 caps. Each cap has a capacity to serve up to eight to ten buildings.

Okay. So in the design we use the two‑stage split approach. We have first stage split, which is at the central office, followed by 1.16 split in the MDF room. The reason why we did this is because we anticipate in the future if we ever need to support higher broadband, the first split and the line split came from the central office and we have 1.16. So this would help us to enable the higher broadband support.

So in the central office, residential service 1.34 split and the nonresidential will use 1.16 split in our service offering.

The rollout plan, we original target was to have the fiber network by 2010. But OpenNet decided we need to do it fast. Therefore, we scheduled it out to be completed in three and a half years starting from February 2009. We achieved 95 percent by mid‑2012, which was last year. 1.1 million homes passed and 24,100 nonresidential buildings were reached.

Based on 100% ducted installation, we roll out fiber to the buildings. We do mass home‑reached exercise during rollout. Essentially during this rollout we have a termination point installed. So we have exercise where we send to the homes to inform them they are coming and the termination point with the fiber. So all in all, about 65% of residential homes passed decided to take it. About 35% decided not to do it. Some felt they don't need it. Some felt that they don't like the service we were using. A lot of reason was given. All in all about 65% was what we call home reached. Termination point and the fiber has gone into the building or into the premise itself.

So how we did the rollout to the homes, in the high rise, residential rollout from the CO we will bring the fiber into what we call FDP, fiber distribution point, every level of the high rise building. This FDP, so every building on every building there will be an FDP. From there we roll out the second stage to put it into the building. That is what we call home reach.

So this is for high rise. It's a slight difference here. Instead the FDP is located in the manhole, is residing near to all the extended properties, and from there we carry out the home reach exercise into the home.

So this for residential where we have high rise. A bit on how we actually go into the home. So we can see that the ‑‑ this is a typical HDB unit. Inside you can see a riser. It's written there. We bring the fiber up the riser. From there we deploy ‑‑ punch a hole in the riser into the unit. From there we would bring the fiber into the home. The front door of the unit here. So this trunking within the home essentially run from the door all the way to a location where there is a point, particularly the living room. Less than 15 meter in most of the cases. Very short for deployment.

It's a bit different for nonresidential. Essentially the dynamics is different in that the configuration and the tendency changes regularly ‑‑ tenants changes regularly. Every few years you will see the configuration of a particular floor space and nonresidential changes because the tenants come and go out regularly. We deploy what we call home reach, we did TP inside office building on day one. We do it in this order. So the fiber is brought to the MDF room in the building first. And when it's also ‑‑ when the fiber is brought to the building then it's called building reached. Once it's reached we bring it to the tenant location.

We always have a site service done to make sure it's ready in the termination point. Someone wants it to be in the computer room, some several rooms. That's why we can never do a TP installation ‑‑ a pre‑installation before the order comes.

In taller buildings, we have into the microchips. So this is fiber to be used later on. The building is five levels or so. So we have to make sure that implementation is easy. We can overcome the need to open and close the fire ceiling material in such an order comes along.

Here is a high level view. Open net the bottom layer where we have infrastructure. And on top is the second layer, that's the active infrastructure deployment. Finally, that's the service to the end user.

So there are currently customer so the service to the RSP, to the service provider. It's also funded by the government to help with this project.

Some of the service offering that we have in ICO. So we have residential end user connection, which offer at a rate of $15 per month. Nonresidential $50 per month. And we have network nonbuilding access point initial location that's outside in the public, where there's no access. Some people wants to use it for camera monitoring, etc. So it connect from CO to CO, CO to MDF. This is residential connection. The next one is the nonresidential connection. Last one on the list nonresidential connection premise point.

Where we are today, very quickly, we have over 1.1 million household reached, home pass is 1.1. 26,000 is nonresidential covered. Today our subscription is growing very fast at over 400,000. This is equal to about one in three household in Singapore has fiber services activated. Probably by next year half ‑‑ one in two household will have fiber services active.

Some of the quick insights I'll share and we go discuss more on the panels. I'll just try to quickly. I think number one is the regulatory building codes that's important in providing access. One of the challenges is accessing private buildings. In cases where the building manager refuse us access or sometimes make it very difficult for us to provide service. So having proper building codes is important. We have just this year what we call the building code was updated to ensure that the developer put in termination point and fiber in the building when it's built. So all new buildings are built after this year will have this kind of fiber termination point and fiber built in. So it will solve a lot of problem in getting access.

Focusing earlier on the project, making sure not at the end of it, but at the beginning of it. It will help the residents, the people in the business understand the importance of fiber, and they need to allow us to come into put fiber into the building. So that is something that we thought is very important, but we saw that.

It's very important because we underestimated the rate of growth. Now what we do it's exceeding demand. One of the things is technicians. Installation is something that we don't just pick off someone from the public do it. We need someone that's trained and capable. So this is one year that we struggling with right now because at the manned is very robust.

Another point that we thought might be important to consider is market trend. We depend on ‑‑ we have Internet network, but unfortunately this was not catering to another that happened in the market churn. We realize every two years when the contract year, they switch. What happens is it's related to a switch, and it usually lasting less than a month; so just to support this kind of behavior. So when you plan for network, this is something you should consider.

Last one on the list is the in‑home wiring. While we have fiber to the end user to the homes to the offices, the from the termination point to the end user, so while this is common deployment to enable the end user to access the broadband, but it doesn't work in some cases where it goes through walls and therefore the signal comes in a different room. So now we are having challenges in making sure that the end user can enjoy the full benefit of fiber because the rooms ‑‑ a number of things have been done today. One of the things considered is it doesn't work all the time, especially if you have TV's around. It interferes with the signal.

Another thing that's being done is the building code again. The building code now requires that a developer put infrastructure cabling to every room when any building is built. This will be ensure there is connectivity to every room in all new buildings. In the meantime we're trying to figure out how best to enable the end user to enjoy the benefit of fiber. It's one of our challenges.

With this, I will end my challenges.

>> MR. RHEE: Thank you very much, Mr. Ho.

(Applause)

>> MR. RHEE: Now, the session is open for the Q&A questions and answers. Do you have any comments or questions?

>> Okay. I have a brief question. So you discussed the building code and the policy issues; right? Besides that, what could be the main driver that can make the Giga Internet successful in Singapore.

>> DR. HO: We wanted to make sure that competition is not ‑‑ we wanted it to be service level. When competition had an offering, it becomes very innovative, very competitive, it will drive a lot of usage. So we think that when more innovation or innovative services will be deployed, it will drive fiber up. Today it's Internet access, but we're seeing some new services that are being tested. We have one project now where we are testing of NUS on program for stroke patients. So they are now able to come out to their home to the center. So we bring it to them. So fiber is being used to help them do therapy, follow‑up sessions with the therapies from the center.

So some of these projects are important in driving this fiber requirement. And we think this is the way to go. Having access change is important. But I think it's more important to have that. Great.

>> MR. RHEE: Thank you very much. Again, we thank Mr. Ho for his nice presentation. Interesting, nice presentation.

(Applause)

>> MR. RHEE: The third presentation today is switched from the fifth presentation. We are inviting Mr. Toshihiro Yoshihara from Japan. He will discuss about the current status of FTH services and network, including Giga Internet entity. Mr. Yoshihara is a graduate from the south ‑‑ University of Southern California with MBA, and also he is currently working as the optical infra‑IP network system development at NTT. We would like to welcome Mr. Yoshihara.

(Applause)

>> MR. YOSHIHARA: Thank you very much for introduction. My name is Toshihiro Yoshihara. I'm working for the Japanese company called NTT. So today I'm going to talk about current status of FTTH in Japan as well, including Giga Internet services. Just press this button?

Firstly I'm going to talk about some general business outline of NTT local business. The structure we have nearly five business operating company under the holding company NTT. So in these companies NTT East and West are doing the local fixed line business. So we started for FTTH service in 2002. So after that we got many customers. Currently NTT East has almost ten million users in eastern Japan, and NTT West has 1.5 million FTTH subscribers.

This is broadband situation in Japan over all. In this fixed line side, FTTH is the most popular broadband access service in Japan. In this market NTT has approximately 72% in this market today I'm focusing on this FTTH services because one gig Internet service is only available through FTTH service.

In the mobile side, major mobile operating companies are now offering LTE services. The speed of that service is like up to 75 meg. It's not far below the one gig now. But maybe in a few years most of the mobile company in Japan is start offering LT that can be up to one gig, depending on the spectrum they are using. Anyway, today I'm talking about FTTH service.

