

## **IGF 2015 – João Pessoa**

### **Workshop 188:**

#### **Spectrum allocation: Challenges and opportunities at the edge**

#### **Edited transcript**

Date: 10-November-2015 Time: 11:00 - 12:30

Workshop Organizers: Instituto Nupef, CGI.br, and APC

Chairperson/Moderator: Maximiliano Martinhão, Ministry of Communications, Brazil

Rapporteurs/Note takers: Carlos A. Afonso (Nupef), Vinicius W.O. Santos (NIC.br)

#### **List of Speakers and their institutional affiliations:**

- Catherine Middleton, Ryerson University (Canada)
- Adriano Belisário, Nupef (Brazil)
- Steve Song, Village Telco (USA/South Africa)
- Rodrigo Zerbone, Anatel (Brazil)
- Robert Nelson, FCC (USA) - video
- Gregory Taylor, University of Calgary (Canada)
- Mike Jensen, APC (South Africa)
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- Harold Feld, Public Knowledge (USA)
- Giacomo Mazzone, EBU (Switzerland)

## I. Key issues raised

- Effective use of spectrum in most cities may be around 50% of available/designated spectrum
- New software radio technologies open up relevant possibilities for innovative use of spectrum
- Relevance of enabling local governments, entrepreneurs and communities to deploy new spectrum technologies for networking at local/community/municipality levels
- Regulatory policies on TV white spaces should enable innovative uses of spectrum for data transmission and broadcasting at the edge, enhancing the right to communicate at a local level
- Innovative use of digital TV and digital radio broadcasting at community level — regulatory policies needed to facilitate these initiatives, particularly for non-profit and local government applications
- Optimal combination of fiber backhaul and innovative radio techniques at the edge to universalize and democratize access
- Pilot projects in innovative uses of white spaces at the edge being developed in Brazil with experimental licences from Anatel and support from the Ministry of Communications - relevant as reference practice
- Use of idle bands, or secondary use of spectrum, among techniques viable with cognitive radio technologies; need specific regulatory practices to facilitate these
- VHF/UHF frequencies ideal for long-range applications; deployments in Canada to reach rural communities are relevant references
- Current disputes between telecommunications companies and media companies as reflected in the 2015 ITU World Radio Conference may result in additional barriers for community use of VHF/UHF spectrum bands; need for stronger mobilisation from civil society and other community interest groups
- Protection of spectrum users at local level: privacy rights and surveillance
- Video presentation by Robert Nelson (FCC) - overview of US regulatory policies regarding the transition to digital TV and use of white spaces for local network services.
- Measuring effective use of spectrum at local level, in order to evaluate options for regulatory policies which would improve and expand spectrum usage and enhance prospects for the application of wireless services in developing digital municipalities. Low-cost technical resources exist today for the community itself to carry out this monitoring.
- Seeking regulations and incentive policies regarding innovation at the local level in deploying wireless services, particularly involving innovative use of spectrum (including new technologies, facilitation of secondary use, light-licencing or free limited use of available VHF/UHF channels and so on). In short, flexibility in spectrum access for innovation and digital inclusion at the local level.
- Making sure that disputes involving big players (large telecommunications companies, dominant media companies) for grabbing as much spectrum as possible do not exclude communities to gain access to spectrum for innovation, digital inclusion, and local services.
- Importance of organized civil society (together with technical community) presence in regulatory policy formulation and decision-making: proactively advocating for

(and getting involved in) multistakeholder processes regarding these issues.

## II. Statements

### *Maximiliano Martinh o*

It's a pleasure to be here. And I thank the organizers for the invitation.

I used to be a national spectrum manager here in Brazil. And from my experience, it's a job that has some difficulties, but I understand that spectrum is an important tool to deal with. One of the concerns of this IGF, that is connecting the next billion. I believe spectrum can play an important role in helping us to find intelligent ways to connecting the next billion people with the Internet.

Today we see a lot of different and interesting ways to use spectrum and have people connected to the Internet. We can have, of course, the mobile networks, here in Brazil we have over 200 million access to the Internet that is done by mobile networks. But still, even though we have a huge coverage of mobile networks, mobile access in Brazil, we have half of the population without Internet access, even though we have a huge number of Mobile Broadband systems users.

And we see other technologies, such as satellites, and we used to consider the use of spectrum with satellites, but now we see lower satellites, more and more known geosatellites, orbits, being planned to provide broadband services. We see HAPS, that is the high altitude platform services. We have seen UAVs, on manning the aircrafts, and we see balloons. Okay, let's launch a balloon and a balloon will have a transmitter that will provide Internet for the people. And all of this puts pressure in the use of spectrum.

In order to have all the system working well, there is one term that we apply here in Brazil, and in reading our law, our telecommunications law, it is the efficient use of radio spectrum. And here in Brazil we have a Regulation for that. We try to look at those systems that are using the radio spectrum and see if they are using the spectrum efficiently. We have a kind of a map ? that we use to define this – a map that defines if the system is used efficient or not.

But nevertheless, even with that, here in Brazil, if you look at the mobile spectrum, we have around 50 percent of our cities where only a small part of the spectrum is being used. So there is still blank in the spectrum. So, in 50 percent of the cities, only 50 percent of the spectrum that is allocated for mobile usage is being used.

And this brings to my attention one technology that is quite interesting, which is called cognitive radio and white space, that brings opportunities for a more efficient use of the spectrum.

And let's imagine a technology that could automatically and dynamically identify radio frequencies that are available, and not being used. Transmitting it without interfering with other services, other radiocommunication services. From my experience, that would be a dream. And that would democratize the use of the spectrum, it would make it easier for companies and people to use the spectrum and in our case, to provide one of our priorities, which is Internet access.