So this is just showing generic trend over Internet use. Until ten years ago the most connected to the ‑‑ most of the devices connected to the Internet was just PC's. There were just one or two or limited number of the PC's in the house. Most of them just e‑mail or sometimes picture. But currently the situation has totally changed, as you know. Most of the traffic, video, more than 50% of total traffic in Internet is video now. And also, there are many types of devices available now. Not only the PC's, but tablets and the Smartphones and TV's or sometimes your condition is also connected to the Internet now.

So let me show you the status of our NTT's video services. So we are offering the IPTV service called HikariTV. We have three million users. This TV service is offering many functions. Showing this right‑hand side. Not only the setup box, but Smartphone, tablet, and PC and the navigation could be connected to this service. And also this service has many functions. So shopping and downloads like that. And this side shows Internet video. So as you know, YouTube is a very popular among all over the world and in Japan, too. So the number of access for the YouTube has skyrocketed.

There is a service called Niconico. This is a unique video service available only if Japan. This is currently the second‑most popular video site. Recently NTT got some percentage of stocks share over this company now.

So the video access increased rapidly, and also many devices connected to the net. So we think the key value for the customers are offering the comfortable, stress‑free access to many types of contents. That is why NTT West decided to offer the one gig service called Flet Hikari. It's fiber falcon. One year ago this service is offering up to one gig up to 200 Japan plus. End users should pay ISP charge additionally. I think this is very competitive price. And this is the service offering ‑‑ sorry.

I want to ‑‑ let me try to show the promotion website of this Hayabusa.

This is written in Japanese, but maybe you can imagine. So this is the promotion videos for this Hayabusa. So we appealed very fast speed here. This is not fast forwarded. So now start the number in the calculator. It's a very fast inputting. So it's a superwoman. Like just nine seconds and the general person 50 seconds.

The next going to their Internet. So very, very fast Hayabusa up to one gig bps. So comparing LTE and 3 G, so the upper two is 1 gig. Very, very fast. So this is a promotion video. We can compare the speed of so this is a streaming video. This is music downloads, and this is our movie downloads. So let me try this streaming videos. So this, too, is offered by Flet Hayabusa services. This is not actual one. This is just a model. Like this. Very easy to understand.

So the main kind of promotion point of this is just speed: So this is service operating model of FTE services. NTE is ‑‑ NTT East and West are currently very strictly restricted by the government regulations. NTT East and West count over Internet service. So instead, NTT East and West are just tunneling the user's pocket to the ISP each end user chose. So we use the GE technology and the access line side. That is why each end user has to pay the ISP fee in addition to the Flet's NTT services.

The price of ISP fee vary from ISP to ISP, but I think generally on average in the monthly charge is around 1,000 to 2,000 yen. This is the history of the NTT West fiber service. Currently we got fiber coverage rate approximately 90% in population base. And the NTT East realize approximately 98% now.

But NTT East have not started to offer one gig service yet. They are considering that, but they're ‑‑ they do not decide it yet.

Not only NTT. Other companies are providing the one gig services as well. So his KDDI is the second largest company in Japan. The green card companies are a subsidiary of the electric power companies. So they're kind of intense competition especially in the western Japan area. As you see, the price of very competitive and the low priced for one gig services.

So in the future, maybe high quality video is a maybe key factor to top the older high speed broadband services. In Japan, just three months ago, the industry group called NexTV‑F, it was established. The goal of this forum to launch in the 4K and 8 K service very quickly, the members include the major broadcast companies like NHK and telecom companies like us and many manufacturers as well. So the goal is to start 4K services in the next year through the satellite, and also the IPTV VoD trial will be started.

This is initiative for the NTT West and NTT smartconnect. It could be made over the Internet. It shows the trial in the Internet‑related event called IMC Tokyo recently. R & D now focusing on developing the new 4K called H.265/HEVC. This technology they realize the 4K over the Internet. This was maybe the first trial 4K over the Internet.

So I think this kind of high quality video is very future key to create the huge demand for the high speed Internet services.

Thank you very much.

(Applause)

>> MR. RHEE: Thank you very much for your nice presentation. You have question?

>> All this from the KAIST. I have two questions. One of them is you show the price about $50 per year, roughly. How about for the company? I have my company, okay? Small company. And I want to have that one, one gig. How much would you charge? Same price or different price? This is my first question.

Second question is more difficult. You said the coverage is about 90% to the 98%. I'm interested in those remaining 2% or 10%. What is your policy and also the Japan's government policy? Suppose I'm in some remote area. Okay. Say I got one household. I want one gig service. You say I got no, I can't. That's the answer or what's the procedure in Japan?

Also, if there is Korean telecom, a similar location (laughter).

>> MR. YOSHIHARA: NTT is going too fast. So we got the first question. So the competition in broadband, especially ‑‑

>> MR. RHEE: Brief.

>> MR. YOSHIHARA: Broadband is very fierce now. So maybe in cost side, offering the one gig at almost $50 a month is a very, very process for us, it's limited. But we have to win the competition. So that is why maybe we still keep the same price.

>> How much you charge for the company?

>> MR. YOSHIHARA: Company? The business customers? Some business customers? Business customers we offer a little bit expensive prices. I do remember.

(Off microphone)

>> MR. YOSHIHARA: Many 10,000. More than 10,000 Japanese yen.

>> That much?

>> MR. YOSHIHARA: Okay. I'll check it later. On the Website.

(Off microphone)

>> MR. YOSHIHARA: Oh, okay. And the second question.

>> Depending on the country, the difference, all I know is in Korea probably the difference maybe of ten times or hundred times. In Japan my guess is a couple times.

>> MR. YOSHIHARA: Yeah, couple of times.

>> So I want to know the figure, because my figure is is very ballpark figure.

>> MR. YOSHIHARA: Yeah, maybe just a couple times.

>> That's not very good.

>> MR. YOSHIHARA: But it sound ‑‑ high quality service is different. It's much higher than that. This is a best effort based services. So second question. That's good question. So two percent. Ten percent is very big problem of challenges for us. So we decide the area. We cover the FTTH is based on the just business, return on investment. So maybe NTT East almost complete their installation of fiber because 2% is a very rural, countryside, is not ‑‑ it's very expensive and not economically making sense. In western side we are still spread out FTTH fiber, but maybe the goal is almost the same in the eastern side, 97 or 98. We don't get the government subsidy for building the FTTH, not so far. So just purely based on the business decision.

(Off microphone)

>> Japan's government to mandate to provide ITP service.

>> MR. YOSHIHARA: The not yet now.

>> Is there such a movement?

>> MR. YOSHIHARA: In Japan? Such kind of planning is customary in the government on the Internet, but not decided the specific plan yet.

>> MR. RHEE: I have to stop here because of the time limit. You can join in the panel session in the afternoon. Thank you very much.

(Off microphone)

>> These were supposed to be panel discussion groups.

>> MR. RHEE: We have a panel discussion at 12 p.m. so please come back again for more discussion (laughter).

We thank again Mr. Yoshihara. So please thank you very much.

(Applause)

>> MR. RHEE: Now, I think we have to move a little bit faster. So we are moving to the next presentation from Hong Kong. Mr. Gerit Bahlman. He is the ‑‑ he's currently the director of IT of the Hong Kong University Federation or something like that. It's all written in Korean.

>> DR. BAHLMAN: I'm the director of information technology at a university in Hong Kong, the Hong Kong Polytechnic University. I have been the director of JUCC, which is the joint university's computer center. Currently I'm on the board of JUCC and I'm a member of the Steering Committee of JUCC.

So I want to tell you a little bit about JUCC, so I will. Mainly because it is an interesting structure for collaboration. If you think about where I'm coming from, it is the university environment. Across the world there is an extraordinary amount of collaboration in developing research and education high speed networks. These networks are designed to allow academics and researchers to experiment without the constraints of commercial structures.

So they get effectively free broadband worldwide to explore.

So the joint universities computer center was set up 40 years ago. I think it's now 42 years. In Hong Kong it joins together eight universities and a number of other organizations that are associate members. And it really is, in my view, a machine for collaborating.

So it started with needing to share big computers you. Now it does a range of different things, including the Hong Kong advanced research network, but it also works in areas such as procurement, training and development staff, and it really is being used all the time to try and find ways of, frankly, getting money from the government to fund research activities across the university that can be shared.

So the current services right now JUCC runs HARNET. It is involved in negotiating software licenses joint tendering, training and conferences. I'll go through these later on. It also maintains relationships with similar organizations across the world, including in the United States and so on.

It also gets involved in providing community services. The last two will be familiar to those of you in the academic sector, where there are opportunities for easy collaboration between staff members in universities.