This technology is not new. The system is not new. I've been following this technology, white space radio technologies since 2007. I was in the United States in 2010, looking into this technology. And recently I received a colleague that participated in a trip to the United States to deal with this technology, and I asked him, okay, we discussed white space cognitive radio in 2010. Here we are five years later, so what's happened to this technology? How can I say that? Because not much is happening in this area. So there is still a need to progress with the technology in order to make it useful.

So today our dialogue will deal with the use of the spectrum. So I think what is important for us in our discussions is to answer some questions such as: are there new technologies that can provide more efficient and equitable use of the spectrum? The existing spectrum that is being used, is it being used efficiently?

What are the opportunities and challenges for the use of the spectrum, particularly on the transition from analog to digital TV? And how the regulatory process might help and stimulate the spectrum use by local entrepreneurs, communities, and local Governments. So I would like to start our conversation. And the first one to start is Catherine Middleton.

### ***Catherine Middleton***

Good. Thank you. So I'll give a Canadian example. I want to thank Carlos and CGI Brazil for bringing us here. I want to talk about the possibility for innovation through TV white spaces and the reality in Canada where nothing has happened yet, consistent with what you just said. What we see is the Canadian market, just to give you a context, it's a developed market, mature mobile market. We have good quality mobile. 93 percent coverage of LTE, fourth generation mobile.

There are three dominant mobile carriers. But our Mobile Broadband uptake is really low. So when people look at the numbers of the statistics they are surprised of the numbers. We lag behind Brazil, Australia, UK, U.S. And many other cases, but it's lower than you would expect. And we have the most expensive broadband in the OECD – the most expensive Mobile Broadband, that is looking specifically at stand-alone services for two gigs of data. We have the most expensive quadruple play services. So here is a country where there is a good quality service but not as much competition as you think there'd might be. So in many ways, it's a market that is ripe, and ready for some jolt to the system. Some form of competition that is going to come from outside the existing mobile ecosystem. And ideally that should be something that the development of TV white spaces could provide. But we're not seeing that yet.

We do see increasingly that - when you look at what Canadians do on their mobile device -, we are moving to over the top services as is true in most places. So much of what you get when you buy a package from a mobile carrier, you don't use. You are not using the SMS anymore or not as much or the voice services. So there is really this question: how could we provide a service that meets the needs for many, many Canadians, that is based on a data service, and that ideally would come from a different business model than what we're seeing at the moment.

That said, at present, only 3 percent of the revenue in the mobile sector is coming from

stand-alone data services. So there is very little provision of access to Mobile Broadband that is done only as a Mobile Broadband service. So it does seem that there are real opportunities for different approaches.

Our Government, the Canadian Federal Government has been trying, since 2007, to increase competition in the wireless market. In 2007, they did say that the first step was to try to bring in new wireless carriers. There was an auction of spectrum in 2008, where a significant portion of the spectrum was set aside for new entrants. We did see a number of new spectrum entrants in that auction in 2008. But fast forward to 2014, and those new providers have actually had very little traction in the market. They have not really been able to get customers on to their services. Although they have got now 64 percent of the Canadian population and have the possibility of moving to a new provider, they haven't done so. Only 6 percent of the Canadian market has actually moved on to the alternative providers, and that is in the licensed spectrum realm.

So it's difficult to get people to move out of the existing ecosystem. So if we look at the standard mobile telephone operator system, we need to look at television white spaces. In 2011, the Canadian Government launched a consultation on television white spaces. In 2012 they issued the frame work. At the time, they said access to spectrum was identified as one of the challenges facing CANADA. They said CANADA is working on this progress.

So they have said there was progress since 2012 by putting a programme into place, but the reality of ISIF now in 2015 is that we don't actually have anything that is being launched as yet. There is not a database available so it's not yet possible for any operator or anybody to come along and launch a service in that space.

So just to think about this as a very brief case study, what we have is a market where I think there really is a demand for alternatives, where we have had very high prices, we haven't had much competition, where television white spaces are seen as a potential solution to this. When you go back and look at documents, they talk extensively about the potential value, the innovation, the opportunity for communities and others to be involved just as we have been talking about and we will talk about in the panel but the reality is that we're not there yet.

So just to conclude, one of the questions that I hope we will engage with is, what can we do to move things along? What can we do to encourage the speeding up of the regulatory process, but also once we are there, how can we get consumers to move on to these services? And I'll stop there.

***Adriano Belisário***

Good morning, I would like to thank CGI for the invitation. At the same time, it's a great pleasure and a double challenge for me to be here. I've been studying some technopolitical aspects of spectrum usage, but I am far from being an expert in this subject. And - as we know - there are many different positions regarding the spectrum in civil society. So I will not to represent all civil society, but just try to present some ideas about questions raised by this workshop. I must also thanks Rafael Diniz, Diego Vincetin, Thiago Novaes and Paulo Lara. In different ways, they collaborated with this presentation.

Despite still praised as a horizontal media, we know that the Internet has a big concentration of economic and political power in the hands of a few companies and governments. So one big question to ask here is: how to connect the next billion? On one hand, we have companies like Google, trying to [quotes from Google Spectrum Database website] "make more spectrum available for broadband Internet access". On the other hand, we can mention the Baobaxia network of Rede Mocambos from Brazil and some mesh networks initiatives, which are creating digital networks independent from the Internet, but synchronizable with it.

But - beyond these two sides - it is also important to remember that digital convergence doesn't mean replacing all medias for the Internet. It is a mistake to concentrate all the efforts in developing more democratic medias just on the Internet, ignoring the struggle for democratizing broadcast communications or other spectrum uses. In this way, the opportunities arising from digitalization of radio and TV transmissions must include the very democratization of these medias, making the technical possibility to transmit hypermedia applications and the availability of more channels a political opportunity for civil society.

The Internet is based on protocols, researches and technologies developed almost half a century ago. When the Internet Protocol was created, it was impossible to predict all the platforms and applications that are running over it today. Thinking about the emergence of cognitive radio and the spectrum use by civil society, maybe we are now in a similar moment. Currently, we don't know what technologies and devices can arise in the next decades from approaches based on software defined radios. But it is an important historical task to stop the process of spectrum privatization and create technological and institutional protocols that ensures a free spectrum.

So, when we talk about free spectrum, we are also dealing with challenges concerning the use of this resource to broadcast transmissions or comunitary mobile phone networks too, not only to provide Internet access. An interesting example of new possibilities of spectrum uses is a Finnish initiative called Kryptoradio, which use Digital Video Broadcasting to transmit the blockchain of bitcoin transactions. As one of the Bitcoin developers said, "alternative blockchain transports are critical to the success and survivability of the Bitcoin system". They are also thinking the spectrum beyond the Internet.

At first glance, one common mistake around 'Free Spectrum' is grasping this idea as deregulation, when it is precisely the opposite. The Free Spectrum advocacy is a struggle for another regulation, based on spectrum sharing and the civil society role. The ISM bands are too small for us. We want frequency bands for unlicensed and non-commercial use in all parts of radio spectrum used for telecommunications. For too much time, the civil society protagonism on autonomous usage of spectrum survived only thanks to initiatives of free and community radios, TVs and amateur radio operators. Now, with the proliferation of wireless technologies and the possibilities created by the digital radio and TV, things have changed.

In a brief article about Open Spectrum, Aaron Swartz criticized the paradigm based on the scarcity of spectrum, pointing to the idea of a "radio Internet" - something completely different from provide Internet access via radio. He said: "On the Internet, you don't need anyone's permission to talk, you just need an Internet connection. The same is true with

this radio Internet, you just start sending your messages to your neighbors, and they pass them on. [...] We need to define the tools for a cooperative radio Internet. Just as Internet Protocol (IP) brought various networks together into the Internet, we need the same tools that will bring the various spectrum bands into a radio Internet.”

Despite of this, the idea of 'Open Spectrum' sometimes relies on market driven approaches that look for this resource only as a business opportunity. The idea here is that the development of new technologies makes the spectrum management by the State inefficient. One of the supporters of 'Open Spectrum', Eli Noam claims that “it will not be long, historically speaking, before spectrum auctions may become technological obsolete, economically inefficient and legally unconstitutional”. His suggestion is to deal with spectrum as an open resource - not free, he emphasizes. Without exclusive private property, all the frequencies could be used by everyone at any time. In this scenario, algorithms would determine the price for it, based on the demand for each frequency. Here, the concept of 'Open' at 'Open Spectrum' is similar to Open Markets. The main idea of Eli Noam is precisely “bring the invisible hand to the invisible resource”.

Obviously, 'open spectrum' refers to a wide range of different notions about spectrum management. Some of them can share some assumptions with the concept of 'free spectrum', such as questioning of spectrum scarcity. They also can highlight the benefits of unlicensed use of the spectrum for technological innovation and the democratization of communication. However, even though they look similar, I think that there are some fundamental differences about these different approaches that deserve our attention. Recovering the classical definition of free software, Free Spectrum refers to free as in "freedom of speech", not as in "free markets". And – in fact - amplifying the unlicensed and noncommercial use of spectrum is a crucial challenge for the freedom of speech in our century.

### ***Steve Song***

I'm with the Policy Startup Centre and I run a social enterprise called Village Telco, which manufactures low cost devices for voice and data. I want to tell you three things. Psychologists say you can only get people to remember three things in any talk. So the first one is acknowledging that we have a problem. There is a huge problem in spectrum management in terms of access right now. And I want to illustrate that. All of my experience is in sub-Saharan Africa, so I'll draw on those examples. In 2006 they engaged in the digital switch over – switching from analog to digital. And it was expected that that process would be complete by earlier this year, June 2015.

And I think it's worth considering all of the things that didn't exist in 2006. The smartphone had not been invented. The tablet had not been invented. Broadband as we know it now largely did not exist. Interestingly, Netflix which I think you are familiar with, did exist but their media delivery service was the U.S. Postal service. So that decision was taken in a world that almost seems alien to us now in terms of technological access. And indeed in Africa we see many of its switch over processes in crises that are recognized that it's likely that the investments made in digital will not be recouped in terms of the revenue derived from the networks, and we see the launch of other services that will take over.

So in terms of managing a chunk of spectrum – in this case between 350 and 800 MHz, we



have a process that is simply inadequate to the task. And also, as demand has increased for spectrum, what people are willing to pay for it has gone up dramatically. I think the spectrum options we've seen recently in India, something like 17 or 18 billion dollars just for the right to participate in that market.

And that reminded me, as I was reading an article about Über in New York City, I was reminded of the taxi industry in New York City. And this brings me to my second point. Which I wanted to emphasize, is that software is going to eat this problem. And I want to illustrate it by talking about the taxi industry. So in New York City, as the taxis evolved as an economic force in New York, the City of New York created a Commission that gave licenses called Medallion for taxis to operate in New York City. Over time, as they became more lucrative, the demand for those licenses went up. Until as little as just a few years ago, a Medallion to operate a taxi in nooshing city was about a half a million dollars.