So HARNET, the network itself, was set up in '87. Originally it was during the obvious e‑mail and that sort of thing. It provided gate ways between universities. That's the old, old HARNET network, which was originally put together. Things have advanced since then. I once spent time on this. These slides will be shared.

I want to talk a bit about governance. One of the things that happens with different organizations is if they cannot talk to each other easily, then decisions cannot be made. And what JUCC offers is a very senior level of representation. The board of management consists of the owners of JUCC. And they are the eight universities. And they have often the chief financial officer and they will have the director of IT as their representatives. In Poly U's, the executive vice president is also on this board. We're trying to keep a very high level of influence and representation from each of the organizations to keep this collaboration framework working.

The Steering Committee consists of the CIO, chief information operations, who run the operation of JUCC. They have a job of task forces. The task force focuses on the network and task forces focused on security. There's also other collaboration groups that are set up and managed between those.

David Choi is currently the chair of the network task force. He's a good source of technical information, if there's anything you want to follow up on.

The simplified version of the network now, it's focused on Hong Kong. Hong Kong is about 7.3 million citizens. It has eight universities this network services and joins them all together with links to other international networks. You'll see them documented there. I won't go through them particularly to save time. It does provide Internet connect. Right now it's at 3.5 gigs. That means that the 3.5 gigs comes into HARNET and then it's available to each of the universities. The information is shared, but the variable costs are allocated using a formula that reflects the size of the institution. That's the more complex view.

I do have some technical information that the news that is being implemented. I'm very happy to talk about that: The optical network described right here is a series of rings it's using dense optical ‑‑ I'm trying to think of the name of it now. I've lost it. It's effectively allows us to connect to each of the institutions directly with individual optical rings managed through the same fabric. So we can set up connections between two universities that gives you dedicated elements. I'll talk about that a little more later, the history of it.

Rather than going through the slides, you can have copies later on. The recent upgrade this year was to take the Internet bandwidth up to 3.5. We tend to to get pushed by that. The students are demanding more infrastructure and during this the broadband is absolutely flat lining even at this level. So I will show you a graph later. That graph is of the steps we've taken to increase the broadband. Actually, it's a demand curve.

So a 10 G optical HARNET backbone connecting to eight members. There are two hubs, Hong Kong University and Chinese University both maintain hubs for us. And each institution can basically pull off two 10 gig links. It can also distribute those ‑‑ the bottom line is between the two hubs. So we've got a fairly robust structure to work with.

We are able to configure the optical links, add and drop them dynamically, which is what ROADM is about. Tech set up to individual universities and drop then again as needed. It's looking at using dense technology. We are doing this not ourselves, but using commercial providers. We are using PCCW, which is the major telecommunications company in Hong Kong to run it for us. We go through a tendering process every few years to try to renegotiate bandwidth and the quality of service.

So right now there are some statistics there on how we're connecting. We're connecting into China through 150 megabytes on CERNET. We are electing at TEIN 3 at 90. We have relationships with the different.

Sorry, this is interesting. This one is interesting: Google. We actually have a Google device in HARNET to allow us to optimize and cache Google traffic. That's the kind of collaboration that we're seeing coming from Google is they're trying to optimize their activity around the region.

We are working with HARNET and we were able to achieve a higher level of through put and efficiency.

These grafts are almost boring, aren't they? You see every graph has the same shape. They're all going up. I guess the thing that will limit it is when we get to the 90 to 98% take‑up rate and then it will flatten up. But we're not seeing that. We're seeing demand in terms of Internet bandwidth with continuing to increase in getting sharper and sharper. I believe we earlier talked about video. That's a big source of it. We certainly want the networks to be very, very powerful. We want them to be free. And we don't want them to be overloaded. So the reason for that is you can't do experiments if everybody's using it at once. So it's an interesting balance for us.

We are doing things like experimenting with video. We've got some high definition video conference we're running. We're talking about various kinds of sharing, such as video I cards. We have a propagator going to the network and then being sent out to the other universities and the other organizations. That kind of experiment is being conducted.

This one is interesting. My university some years ago ‑‑ it's located in Hongham and pretty busy for Hong Kong. This is the university over here. A lot of people walk through this at the podium level to go between two parts of Hong Kong. So because that was our campus, the service broke down. So we did a deal. And the deal was we will let you broadcast your wireless traffic across our campus, but you have to carry our wireless over your hot point throughout the city. That deal worked and it is expanded. Now all of the university students in Hong Kong are able to access the university WiFi across multiple commercial suppliers who can also then propagate their wireless onto the campus. Very successful and very useful for our students.

So that's a bit more detail about that. It did cost some money to do, as you can see at the end. It was launched ‑‑ the wide solution was launched in 2009. It's been revisited this year and everybody signed up and everybody's happy that it's a great idea and it should continue. It effectively means that all academics in all the universities in Hong Kong, all the students in Hong Kong, are able to use the university's WiFi services to get back to their institution.

Authentication is done locally. So each university authenticates the individual who wants to join universities WiFi. It gets reflected back to the authentication systems in each university. We have some challenges. One of the most important challenges for us is this point here. How do you fund JUCC. It costs about 15 in a year Hong Kong to keep going. That is shared amongst the universities. But it was funded originally by the government through the university grants committee.

They've now moved away from the model and said to the universities, "You must pay in yourself."

So now within the universities there is always a debate about where you spend your money. Do you spend it on new buildings? Do you spend it on new research programs? Or do you spend it on something that the IT people want?

So there's a credibility issue around getting funding for this kind of activity.

So we have to manage the relationships with the senior executives of the universities very carefully to help them understand why broadband gigabit networks are important to them. It's a really important ongoing conversation. You cannot risk, you cannot say, "Well, they understand that now. We can just focus on what we're doing."

You have to constantly manage up. And I think that's an issue that's happening not just in universities, but a direct parallel to what Dr. Larson said, talking about getting an American government to understand and to keep understanding why investment in gigabit networks is vital.

How am I doing for time? I have about three minutes. I'd like to spend a wee bit of time talking about emerging technologies and directions. I'd like to leave you with one very important idea, that's why gigabit networks are vital in educational institutions.

Right now in Hong Kong we're playing around with disaster recovery data centers, and we're using the ring to provide smaller universities with an opportunity to have so two universities are saying I'll be your backup, you be mine, and saving them money on data centers, which is a great argument for having an investment such as HARNET. So we're doing that. That's important.

There are initiatives, obviously, around IPV 6, sensing and so on. A lot of us are going down the public/private Cloud service thing. We are using HARNET to drive that. In administration, there is the very real demand and drive around personalization of services, the profiling of data mining, those kinds of business issues that crop up.

But I think these two are the ones that hold the key for university research networks.

The first is the nature of research. The world has been researching in particular ways over 2,000 years. The ways in which research has changed, initially they had people sitting under trees speculating, nobody does any experiments. And then people began to experiment, Galileo starts to see experimental signs, and then we saw different kinds of simulations turning up as computers came on the scene.

If you look back at research papers in the early part of last century, you will see most of them consist of reports of data that have been collected. You will see that academics researchers have been working for several years to accumulate reliable, repeatable data. And the data is so valuable, that it has to be published and shared. The data items may consist of a page table of information. That's it. With the advent of computers joining up with this equipment, it became possible to measure things very, very quickly. It changes quickly. It's now about what do I do with all these data points so the processing of the data points, the techniques, the visualization, medical equipment are really good examples where we have a multiplicity of data points by measuring devices of such a volume that we cannot possibly handle it as individuals.

So we build machines to visualize it. Big data was not invented by the commercial world. It was invented by academics because they were collecting data at such a rate that they couldn't cope with it. They couldn't store it. They couldn't transport it. We have people doing research in geomomics. We need big, big pipes to shift datasets to each other so people can actually analyze it. You collect so much data so fast; you actually cannot analyze it yourself. You need to collaborate and share.

So in the research space collaboration is about sharing the load of the information that's being gathered by remote sensing devices of various kinds.

So to me that is the most significant point about why we need to have access to big, big networks.

And the last topic is learning and teaching. You'll be aware of the kinds of changes that are happening or trying to happen as people move away from chalk and talk to trying to involve the use of multimedia to enhance the learning of our students. That also involves tremendous volumes of data.

So for me, it's collaboration around research and it's the growth of the teaching and learning environment that demands the continued investment.

Thank you very much.

>> MR. RHEE: Thank you very much. The session is open for one or two brief questions and answers.

Dr. Larson?