And I think we all know that Über has sort of radically changed that market to the point where taxi medallions which are in many ways similar to a spectrum license that, they create a scarcity in the market was overturned in a matter of two years, really, by Über. And I think it doesn't really matter how you feel about Über, you know, in that I think we can all recognize that there have been huge efficiencies brought by bringing software to the management of taxis, that at the same time there are significant down sides, social and economic down sides, that we haven't figured out how to deal with in terms of income stability, in terms of how you treat workers in the so-called shared economy.

And the point I want to make sure is that software is coming for spectrum management. You can either wait for it to be Überized or as a regulator you can seek to manage the process and do it in a way where we maximize the benefits of software solutions to this problem, not to solve it, but to change it and hopefully make it a great deal more efficient.

The third and last point I want to make is the reason why this is important particularly in sub Saharan Africa, where there is the arrival of fiber. As undersea cables came to the shores of sub Saharan African countries, there is a sparking in infrastructure and now metropolitan fiber networks. Historically in order to build a network you had to be responsible for the massive investment that included an International backhaul, building national backhaul networks and the last mile. It was an investment involving billions of dollars. Now with the fiber networks, we have the possibility for small entrepreneurs to use unlicensed spectrum and other forms of spectrum management that we haven't invented yet. But we need a regime that is going to enable both entrepreneurs and communities to solve their own access problem, because that possibility exists now.

### ***Rodrigo Zerbone***

I'm Rodrigo Zerbone from Anatel here in Brazil. And I would like to say that Brazil is currently in the final stage of the switch over from analog to digital TV. We begin this year with a pilot city, Rio Verde, and we are expecting to end this process in 2018. The analog switch off really is of course the spectrum of the 700 MHz band for use in Mobile Broadband services. And the Telecom spectrum auction in 2014 and four mobile service providers have secured blocks of frequencies to provide services in 700 MHz.

These frequencies will only be available of course after the switch off. Due to the excellent

propagation characteristics in this band, extended coverage can be achieved by broadband service providers. As a result, there will be significant growth in broadband coverage and capacity in Brazil. We are expecting this. This of course is like – lists licensed use of UHF spectrum. But additionally, there is of course this, we are discussing it, this potential for unlicensed use of UHF spectrum. The recent advances in white space technology have allowed the development of equipment and devices and the widespread availability of geo-location for services.

Currently, the Minister of Communication and Anatel are participating together in areas in order to develop different access of the TV white space technology. Anatel granted a license for experimental use of a percentage of the UHF frequency band in order to become a viable experimenter. Additionally, Anatel has recently, which is very important for the development of this market in Brazil, deployed a new spectrum management system and database that contains all relevant information for planning, licensing, and monitoring spectrum users in Brazil by Telecom operators and broadcasters. This is the – the system is fully operational and provides information on existing infrastructure and the spectrum use.

Of course, this will give a good level of protection, too, for the primary use and provide a level of information that is very important to develop white spaces operation here in Brazil. Finally, Anatel is currently in the process of updating the existing Regulation for radio frequency spectrum use. A station was conducted in 2014 and the proposed new Regulation is under review by the technical areas at Anatel. A decision by the board of Anatel is expected for early 2016.

All these elements that we will show the barriers the spectrum is facing. Of course, we are expecting that Civil Society and operators can bring us some other inputs. In radio frequency bands that have been allocated to a primary use, there will be the possibility of allocating the same band with some protection for the secondary use. This will be the case when the primary use has not initiated services within a predetermined time period. A user who has been granted frequency bands for the provision of one's services is entitled to request to provide any other services to reach the band it has been allocated.

Clarifications on the distinction between cases in which there is a requirement for a previous request from interested buyers is needed, so that before a frequency band is granted to a user , it is clear the cases where there is no such requirements. Of course, all of this is under public consultation and we are happy to have some more inputs regarding the barriers of spectrum. Thank you.

***Robert Nelson (video presentation)***

Good day, my name is Robert Nelson. Thank you for the opportunity to speak with you of the possibilities brought forth by the digital dividend. I want to indicate through our usual disclaimer that my comments don't necessarily represent the views of the Federal Communications Commission. But I want to give you an idea of the direction the Commission may be going in these areas.

Firstly, I would like to provide some insight into how the FCC has been making progress in regard to the digital dividend. This chart shows all of the TV channels that existed in the United States as late as June 2009. The UHF spectrum in the US 69 channels, or 470 to 806

MHz. In 2009, it had analog TV as well as transitional DT/V stations. You'll note that I divide the spectrum into three rows. The top row are channels 14 through 29. Which are likely at this time to maintain TV broadcast. The bottom row are channels that after the original transition have become 700 MHz wireless band with commercial and public safety use.

The middle row is the next step in consolidation involving our incentive auction. Depending on the outcome of the auction, these channels may be used for either wireless or broadcast. Please note that channel 37 is reserved for radio astronomy and medical devices in the United States. I will now go into detail on 700 MHz and the incentive auction.

First, the original DTV transition freed up 108 MHz of spectrum. Congress gave us direction on its intent for allocation in the band, and a portion of the spectrum was designated for public safety use. In the commercial blocks, 74 MHz was assigned through our auction. This brought in 19 billion U.S. Dollars.

Since that time, those commercial carriers have used this spectrum in their development of LTE. And, it's one of the reasons we have such widespread provision of LTE in the United States today. The public safety spectrum included a portion that was designated for a broadband nationwide network, which we call first net. In addition, we authorized the use of white space devices on those TV channels that would not cause interference to local broadcasters.

This chart should provide you with an idea of the companies who are currently licensed and using the 700 MHz spectrum. Once the broadcasters have cleared this spectrum as a result of the transition, it was pretty much a green field for the wireless entities to build out from. This allowed for rapid deployment of 4G services by those carriers.

The band plan we used is the North American band plan and 3GPP as designations for those bands. Bands 12, 13, 14 and 17 for those of you familiar with band designations. The first net public safety band is also a 3GPP designated band 14. We have in this band, narrow band public safety channels utilized by both local first responders. The first channel comprises about two-thirds of the designated spectrum for public safety.

After completion of the 700 MHz transition it became clear that more was necessary for broadband. The Commission issued a national broadband plan which you can find at [www.broadband.gov](http://www.broadband.gov). Calling for an additional 500 MHz of spectrum over the next ten years. Congress also authorized the Commission in 2012 spectrum to hold incentive auctions, including with the TV broadcast bands.

An incentive option offers the broadcaster the opportunity to turn in their license or move to VHF for compensation. I would point out that participation in the auction is voluntary. If a broadcaster does not wish to participate it does not have to, and it's up for the FCC to find a place for that station, when we, and I'll use a term that we use, when we "Repack" the spectrum. As I mentioned participation is voluntary. The process has two major steps. A backward auction where the broadcaster offers to go off the air or move to VHF at a price. And a standard forward option where the wireless company purchases the spectrum for use. The total offer must exceed the current offer price by the broadcasters for the auction to close. The offered value of the spectrum may change depending on the need for the TV

spatial spectrum or the need for the wireless entity. Thus the part marketplace means of spectrum repurchasing. If we have a surplus or TV stations or not enough money is being offered by the wireless entities. Then the broadcasters may be offered a lower price which they don't have to accept. The band plan may be reduced, and then we continue the process. The process continues until the proceeds exceed the resellers' auction payments.

Again we have several goals in the auction, which include preserving broadcast service for the non-participants, making sure that we meet Congress's objectives. And that proceeds exceed reverse auction payments. Also, we have created a launch pad for new wireless networks. This is a unique opportunity for broadcasters. As it offers them the possibility of some very good return. It also allows us the ability to gain some valuable wireless spectrum.

Now, I noted that the resulting spectrum allocation depends on the results of the auction in primary participation. The band plans or possible outcomes of the auction if there is very high participation, there could be up to 126 MHz of spectrum for wireless coming out of the auction. If market forces result in a smaller plan, they are also shown here. I would point out that guard bands will likely be used for such things as unlicensed devices and we will continue to allow white space devices where possible. We will continue to set aside the former channel 37 for radio astronomy and medical devices.

As I speak with you today, we currently have staff at the World Radio Conference [WRC] in Geneva, looking at additional bands for broadband. This means that we believe that if countries wish to maintain their current use of these bands, they should be able to do so. However, if countries wish to advance Mobile Broadband in these areas, the opportunity should be provided consistently to their domestic priorities.

I hope my presentation has provided you with some insight into the direction we are heading here in the United States. And provide some fuel for your upcoming discussions.

### *Gregory Taylor*

This is a good time to follow the United States when talking about band plan issues, because that's what Canada does largely. So for today I want to look at a unique start we have in Canada right now that has to do with white space development. And I'm not sure how exactly I'm to point this out.

Remote rural broadband is something that has been developed in Canada within the last few years. I'm going to be taking a look at why this is necessary, what it is, and basically the successes or lack thereof thus far in Canada.

Like Brazil, Canada has a history of trying to reach out to the rural areas. Canada like Brazil, is a large country. There is always, with every new development and technology, a struggle of how do we get to the rural areas? And not so much the small communities, but the small rural areas of Canada.

I'll not go through all of these different moments over the last ten years, except to say Canada has had about 10 to 12 Federal initiatives to try to bring broadband to rural parts of the country. It's been going on for over ten years, and most recently with the launch of

Canada digital 150, a 25 page document was produced about connecting Canadians with the country and exploiting economic opportunities. The key platform of that was connecting rural Canada. So this remains a major issue for Canadians.

Canadians living in large centres have access to broadband speeds of about 50 Mbit/s and up to 99 Mbit/s, but only 25 percent of Canadians in rural areas can access these speeds.

This chart is from our regulator, the Canadian radio television communication Commission. If you look up there, the grayish color notes that when you are starting up at slow speeds, rural Canada is almost as strong as urban centres in Canada. And then it drops very quickly as you move up into the higher speeds, the column on the right being rural Canada. As the speeds go up, rural Canada drops off extremely quickly.

So this is a problem not that there is no broadband, but the quality of broadband that is available in some of these areas.

So Canada came up with a policy called remote rural broadband systems, and this had a long gestation period. But the formal announcement came in 2011. It's a fixed wireless station that offers fixed service and operates in the five, 12 to 600 MHz and 614 to 698 MHz bands. This was recognizing that Canada was going through the digital television transition, 700 MHz was not going to be offered because it went to licensed providers. RRBS is what is called a secondary service. It must not cause interference. There is no protection given to these licenses. And licenses are renewed annually. So the licenses are distributed on a first come, first served basis. They are using the television white space in rural areas where Canada does not have a strong over the air television presence. Which is most of Canada. Over the air television in Canada is not widely used. It's used by approximately 10 percent of the population. And when you get into rural parts of Canada, the range in the 600 MHz set aside for over the air television is largely vacant. So this spectrum sits unused in most parts of Canada. So this was a Federal Government initiative to try to bring some development, some use to this really prime part of the spectrum in Canada.