>> DR. LARSON: Excellent point about the revolutionary research. I think about the book Network Science. But could you comment on the relationship of that to another large development, the recent emergence of MOOCS, massive online courseware, and how it relates to education broadly in terms of open education and also open research?

>> The MOOC initiative, stands for massive open online courses. And it's an experiment that's being conducted by a number of universities in different forums, IDICS and KOCERA are examples. What we're trying to do is provide students with the opportunity to consume the information in the courses online. And in one dimension of that, they're thinking about flipping the classroom. Instead of the classroom being the place where you get the information, you get the information and then the classroom becomes the place where you collaborate on understanding it. MOOC is aiming at providing video, multimedia resources to the planet not just the university. There are instances where 100 level courses in mathematics are being offered to 300,000 people around the world from all over the world. So suddenly we have.

Suddenly we have a chance to access communication regardless of where they are. The one thing they need is Internet access. That's the social issue. How do you get education out to people. There are lots of business issues around MOOCs. It's fascinating. There's a teaching benefit that I want to make a point about.

When you are a teacher working with a class of 100, 200 students or maybe 30 students, you are trying to read the understanding of the people in the class as you convey information to them. It's very difficult because you're on your own, because the measurement of the understanding is it's clumsy, because you're just one person.

You get points where the students do not understand. And if you analyze that data, back to big data, if you analyze that the information coming back around the response of the students to the assessment that's happening online if you see the pain points, you can see what it is that you're doing in that topic area and how to improve it. So the exciting thing good MOOC is the fact for the first time we're seeing the use of technology to start to better the way in which what we teach. I think that's very, very powerful. I think it requires networks everywhere at 98 percent. What about the two%? What about the kids that can't get access to education. That's my answer.

I think we have running out of time. So we want to move more discussions in the panel discussion.

Thank you very much again. Thank you very much, Mr. Bahlman.

(applause)

The session is not ‑‑ the session will be just resume in 20 minutes later after the coffee break. So we can have the coffee break time. And then we'll resume the session in ‑‑ at 11:30. So please come back for the session.

Thank you.

(Adjourned for 20 minutes)

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>> CJ HelloVision

Giga Internet Service.

Status and Prospect.

>> MR. RHEE: So we would like to start the second part of the workshop of Broader World of Network, the Giga Internet. So please be seated to start with the session.

Okay. The second part will consist of two different formats. First is we are going to have two more speakers for their presentation of Giga Internet and then starting from 12:10 we will have a panel discussion to conclude the discussions in the session. For this one, every speaker are invited to the panel discussion. In addition to it, we are going to invite Dr. Kong of NIA. All audiences are invited to participate in the panel discussions together.

As the first speaker presentation, presentation of the second part of this workshop, I'd like to introduce Mr. Hong‑ik Kim from CJHV. He's a graduate from the Hong Kong University and currently serving as center director of CJ HelloVision Smart Phone innovation center. We would like to welcome Dr. Hong‑ik Kim for his preparation.

(Applause)

>> DR. KIM: Hello. My name is Hong‑ik Kim. I am working for CJ HelloVision.

CJ HelloVision, I'll talk about the current status of Giga Internet and also talk about the service as well.

I guess something is wrong here. No, this is not my file. The other one.

Okay. Let me first introduce CJ HelloVision to you. CJ HelloVision is a cable MSO working in Korea, one of the largest in Korea and also has the largest number of subscribers. As you can see, this is our coverage area. Through the MNA, the company is actually on the growth pattern, but approximately at the beginning of this year we have about 3.5 million broadcast subscribers and also we have about 700,000 voice call subscribers and 770,000 Internet subscribers.

Regarding the network, network operators have been discussed and have been presented this so many times before. And I just captured this. You know, the manufacturers companies need to sell their products. So they actually set up and exaggerate the market. But even though the numbers are not exactly correct, the trend is actually right. The Internet traffic toward video is actually on the rise. The number of devices is on the sharp increase.

The individual access device, it is also on rapid growth as is the situation, we can't really support all this with the existing Internet environment. However, all network providers, they are actually in the same situation. Internet traffic itself ‑‑ especially in Korea ‑‑ oh, there may be gaps between worldwide carriers, but for CJ HelloVision, the Internet traffic has been increasing at a speed of 30% and about 40%.

So in order to maintain the quality of our service, we need to improve and upgrade our network.

However, the market competition gets fiercer and fiercer. So the income per bit revenue per customer have been decreasing very much.

In the case of Korea, Internet is very high, so the market itself is already saturated. There are not many movement of customers. Customers, you know, they usually buy the bundle service so it actually prevent customers from changing the Internet providers.

Internet, it gets much more advanced, so in the value of service value change, the value of the network has gone down. So the role of the network is a simple delivery.

Despite the situation, to prepare for such market change, we need to make investment in Internet and we to improve our service. However, under circumstances why are we talking about Giga Internet? As a cable service provider, we actually started our service surrounding broadcasting and then expanded the service area to Internet and voice call as well.

As a latecomer in the Internet service market, we need to be much more competitive. Our product should be much more competitive than others. Also, we need to actually change the public awareness toward cable. And if we fail to secure the market competitiveness, then we are actually doomed to fail. This has already been recognized by cable operators, and especially the bundle products are the major items in broadcasting market. So the priority of the customers, where they choose the service, Internet is the most important. So they choose the best Internet provider and then they just buy the bundle items of Internet, broadcasting, and telephone provided by exactly same provider.

For the first time, in December 2011, CJ HelloVision commercially commercialized in Korea. The first commercial area is small town in area we are closed to right now, with the expanded service, our Giga Internet service is named Platinum Giga and 150 Mbps speed is actually guaranteed. That's the minimum.

Actually, nowhere in the world the products are not guaranteeing the minimum speed. However, in Korea the minimum speed guarantee is very much important. So as a standard for our product is one of the 150 Mbps. The pictures you are seeing right now on the bottom of the slide, these are the photo taken in that Giga Internet commercialization ceremony.

They actually shared a very interesting promotion video clip and talked about the rate. Compared to the existing 100 megabyte product, our Giga Internet service product is actually $4 higher than the existing service. However, depending on where you are living, the service charge is different.

As I mentioned before, we are the cable MSO. So network of MSO is HFC network. And we are ‑‑ our business is actually centered on the broadcasting. So, therefore, our subscribers are the broadcasting subscribers. So we need to maintain the merits of the existing service, and at the same time we also need to keep ‑‑ we need Internet service. So we can't really, you know, accept FTTH as it is. So what we thought is within FTTH structure, how we can provide Giga Internet service. So the slide on the top, you can see that idea. In this case the charge is low, but is asymmetric structure. So the speed could be a matter. Also, this is a shared network. Even though we provide the Giga service, we actually will not be able to guarantee a minimum speed.

And here RFoG, if you look at the RFoG structure, this allows us to maintain the existing merits of the cable, but at the same time it allows to enable us to provide FTTH. So we actually prefer this structure. But the problem of this is RFoG, it cost a lot. So the investment per customer is quite high. It actually pose obstacles for commercialization. However, since 2009 we actually initiated our research in RFoG for the commercialization. Of course, Giga Internet can be provided through FTTH, but in this case we need to exchange. We need to trend the legacy infra and also we need to the existing broadband network. It cost a lot.

So at the same time we have to design and ensure the quality of HFC and FTTH. We need to consider the possible issues regarding the inefficiency of the network. So we considered FTTH that actually ‑‑ it was placed in the bottom of our priority list. So how can we do that? We did it into brown field and green field. First the brown field refers to the area that has to use the existing H F C, and green field refers to the areas F testimony that must have the new. We use the existing structure and we consider the forward and backward compatibility with the existing facilities. So we have at the increases the density and also we use CCAP and we also have microhub or ethernet over coax.

The Internet type is quite popular in the region, including EPoc, DPoc, MoCA. We use these to continuously provide Internet service.

In the case of green field, if we use PON, we have to design PON and HFC at the same time, which means we'll spend a lot of investment money and the management will become inefficient. So we are considering PON plus RF and PON plus RF overlay, which so in our case, we are going to choose PON plus RF overlay.

The CJ HelloVision has commercialized RF overlay earlier this year and we are continuously expanding the areas.

The overlay, actually, the network has the structure of FTTH, but the frequency broadband has additional broadcasting broadband. Then regarding the existing broadcasting service, we have to ensure the stable broadcasting service in the Gigabit Internet.

The cable will be removed, and in terms of network, if you look at the picture below, ONT, the WDM separates the wave three coax, and it will be provided to the legacy setup or PC of households. Planning the commercialization of this concept, the commercialization includes the ONT type and collective overlay type, which is used in the apartment.

So the type of RF overlay ONT is different between the general housing and the apartment housing.

A few months ago CJ HelloVision actually commercialized the Giga Wifi for households. In the case of Giga WiFi for households, we are the first company to commercial eyes the household service.

As you see here, if you compare the speed, the existing 802.11 A, if you compare the speed between the two standards, the 802.11 ac has much higher speed.

And this shows the speed of Giga Internet. So this is the speed when you first opened the service, of course, if the number of subscribers increases, then the speed may become a little lower. But when you first launch the service, the speed was from 800 to 900 Mbps. So if you look at the picture regarding WiFi speed, you can see the speed. Actually, Giga WiFi offers very good connection. So based on this concept, we can offer the Giga Internet service.

And the equipment you see below are the ones we used to offer RF overlay service.

At the beginning of this year, for now we are offering the service to remote areas and next year we're trying to upgrade our service and further spread this to other regions in Korea.

While working on Giga Internet, I received this question a lot. If you enable this the wide broadband of the Giga Internet, what kind of service are you going to provide. And the type of service we are thinking of are two. Firstly, the consumption of multimedia contents is increasing. So in order to respond to the increasing consumption of multimedia, it means that the number of device that uses multimedia service will increase. So first we have to respond to the increasing number of services and contents.

In order to ensure the good quality service, we have to well manage the Internet traffic. And that is possible through Giga Internet. That's why we're focusing on UHDTV service. Next year we're planning to commercially launch UHDTV service.

The picture you see here is what we demonstrated to the Japanese people last year. And there was also press report about our ‑‑ about the services we are planning.

Second service we are focusing on is Cloud broadcasting. Broadcasting is currently offered through diverse methods. Cloud broadcasting requires high specification and the broadcasting is based on the client's needs. So that means we need to have the high specification and high capacity for the broadcasting service.

Third service is multiscreen service. This is also a must service for Giga Internet.

So I'm going to briefly explain to you about our plan.

In Korea, CJ HelloVision has commercialized Giga Internet for the first time among Korean companies. Although the speed of our Giga Internet service is not very fast and we're trying to maximize the Giga Internet speed at reasonable price, and our choices RF overlay, we're trying to spread the RF overlay‑based service and extend the service to 10G. Not only the infrastructure providers, we are trying to become not only the infrastructure provider, but also the service ‑‑ Giga Internet service provider.

I will take questions.

(Applause)

>> MR. RHEE: The floor is open for Q&A. Could you state your name and the affiliation?

>> I think multiprogram is not related to Giga Internet services. Most technologists are basically reduced in traffic. So multitechnique more so efficient technology. So Internet services is one technology is multicasted TVs are not sufficient based Internet service.

>> Thank you.

>> MR. RHEE: If there aren't any further questions, we would like to move to the next presentation. We thank again Dr. Kim.

The next presentation will be given by Dr. Hyunglin Park from KT. He is currently with KTF Solution development team. The team director of the next generation access network.

So we would like to welcome Mr. Park for his presentation.

(Applause)

>> MR. PARK: My name is Hyunglin Park from KT. I'm the infrastructure director. We have started Giga Internet service since 2009. Actually, we have around 2,000 trial service subscribers, actually. About FTTH, we have started the first FTTH commercialization at 2005. So it was about eight years ago. And we now have about four million subscribers connected with the fiber.

The total amount of broadband subscribers is about eight million subscribers. So based on this number of fiber‑based subscribers, we actually are preparing for the Giga Internet services since five years ago.

So in this presentation I will explain about the progress and what is the direction that we are thinking of about the Giga Internet service.

So based on the subscriber base connected with the fiber, one of the major main characteristics of the Internet in KT is the data explosion. It has started with the traffic off‑load by traffic into IP‑based network. So after that, with the expansion of smart devices, further increase of traffic is happening.

Adding to that, media application, mainly ITPV services, and also the media application that are working on the smart devices are adding to those data increase.

So based on that, we are feeling the need to improve the network capacity to prevent the network blackout, especially in the aggregation section of the network. There are a lot of traffic that are flowing. So the main risk of transitioning into Giga Internet network is to increase further the ‑‑ all those flows that are concentrated in the aggregation part. This is one of the challenges that we feel to solve.

Another characteristic of the Internet environment today is the gigabit connectivity at home. As you can see, there are many, many devices now that provide gigabit connectivity at home. Until now we provide only one hundred megabit Mbps of connectively. After that the gigabit connection to the network. Then we expect that those devices ‑‑ the sum of those devices will exceed bandwidth of 100 megabyte soon.

The environment is, I think, already there.

So the main challenge and main concern that we feel as a telephone company is how to provide a service that can make money. And I think that can be achieved by providing our service that can differentiate between other existing. So in this stream we are considering of providing a further elaboration that can that can differentiate between combining the volunteer and voice together, and between the real time and non-real-time services.

So the gigabit ‑‑ the Giga Internet provides a very huge bandwidth to a single subscriber, whereas that could be either consumer or enterprise.

So in case of the customer is enterprise customer, then they may be many, many flows that are pertaining to either web or video or voice or some sort of combined services.

So the capability of discriminating what type of services is flowing from the customer side and be able to guarantee certain level of quality of service that could be a value that Giga Internet can provide.

So this slide shows, so in the past, until now, the only business model provided by the telephone company was just providing bandwidth or pipe. That is not controllable. You just open the bandwidth, the pipe, and then we receive money from customers.

But this, I think, has reached some limit as ‑‑ in the business point of view. So beginning with the Giga Internet service, we think that we have to provide a further value experience to subscribers by not just providing bandwidth, but also providing some value that can be given to each and felt to each subscribers.

And I hope and we expect that those kind of giving some added experience to each customer will enable us to earn some more increase in that sense.

But enabling more experience out of the ‑‑ just pipe will give many, many challenges. For example, there could be a mismatch of speed, for example. If the device at home does not support connectivity or just limited performance regarding the connection, that can limit and affect the whole experience that we are intending to provide.

So understanding from end to end point of view, what is the main challenge that you have to overcome in order to give exactly to what we are expecting as a value experience to each subscriber is very important.

And regarding the strong candidate for the Giga Internet service is, of course, we also see the UHD TV is a very strong candidate for Giga Internet service, because it generates traffic which is constantly flowing. And at the very high rate from about 30 to even exceeding 100 Mbps, according to the compression technique.

But as the industry of TV, for example, shows a very rapid dropping in the cost point of view, for example, the 50 inch of HDTV, so we are expecting that next year or even two years ‑‑ the majority of the HD infrastructure will be measured very rapidly.

So many, many service has been delivered by other broadcasters in Korea to check the availability of the UHD TV. But there are about two things that will ‑‑ that has to be overcome in order to be successful in this business, is that as it can see in the right side, we need contents, first of all. Also, the network that deliver those contents to each customer. Also, of course, the platform and the device to properly deliver those contents to each subscriber.

Those value circle should not be broken. The success factor lies in the strong alliance between those various parameters.

Another success factor is the network. So actually, we have KT has a network that has a topology that concentrate many subscriber lines into a single router, for example. And those topology is for the traffic, for example. But if those continuous traffic of 10 or 100 Mbps and many are flowing at the same time, then they may be congestion very often in the aggregation segment of the network.

So technology to properly guarantee the quality of service in terms of the transmission is needed to be established.

So as I have told in the previous slide, we have started the Giga Internet service since five years ago. Actually, we have about five consortium participating to the trial Internet service. Among them, you have already heard the presentation about CJ HelloVision which specialized service in 2011. The next year, also SK telecom, and KT is participating also in the trial service.

And the main packet of our Giga Internet is to extend the coverage of gigabit to the level of 90% nationwide until 2017.

So in order to broaden, to expand ‑‑

>> MR. RHEE: Three minutes.

>> We are constantly evolving our access network technology. So naturally, we have extending it out here. Those technologies are very important because it is closely related with the gigabit coverage. So what kind of technology we choose will affect the speed of the gigabit coverage expansion.

So this is the topology of actual trial service that we are deploying, actually. So it is all has a common base on the PON technology, which connects through fiber to each subscriber environment, either directly or from the basement or from the main distribution room. So the last challenge that we are trying to overcome is the last segment, last mile, that connects to the subscribers. So they may be some UTP cables or they may be some HG table or TRE cables. So there are many, many types of cables that are connecting to the subscribers.

So connecting to those locations with the gigabit pipe is a big challenge for us. So this is the technology of the network, the topology that we are actually deploying. We have used gigabit WDM‑PON in the trial field. Also, we have used 1GPON and also 10G PON in the trial service.