So as far as defining it, what is rural? Well, a hundred thousand people living within 50 kilometer radius. How do you define rural? Small communities in Canada are generally able to get wired service, the rural areas less so. So part of the problem was defining rural.

So why is it necessary? Well, Canada lags behind in urban centres and high speed deployment. Fixed, what is it? It's TV white space, secondary to broadcasting and licensed annually. Now to take a look at where it is, this is a map outlining where remote rural broadband systems, that existed in Canada in 2014. You can see they are mostly in the west. Also, they are mostly near the northern parts and near areas where there are obviously very small population centres. What we are really in the beginning of trying to figure out is the next part, and this is that a year later, and here we are a year after that. And 40% - this is 2015 now -, 40% of the remote rural broadband systems have ceased to operate.

So something happened in the early stage of offering this new system where 40 percent of the providers stopped providing services. And we believe that most of it can be attributed to the fact that right now they're looking to reassess the 600 MHz band in Canada, and this is

precisely because of what is happening in the United States, as Robert Nelson just said to us. They are reprogramming the 600 MHz. Canada is now waiting to see what is happening in the United States. And in doing so, they have frozen any new licenses for remote rural broadband in Canada, and they cannot modify or grow their systems at all. Right now there is a freeze. And it's a brand new industry and right now 40% of the brand new industry stopped providing services.

They have no protection, it has re-purposed 600 MHz of spectrum, and in the end Canada has to follow what happens in the US 600 MHz plan. To say that it's a North American band plan on the 700 MHz isn't quite true. Canada follows along with that band plan but not necessarily other countries: Mexico does not use the same 700 MHz band plan.

So this is it. It's how the system works in Canada. And we have spoken to a couple of providers, and one of the points that came out is that if they change frequencies, it severely impacts small providers. They would have to go to each of their customers. They measure their customers in hundreds. Not thousands, not tens of thousand, but hundreds of customers. They have been quite clear that if they change the spectrum that they have been given, that will put them out of business. They need good spectrum in order to get through coverage in parts of rural Canada. So two things are slowing the development. The uncertainty of the long-term availability of the spectrum, annual licenses make for a difficult business model. And, two, the spectrum being a tier 2 license and subject to being overturned by a broadcasting station. There is no security. It's hard to operate with such little security in this area. So it's a new initiative that Canada is using in providing for rural areas. It's using white space. But it has only had a mixed success.

This is also from a provider who said we are using very basic features and we would like to develop it further. But uncertainty of usable spectrum cools down development. So we have an example of a new initiative in white space. Which has real potential. But it hasn't really been given the opportunity to develop and I think it's one that provides a template that other countries might find useful as well.

### ***Mike Jensen***

Thank you. It's Mike Jensen here from the Association for Progressive Communications. We are an association of NGOs from around the world, focusing on improving Internet access from a Developing Country perspective. The first point to make is that there is no real 'one size fits all' strategy with regard to developing a national spectrum strategy.

We can't really adopt one particular model, where for example, in North America or Europe, most houses have either cable TV or don't use over the air broadcasting or have 99 percent penetration of residential broadband, while in some Developing Countries there is almost no fixed line infrastructure and very little broadcasting especially outside of the major urban centres. So the environments are very different and we have to be careful about thinking that there is a single global strategy with regard to how we move forward in the spectrum area.

TV white space has huge potential in Developing Countries for meeting connectivity needs and we have seen that tests in even the most densely used areas of the broadcasting spectrum in Africa, such as in Cape Town (due to the mountainous topography and the

advanced broadcasting industry) that the TV white space use had no interference with broadcasting services. As we move into other parts of Africa, virtually none of the broadcasting spectrum is used in rural areas, except perhaps in some cases for some of the national broadcasters.

APC is particularly concerned about the vested interests in old technologies, in old business systems and in old ways of doing things which are slowing down the innovative use of spectrum such as TV white space.

We are seeing mobile telecom operators using control over spectrum access as a way of maintaining their franchise and limiting efforts to use spectrum more efficiently, saying that we don't need TV white space because Mobile Broadband is the only solution we need to provide connectivity to the next billion.

Similarly, we see many regulators still focused on the old way of doing things. For example, now after four years of preparation, a whole month is currently being spent in Geneva at the ITU World Radio Conference, where people spend days haggling over just 50 kilohertz of spectrum. This is clearly not an efficient use of human resources when software can do a much better job of this.

Similarly, we need to anticipate to what extent we really need spectrum for broadcasting in the future. Clearly they are needed right now, but when we look at incredible switchover in North America and Europe and parts of Asia, and even in parts of Africa where there is good broadband, people are using broadband services for accessing traditional broadcast content. So we have to think about where things are going in the future, even though we might not be there just yet.

### *Veridiana Alimonti*

Spectrum has been a public and crucial resource to communication since the radio era. Since the introduction of radio, it was discussed its potential to amplify communication between people. Regulatory choices and constraints can now be changed with information digitalization and technologies, such as cognitive radios which have considerably limited this potential, but during the last decades we developed new information and communication technologies based on Internet and on the context of information digitalization that brings more and more to the reality these 1930's dreams.

Regarding Internet, this communication potencial will only be for everyone if we overcome the challenge of unrestricted and universal Internet access. At the same time, to efectively serve to empower people and communities, it must be driven by public interest, with a broad social participation.