In the next slide I will present challenges that you have met during the trial test. The first one is that the PC from the customer does not support properly the input/output speed interface. For example, they are old desktop PC's that provide only PCI interface, for example. For example, the ISP is 1 Gbps for input and output. So dividing to that, we found that the maximum speed will only give some rate under the gigabit bps.

Under the other challenges, as I have mentioned earlier, is the last segment cable. So this shows only the fiber, but each apartment, for example. Many, many locations are providing only copper cables in this segment. So how to provide Giga Internet in this location is a big challenge for us.

Another challenge is heavy user traffic. So this is one case of trial service. There were one customer who is a consumer, who about ten ONT's and collected to a server and uploaded. That generated traffic ‑‑ heavy load traffic for about two or three weeks. So enabling to detect those heavy traffic and to control them is another issue that we can expect when Giga Internet service is commercialized.

Okay. So by deploying the Giga Internet service deployment, we expect the network will be a network very strong with low cost.

This will be my last slide. Then based on this strong network, seamless connectivity between devices and based on those expansion, the traffic will grow more and more. So in this circle rounding, there may be many, many business opportunities or job creation. Also, there may be some issues; fair pricing for issues has to be solved.

Thank you very much.

(Applause)

>> MR. RHEE: Thank you very much. Now the floor is open for questions and answers. Do you have any questions or comments for Mr. Park? Could you state again your name and affiliation?

>> As you mentioned, the heavy users is also heavy for us. In Japan the United States mobile carrier there is a traffic limit to the customer. Do you have a problem ‑‑ do you have such problem or do you already deployed it?

>> MR. PARK: First you have to discuss it with the current government about that planning. So, of course, as a telephone company, you have plan to make a fair usage ‑‑ fair pricing on the usage base. So this has to be solved between the telephone companies and the Korean government.

>> So still discussing?

>> MR. PARK: Yes.

>> I see. Thank you.

>> MR. RHEE: Thank you. If there's no further question ‑‑ okay. Yes.

>> I have a quick comment. I'm a customer of yours. A few years ago the DSL modem in a rural area broke down. So the KT serviceman came, replaced it with fiberoptic, ran a fiber line. There was no service charge at all. It just we switched over to fiber service.

>> MR. PARK: Right. In each year we are replacing those DSL lines with the fiber.

>> MR. RHEE: Well, we'll reorganize the podium so we can continue with the panel discussion. So the session will be ‑‑ will start again in a couple of minutes after we reorganize the podium.

So please be seated and wait. Please don't go away. (Laughter) we'll start the panel again.

(Applause)

>> MR. RHEE: I'm pleased to start the panel discussion. And we have the previous speakers of the session as the panelists, plus one more guest from NIA. So I'm going to introduce those panelists one by one.

So the first one just right beside me is Dr. Sunmukong. He sponsored the agency to develop the Internet society in Korea. So we welcome Mr. Kong.

The second is I introduce him in the session, to we'll skip the introduction of him, Mr. Bahlman.

The third one is Mr. Daniel Ho from Singapore. And the fourth one is Mr. Toshihiro Yoshihara from NTH of Japan. Dr. James Larson from KAIST representing the U.S. side. And the fourth one is Mr. Hyunglin Park with KT. The last panelist is Mr. ‑‑ Dr. Kim from CJ HelloVision in Korea.

Briefly I'd like to bring up the issues of today. So the session was first organized to understand or extend our understanding on the Giga Internet era. So the one issue that we had in mind is increase of Internet in the next generation network Giga Internet due to mass storage of digital contents like UHD and 3D, the ac based gigabit class and expansion of fiber into the home, different ecosystems in the Internet. This year the forum is "towards a better Internet" provides prospects for Internet ecosystem changes according to the spread of Giga Internet. In order to investigate or share the ideas or points on these issues are well presented during the session presentation, and so I'd like to bring up some dimensions to think for the success of the Giga Internet. One of them is technology issue and market presentation of Giga Internet access technologies, market penetration of Giga Internet technologies. That's one of the issues we want to consider for the panel discussion.

Secondly, newly emerging service and killer application will be a similar topic for us to discuss. Also, we want to consider the influence of Giga Internet access to the overall Internet ecosystem, including the development or evolution of the core network together.

The ideas that we want to investigate, but in the bottom of that, we want to bring up ‑‑ I want to bring up some big questions. So this is kind of classical thoughts that you have, that you can bring into panel discussion. By the panelists or from the audience together.

So Giga is great. It's deployable. Every presentation showed that the deployment of Gigabit Internet is very feasible and actually has done.

Then we want to ask who is going to pay for it? Very fundamental consideration. And for what? People are not just spending money, so they are people must be spending money for something; right? And we want to kind of rationalize how this can be done.

In addition to that one, I didn't catch it in the file, but a couple more discussions that we want to talk about. So from the presentations of today, what we have learned is we want to ask ourself, is government support the only enabler? May not be. So we want to bring up that kind of discussion, too.

Is cost the show stopper? Even though the cost is higher with the Giga Internet or the 10 G PON, would the cost be the show stopper?

Right. So also, there are some other considerations that we have to think, but they could be important. One of them is a heavy users, as discussed in the last presentation, and also what we can do for the users in the area, which is out of FTTH coverage. That's another important discussion that we have ‑‑ that we can consider.

So for the panel, I ask the panelist to bring just one or two slide discussions for the ‑‑ as an icebreaker. And some panelists have the presentation materials and some does not. Others does not. So I'd like to just discuss what they have in their mind. I'd like to start with Dr. Larson. As he is ready for the discussion with the slides.

>> DR. LARSON: You got the slides. Okay. I've got ‑‑ I have the control here. Yeah, I was asked about this. All right. Giga Internet, it's clear requires fiber. Mobile alone isn't going to do it anywhere in the world. You've got to have fiber networks. So it's going to come first to the world's advanced economies, not to the developing countries. This will ensure that there's a continuing global digital divide between the haves ‑‑ the countries that have Giga Internet and those that don't or major sections of those countries that have or don't.

Furthermore, ultra‑fast broadband is needed for so‑called sustainable development. What Jeffrey Sach at Columbia University are concerned with. This is a quote from a recent post by Sach. "Humanity faces a stark choice if the world economy's can repeat growth patterns continue, we face ecological disaster."

He's talking about the mobile phone being one of the most revolutionary technology developments in terms of working with the issue of development. Essentially through these slides what I'm trying to raise is the question of how in the implementing ultra broadband will we deal with this digital divide issue, whether it's an issue of developing nations, not having as much nations or the digital divide within nations. I don't have the answer, but that's the issue that I chose to put forth to the panel, if anybody.

>> MR. RHEE: Thank you very much. And I'm going to move to the next icebreaker discussion. Well, Mr. Yoshihara has prepared a couple of slides for his icebreaker discussion. By the way, I'm sorry, the panel can be discussing either in Korean and English. So the audience can also ask a question and make comments in Korean, too. Japanese? (Laughter).

>> MR. YOSHIHARA: I want to talk about technology issues. I think there are several issues in technology and other areas. I think they're mainly two technology issues here. The first one is just speed. So the information in my presentations currently it's kind of a very common thing in Japan. In the next stage the consumer who is business customers require much more higher speed. And I think it depends on there are future obligations like UHD or other devices. So we have to think about the new technology in GE‑PON and XG‑PON, both of which encounter the communications. In the future will increase much higher speed can be deployed. So that requires the implementation cost for the operating company like us. That's kind of issues for our operators.

And the other issue is electronic power consumption saving. It's not directly related to the bringing the higher speed service to the customers, but this is a very big social/environmental issues, I think. It's kind of a very global issue.

So in Japan we have very big earthquake almost two years ago. After that, the power saving is very big importance social issues. So we have to save electric, not only in the home, but also in the office as well.

So in this situation we have to reduce the energy consumption like network, energy consumption. In the IP network, access network is mostly consuming the electric power. So now NTT R & D is focusing on reducing the electric consumption of PON equipment like ONU and OLT. Because there are many subscribers here, so access equipments is a very key point.

There is global consortium called Green Touch. AT&T and France telecom and also Korea telecom are involved in this Green Touch. I think most of the major Koreas are involved. So this consortium to target to even able to increase network energy efficiency by a factor of 1,000 compared to 2010 levels by 2020. So this is kind of a big project. So that consortium shows the very importance of this electric power consumption issues.

>> MR. RHEE: Thank you very much. So I'm going to go one by one for the next presentation. Dr. Kong, do you have any stimulating opinion or issues.

>> Dr. KONG: I'd like to thank all participant who are present in this session. There is now supporting NSIT for deploying Giga Internet in Korean network. And the communication companies joined the project and two more cable networks. Three communication companies, they didn't start the commercial eyes service yet, but two cable companies already started providing the commercial services. And I believe the ‑‑ some point that they are very successful in getting subscribers for that relevant services.

And I think some communication companies, they have some pain in deploying the Giga Internet services because they provide dedicated for the high speed gigabit over 100 megabit services. So these very big competition in different business sectors to provide the Gigabit Internet services as normal users.

Also, in the pilot project, the companies we prepared a very special services as a killer apps like high definition TV and 4K video. And some other killer apps we think about is some 3D services and the cable network providers, they provide these kind of things in the public areas. And also they develop tele cloud service to provide Cloud service to the S and E, video enterprise companies.

And I suggest these kind of applications would be the killer application in the future. And nowadays the mobile technologies are already developed in Korea, such as the gigabit WiFi services at home and also the mobile companies, they start to provide other services and also LK services.

I believe these mobile services will bring the Gigabit Internet services in the southern change in the Korean community.

I suggest the cooperative research works for such a project among countries like Japan, Singapore, and including USA, using high speed research education network.

Thank you.

>> MR. RHEE: Thank you. I appreciate if you can bring one or two brief issues to the statements on the issues within one or two minutes.

So I want to move with Mr. Bahlman.

>> DR. BAHLMAN: Thank you. I'm thinking about the nature of the change of society. So the issue for me is ‑‑ I think the killer apps are entertainment. But I want to argue that it's also education. And I'm gonna tie that in with Dr. Larson's comment about the digital divide, and ask the question how is Giga Internet going to affect society and how is it going to address the digital divide, and what is the impact going to be on the way we work and live?

And the other thing that there is green IT, how can technology reduce the energy consumption? One of the big problems we have with cities growing, with congestion, cows not being able to move, people not go able to get where they need to go, and the question why to they need to go? So why don't we change the way in which we work? Why can't we do our work remotely? Why can't we avoid unnecessary travel? Why can't we optimize our travel?

So I'm thinking about social change driven by technology which lets people live differently. That involves significant changes in attitude. Governments have to think differently about the nature of work. Is it possible to work at home? Well, if you're in a very small apartment, maybe in Hong Kong or in Singapore, maybe there are reasons why you want to get out; right? So there are a whole lot of dynamics around that.

I know that education is a killer app. I know that education is going to help address the digital divide. People are not going to be able to change the way they work unless they have the right skills. It means we need to take education, to people who can't currently get it. So that's. That's my point.

>> MR. RHEE: Thank you very much. Mr.

>> DR. HO: I think there are two areas that I will bring up. For instance, with the fiber to the entire nation, the question is what do you do with it to make a difference? What is it economy or in the social life? We see some changes taking place where companies are trying to use from home as a way to innovate. But this is just the beginning. I think the important thing is that beyond just entertainment, what do we do with this fiber? The government is taking a small city where they put meters in the buildings so these are things that are being worked up now. But we're still at a very initial stage. So it's such a huge investment going in. I think we need to do more than just focus on delivering high band entertainment.

The other thing that I think is important from my speaker perspective, the bandwidth change in the past in the international segment and now the fiber in the nation, it's no longer in the domestic segment. It's ‑‑ the last mile is within the home where we don't have technologies to enable the end user to tap fully the benefit of fiber. But if you end users we notice challenges in delivering that full bandwidth benefit to the end user. I think it's an idea that probably more thinking and more development so that we can really have a big full benefit of having full deployment.

>> MR. RHEE: That's interesting discussion. Thank you very much. Let's move to Mr. Park.

>> MR. PARK: Okay. As a telephone company and provider for the Giga Internet trial service, we have made some survey to trial subscribers, and found out that the subscribers didn't felt any difference between the 100 Mbps Internet and the Giga Internet service. That is when they are browsing the Web and looking for some contents, then they felt that it was about the same. So the issue is that what is the main packet ‑‑ service proposed of Giga Internet that can differentiate between the existing 100 Mbps Internet. So finding the proper killer application that can provide some quality of experience that can differentiate between the existing infrastructure is a big issue that I feel, yeah.

>> MR. RHEE: Thank you very much.

>> DR. KIM: First, the wireless Internet meter exists. In order to continue to exist, it must have competitiveness, compared to wireless Internet, for wired Internet to exist in a sustainable manner, the wired Internet service must have competitiveness. And the Giga Internet will show that the wired Internet service also has competitiveness to enable sustainable growth.

And I think we need to persuade the customers and users on the importance of Giga Internet.

Secondly, there's a business service‑related issues, like business model. If the existing ‑‑ I don't think that the existing business model will just fail. I think that we need to find a new business model for Giga Internet.

Although I don't have clear specific idea about the new model first I think that every month we receive subscription fee from customers, but we should no longer depend on just subscription fee. We need to look at the situation from a whole new perspective.

We need to make more efforts to find a new business model on this new Giga Internet.

>> MR. RHEE: Thanks to all of the panelist. If I could summarize all of the, I can bring up several points.

(No English spoken).

>> MR. RHEE: And also we can engage a lot of true Internet oriented services into key Internet access.

On the other side, we have concerns about the how we can vital eyes this kind of deployment of the Internet systems. And we have to concern how the Giga Internet access can be more successful in terms of penetrating the market. For example, the can you be describer doesn't feel any difference between 100 meeting service and 1 gig service, we may not be winning in the race. So those kind of issues are brought up here. Now I'd like to ask the panelist to discuss or give some comments how we can be successful in those three kind of areas.

Okay. Dr. Larson.

>> DR. LARSON: You know, this is just a personal comment about speed and the survey that Dr. Park mentioned that KT had done. I am mystified by this because this isn't the first time I've heard it said that why do you need a gig of speed? But it seems to me that some of the presentations showed situations where speed is necessary, like we saw in Japan on the Web site the download speed. If you've ever sat and waited for a video to buffer or movie to download or something, you know, that's speed. That's important.

For what it's worth, I was, up until last year, in an office at KAIST with 100 megabit service. I didn't know once I moved up to the second floor, the same computer, a desktop, fairly new Dell desktop, was connected to the Giga Internet. But I noticed it. It's faster. Every click of the mouse. What I'm saying here is maybe, like me, many of you are working typically with a couple of screens, and you'll pull up a book or an academic Article or do a quick Google search to pull down a video, and this and that, and you're doing all of this. In that situation you notice speed. So I think probably the KT survey was with a general audience where their media usage might be.

But to come back to another comment by one of the ‑‑ by Dr. Bahlman, it's more than just video. And it's more than just the individual experience of speed. It's also the whole explosion of information. That's happening, a lot of it, because of social media. Blogging, the fact that everybody can be an author and publish. And this is irreversible, it seems to me. And the more the data's getting so big that to do science, to attack the world's problems and so forth, I think speed is gonna be needed.

>> MR. RHEE: Let me ask you a question, Dr. Larson. So it could be a comment. The Internet service is kind of based on flow; right? Flow from the server and ending at the user, and if make the access for only fast, still if the server is slow, then probably we don't see actual improvements. That's probably one of the consideration that we have to bring up here. Definitely the local service could be faster, but the remote ‑‑ the service that comes from remote node could be somewhat limited and overall. How are we going to resolve all this kind of complicated service situation?

>> DR. LARSON: Well, the technical side ‑‑ I'll leave it to more technically inclined people to solve that problem. But I also did want to comment that even as Dr. Kong mentioned, there's a need that's unmet as yet for nations. And I'm talking about not just government to government to collaborate, but governments, citizens, academic groups, civil society organizations, as well as corporate entities are all participating. And we all know this. This is happening everywhere in the world. And this is going to require more speed.

>> DR. PARK: Thank you. I'd like to pick up a very simple principle. When you design architecture or you design technical solutions, one of the things you must ask yourself is what is the single point of failure. You apply that to the Giga Internet discussion and the point comes out. The end point devices aren't fast enough to handle GE, you've got to have the right level of input devices.

Your servers have to be fast enough to deliver it.

What are the biggest points of failures? In the Internet connected global world is the international links. It's the thinnest pipes we're dealing with. It's where most of the profits are being leveraged from. Is that a bad thing. I think the issue is where is the major content source what we need to do in each of our countries is to seriously ask how much redundancy or resilience do we have if the international links break? It's a complete break down of society and an inability to maintain normal processes and systems. It was the religious organizations, monestaries, and they had a tradition of holding in their libraries and looking after the remnants of human knowledge.