Internet Access – again, it is here the centrality of spectrum allocation. An important part of the persistent digital divide, that opens room for distorted solutions as zero rating and the app Free Basics (part of the Internet.org Project), could be overcome with a more democratic spectrum allocation. MOBILE ACCESS IN BRAZIL (low data caps). In rural areas the situation is worse, and the politics quite insufficient, with really poor coverage. In Brazil, the spectrum allocation to mobile services has privileged the main companies, without adopting a standard to reserve portions of the allocated spectrum for Public Power

use (directed to policies implementation) or a larger subdivision in order to make the licenses more accessible to smaller providers. A different vision was recently applied by Anatel (our Telecom regulatory body) when approved the notice for bidding the remains of the 1.8, 1.9 and 2.5 GHz bands, for the provision of fixed and mobile broadband, in some cases selling the frequencies by municipalities to encourage the entry of smaller providers.

However, this initiative raises another issue: the non-use or under-use of a significant part of these frequencies. (Maximiliano) In 50% of the Brazilian cities, 50% of the spectrum is being used. We need to advance on the secondary use of radio frequencies, taking into account cognitive radio technologies. In Brazil, we are discussing a new Regulation on Restricted Radiation, with the proposal to remove the licensing need for the provision of broadband by small providers through restricted radiation radiocommunications equipments.

It is an interesting initiative, but some civil society organizations consider that other bands should be included as well as the regulation on the use of non-licensed bandwidth should stimulate, and even prioritize, non-profit initiatives or the direct state provision in the context of public policies.

Finally, but not less important, as Adriano said the digitalization of information and cognitive radio technology allows us to move forward in the democratization of the use of the spectrum also for other services, with its unlicensed use or with light licenses for community use in more traditional services of communication, such as radio and television.

### ***Harold Feld***

I'm with an NGO called Public Knowledge. I've been involved in spectrum policy in the public interest for going on 20 years now. Rather than stating my agreement with many of the comments that were made by my colleagues, let me talk briefly about the challenges for Civil Society in participating in spectrum policy.

Because the stakes are so incredibly valuable right now, I would like to point out that one of the problems that we often have is people don't notice what is going on. We talk about caring about serving rural, I can tell you that people who think nothing is happening in white spaces in the United States are unaware that through unlicensed spectrum we are now serving perhaps about 5 million of the most rural inhabitants in the United States. Many of those with providers, wireless ISP providers are supplementing with first generation fixed white spaces equipment. As you would expect, particularly with a regulatory overhang from the upcoming spectrum auction of broadcast space, the deployment is doing a lot of things. There are issues. People are learning from them. And the next-generation presuming that regulators don't pull the plug on it will be dramatically improved.

And this is one example in things of what we are talking about in terms of licensed exempt spectrum. There is enormous possibility here. We are at a stage where technology at least is catching up to things that we envisioned 10 or 15 years ago as possibility, and the regulatory sphere, while still very closed, is starting to shift.



As I sometimes say, I am the beneficiary of people who worked in this before me who managed to turn hard rock into something close to slowly flowing magma. And I'm hoping that we will be able to accelerate that pace of change from maybe slowly flowing magma to something flowing like faster flowing magma sometime soon.

The issues for Civil Society are first of all, and it's important to understand that there is an enormous ramp up of expertise within Civil Society that has to take place. This is an issue that takes a long time to get into the details and the details matter. That is very frustrating to people, particularly to funders. Who are looking for results. Vint Cerf pointed out in a panel earlier, that it was ten years from the time when they wrote the first paper on the Internet to have ten years until there was an Internet connection and ten years after that before there was a www. We are not giving that much time in Civil Society to describe things.

We need representation in the ITU processes, particularly the World Radio Conference and standards bodies because these are the places where we will achieve harmonization and gains of scale which drive the low cost. WiFi has become so exciting as a means of deployment, precisely because there is an International standard. It has been widely adopted. It drove down costs, WRC is important in harmonizing the band plans. It's dominated by the license carriers and broadcaster, and a Civil Society presence is surely needed there to raise issues that are not directly translated into business plans. Similarly, we need to change the mentality of regulators. We're not changing anybody's idea about anything, it takes a long time and most of what we thought we knew about spectrum and spectrum policy turns out to be utter completely and catastrophically wrong. We don't need to limit the number of people that use the public airwaves in order to prevent interference, now we have software that is better than that, than regulators. We don't need to have auctions to allocate resource. But the lure of that revenue is powerful for regulators, for local Government, for national Governments, and the fact that it assists the wealthiest interest is part of what formulates that dynamic.

Only a strong Civil Society presence well versed in both the technical arguments, the economic arguments, and the use cases that are proving successful can outweigh these issues.

I do not want to pretend that if we don't get it right in the next few years that we will never have another chance. After all, we have a chance now with unlicensed spectrum to correct the mistakes of the last century. But to get that second chance took a hundred years. And I'd like us to not plow it this time around, particularly when in so much of the world there is so much green field in spectrum that if we can actually get the policy, which should be the easy part, right, the technology and the economics follow simply from that.

### ***Giacomo Mazzone***

I'm Giacomo Mazzone, representing here the European Broadcasting Union and your question is a complex one. We have among our members state broadcasters, civil society and commercial enterprises. So I leave to you the interpretation. What I want to say is that simply I'm here escaping briefly from the World Radio Conference, which was mentioned many times today, because the Conference started last week and will end the the end of the month in November. This conference will change a lot in the Regulation, because from now

on until 2018, there will be no more conference of this kind very probably to discuss about the use of the spectrum. And there are some important things that are happening that are behind closed doors. Even for the delegates. Some of the things are happening by negotiation and by interference by Governments.