I think we've actually got to think like that in terms of the Internet. Most of the traffic is coming from one country. We've got to change that. We've got to start replicating it. We've got to start building up resilience, and we've got to start capturing our own cultures and storing our own cultures in our resilient way.

Now, I'm making a statement here about where I think the Giga Internet discussion needs to change. I don't think it is about the fact that a user perceives a particular service as being slow, whether they have a hundred or a gigabit link. The issue is where's the service coming from? Where is the information coming from? Where is the single point of least through put? And tied up with that is the social thing. Can we get our own governments and societies to start to think about what is important about our culture? What is important about our information so that we start to invest in being the source as well as depending on other countries.

So that's my thought.

>> MR. RHEE: That's very comprehensive understanding of the ecosystem. So other comments along this issue?

>> DR. LARSON: The killer app is content. The reason why it's coming from one country, I think we know which country that is, is that this company called Google is too, two young students at Stanford decided they wanted to try to organize the world's information. And like back before they did this, I'd already become a university professor. So I've written some books. But the project that they undertook to digitize the world's books starting in the United States, then moving to digitalization to Europe and I'm in full agreement with Dr. Bahlman's comments about the need to broaden this phenomenon. But the world's library, the card catalog, is no longer in any library. It's not in any university library in the United States. It's at our fingertips and it's called Google Books. And the Google N brand viewer for those who may have friends in the humanities.

>> MR. RHEE: That's a big change in the social understanding.

So there's ‑‑ this is one side of the concern that we had for this in order to make the Giga Internet more successful in the future. Another side we discuss is the actual business model or the killer applications that actually need gigabit pipeline.

So NTT, I think, is the most advanced in developing these issues, I think. KT has some experience and CJ HelloVision also brings up a lot of contents that can be killer applications in the Gigabit Internet service. So could you make some comments how you envision that all these can be successful in terms of business models? My question, how can you draw money out of the subscribers; right? That's another concern that you can discuss.

>> MR. YOSHIHARA: Unfortunately, I can't give you any specific application that requires one gig so far, but as I mentioned in the presentations, the next generations video is, of course, key contents in the future. So 4K requires just 20 meeting or 30 meg bps. But there are many devices so if we think about the simultaneous access from those many devices, I think more than one hundred megabit bps access is required and maybe consumer need such ultra high speed Internet, very soon, maybe in a few years, I think.

>> MR. RHEE: In a few years. That's very exciting. Dr. Kong first requested for his comment.

>> Dr. KONG: I think killer application, power consumption, transportation can be reduced very much with the smart work or homework. Nowadays in Korea we started ‑‑ we expand very much in the smart work things. The government, they try to put their offices work at home. So it can be the killer application in the high speed networks, because we need virtual cooperative work space for that kind of smart work in the future, I believe.

>> MR. RHEE: I'd like to extend the session by ten minutes more. So there's a few more requests to discuss. I think everyone here is okay with that; right? Okay. There is an request by Dr. Larson, and I'm moving with one of the request.

>> DR. LARSON: I can think of some applications, might not be killer applications, but would require gigabit speed one of them is a very personal example. When Dr. Bahlman was talking about the gigabit experience, in my doctoral dissertation, then I later hired a graduate student during my first teaching job who did hundreds of hours of content coding in order to publish my first book, Televisions Window on the World, a ten‑year study of television news. This is a specific application that requires speed. The Vanderbilt television news archives was one of the earliest archives in the world. It's a repository of visual history. This is important not just for the United States, but for Viet Nam, for example, because a lot of that is news coverage of the Vietnam War. It's our history. It's visual. It's video, and it's huge amounts of video. And the library of Congress got involved. Right now I can't download video because I don't have enough speed in the Internet connection, even at KAIST on the Giga network because of the international connections and all of this. So that's ‑‑ I wanted to contribute an example of an app that would require a lot of speed, but would benefit many, many people. Anyone really interested in looking at television news back in the 20th century and as time goes on.

>> MR. RHEE: That brings idea about the compelling reason why we want to have gigabit. Could you state your name and affiliation before starting discussion?

>> I think I bounced. My name is Adam Peak. I work in Tokyo for a research institute called Glocom. I hope it's not too rude a question, but mainly to the incumbent providers. This is a very familiar discussion, finding the killer app felt ten years ago we were thinking what is the killer application. What is the killer application for a hundred megabits. And my suggestion is so long as you keep Giga Internet access and not Giga access, giving principles of openness and so on, my question really is how are you going to deal with the next generation of over the top providers who will be the ones providing killer applications. I don't think it will come from NTT or KT. I mean, history suggests it's no. And so how will you deal with them? They're the ones who will be innovate go over your networks. You'll be upset that they're making lots of money. You're probably going to be upset that they're more prestigious than you. It is an awkward question, but I think it's a truthful question and one that you will have to face. So I'd be interested. Thank you.

>> MR. RHEE: Anyone? Do you have answer to his question?

>> Not my company, it's my humble opinion. Deploying the Giga Internet is just saving time before saturating the network. So the killer application has double meaning while correcting the customer for more higher art. But killer application is more bandwidth, also is a network itself. So the guides somebody says that deploying the Giga Internet we will also want services to getting more money. But I think that the concept of SPNP pays. That's my feeling and then do you have any idea to collect the money from the OTT's?

>> MR. RHEE: Thank you very much for comment.

>> MR. PARK: This is one of the challenges. The smart TV, for example, but the thing is that right now the resources for providing all the bandwidth to even free riders for, for example, but transitioning to Giga Internet does not mean that the minimum bandwidth is also increased. But in order to do that, we have to increase the overall and the infrastructure that will cost huge money. Giga Internet means providing gigabit connectivity interface. So that will keep lot of communities to OTT providers. But we have limited resources. So we have ‑‑ we are ‑‑ we have some reference, some threshold for managing the overall network resources in our infrastructure. And as ‑‑ by this field with all the traffic and if the traffic passing the 70% of the capacity, then you have to increase the number of modes in the backbone side. It cost money. But you still have no additional earning from customers. They pay all the same. And that's the whole dilemma of the telecom companies. In dealing with OTT, if we agree with the fair pricing relationship, then we will give some QS that will guarantee the proper circulation of OTT contents, for example. And that will be one of the good business models that we can think of. Yeah.

>> MR. RHEE: Thank you very much for the comment. So I think because of the time limit, we would like to somehow summarize and wrap up this discussion. Is there any ‑‑ the high level wrap‑up comments from the audience or from the panelists that you want to address? Any other issue? One panel discussion cannot recover all the discussions. We are very ‑‑ even though we have very limited discussions, we have some sort of insights what are the fundamental issues of today for the success of the Giga Internet. So first one was, I think, the Internet. It doesn't matter the Internet in society, it brings a lot of sharing and generation of information, can bring actual, you know, benefits to the society in terms of the human behavior and also the social systems. In this area, for example, one of the examples of work at home environment or smart work environment, it can save a lot of cost in transportation of a society. This area, I think, I'd like to propose that this area may not be just an issue of consumer and also the service provider. This can be more important to the government policy makers, too. So I think this issue we really want to leave this issue to the governance problem of each government.

The second issue, we discuss a lot about the killer application, you know, what application will we really ‑‑ will really need killer speed. And there are not many yet, but, again, there are many suggestions, proposals, including UHD, 8 K video services get together, and also smart work must need a very broad bandwidth to provide a real time interaction over the Internet.

So these ‑‑ this can summarize the second issue. The third one we want to bring up some true business model, especially even though we have OTT service models that they may not be enough to bring the success of the Giga Internet business in the market.

So we probably want to develop more creative service models that can really bring Giga Internet successfully in the narcotic.

One of a comment, Dr. Larson?

>> DR. LARSON: You asked for high level. I think that this whole session today has really illustrated the global scope of this whole question, how different countries, different companies, different groups, are approaching it. In the post‑Dubai era, you mentioned governments. I think it's good for all of us to keep in mind the Internet, one characteristic of it is it's global. It's instantly. You talk about a killer app. If the killer app only works here in Korea, it's not really going to help KT. It's instantly global. And so Dr. Kong's comments, keeping that in a high level, broad perspective. But I've learned a lot and I think this session was quite good.

>> MR. RHEE: Thank you very much for your compliment.

Okay. Any other comments from the audience? Well, if not, then we would like to close the session today. And I thank you very much for the audience for attending this session, and also I'd like to give my deepest thanks to all the session speakers and panelists. Thank you very much.

(Applause)

>> There will be a luncheon for speakers and the guy over there will lead the speakers to the restaurant and we will be moving by car.

(Adjourned)

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