As you probably know, all the regions except one arrived to the conference saying that there will be no change in the broadcasting spectrum, for instance, and in other kinds of spectrum band C which is used for satellite communication, for instance. And then once the Conference started, some Governments started to call a delegation or they called the capital, asking to change the position of the Delegation. Notably, this is the position of the U.S. That is lobbying intensively on many other countries, asking them to change their positions. What is going on is that there are requests for lowering the spectrum for broadcasting beyond 600. So going to 400. Not only for region 1, North America, but also for the rest of region 1 and all the others. And also there is a request for getting space from the band C that is used for satellite.

The day that I left Geneva where we were discussing, there were all the satellite, European space agencies that were desperate, because at the moment the telecom operators may get their bandwidth, and as for satellite research, for instance, their bandwidth might have been used for mobile services.

So this is a problem. All the spectrum is going to be auctioned and it will be attributed only on purely economic and financial basis. As you probably know, Obama, in the agreement that we made with the Republican majority in the Congress, won this point, it's surprising the agreement between the President of the US and the main opposition party that rules the chambers, is that he is obliged to sell, to put on auction all -- most of the part of the spectrum that is used for public use in the US over the coming years.

Why? I think that there is a deliberate will to transform the spectrum in purely an economic and business oriented activity, where public interest, public goods and public services have no space at all. So the white space exists for the broadcasting space, if that part of the spectrum is used for broadcasting. But if it's used for mobile, the white space doesn't exist anymore.

So I wonder if in the future we will still have to discuss about these kinds of things. The main problem is that if we don't change the general attitude that the spectrum is a common good and needs to be preserved for the general interest, there will be no more kind of discussion.

### III. Dialogue

**Maximiliano Martinhão** – What is funny is that in the WRC there were some booths in the conference center. And EBU has a booth. There is also the satellite association with the booth. And they are both in front of the GSMA booth. And the GSMA booth displays “the spectrum is for all”, but they are trying to take over the broadcast piece of the spectrum, as you just said.

**Thiago Novaes** – I'm a researcher, collaborating with Instituto Nupef. I would like to defend that we ensure spectrum space for communities and the public interest. I would like to know what you think about the recommendation of the UN, which suggests spectrum splitting. This has been discussed in Latin America: something like one-third for government, one-third for community applications, one-third for the market. As United Nations' recommendation and as possibly the best way to ensure that communities will have the possibility to develop their communications, what do you all think about reserving a portion of the spectrum (a common good) for community applications?

**Lucas Teixeira** – I work for a civil society organization, Coding Rights. We work mainly with surveillance and privacy issues. And I would like to ask if there are considerations and discussions regarding surveillance. As you may know, the UN Rapporteur for Freedom of Expression, David Kaye, emphasizes the importance of cryptography for Freedom of Expression. Also, the IETF is now having privacy considerations in each of the documents that they produce about standards. And I'd like to know how this subject is being approached by the spectrum discussions and community.

**Maximiliano Martinhão** – What I would like to propose for our table is to address the issues that were raised during our dialogue. And I would like to summarize some points and bear in mind that I may have some problems in understanding some of the points that were raised. But Catherine made a point that we need to speed up access to spectrum. And that was one of the points raised by the civil society representatives, Adriano and Veridiana. And it was also mentioned the need to open the spectrum, as was suggested by Adriano. Harold mentioned spectrum licensing – I can tell you, Harold, unlicensed spectrum in Brazil allows for at least 4,000 different ISPs providing services across the country. So it's a very interesting way that spectrum has been used, as I mentioned before, to have more people accessing the Internet. Unlicensed spectrum is a very important piece of this discussion. Steve mentioned the technology that will bring new stages in the spectrum management. Mike mentioned, also, the opportunity for using white spaces in rural areas, and Gregory also had an example from Canada raising a new way to approach the spectrum in rural areas. But when our regulators' colleagues (and I myself, I'm a regulator, I work for the Ministry of Communications but I'm an employee of the Brazilian regulator) just said to us, they said “we should do auctions”? I can't do auctions for small operators. We have that in mind. But still we are managing the spectrum – spectrum has been managed for like 40 years. So where is the problem? Harold started talking about that. And our colleagues in the audience they made comments. So these would be the issues I see for our roundtable.

**Mike Jensen** – Thank you. I am not familiar with the UN resolution, but I don't think we should be thinking about reserving some of the spectrum as a public good. I think the entire spectrum band is a public good. And we should be looking at better management of it in its

entirety, and not just thinking that some of it should be sectioned off for the public and the rest being private.

**Harold Feld** – I think the UN resolution encapsulates everything that is wrong with how we think about spectrum. And in particular as a practical matter, the approach of segmenting and giving communities small portions generally has been enormously unsuccessful, because of the costs, the lack of economies of scale (except in certain places like low-power community TV), and ultimately they are made subordinate to the commercial interests and gradually eventually reclaimed from the commercial interests. So I think the broader approach is to move away from an idea of scarcity that we need to somehow preserve and shift to an idea of abundance. There is a lot of spectrum out there. It should not be constrained and our focus should be on how to ensure that local communities and individuals are empowered to use these technologies, and actually own the means of communication rather than be dependent upon large corporations owning the means of communication.

**Gregory Taylor** – I have one difficulty with the one-third one-third one-third approach because it doesn't clean up what is clearly different from place to place. I'd like to say: it's something that has to change. And this is where academia and civil society can, I think, play a strong role. And that is to change the dialogue about scarcity. Scarcity has become the de facto approach for the last 12 hundred years and it's still taken as a given. There is a lot of evidence right now to request the very basis of the spectrum scarcity approach. And until we prove the difficulty of that approach, I think we're still facing an uphill battle. So I think that a lot of emphasis and effort should be made right now on proving that the scarcity argument is a construction. It's not what simple fact of science as it's so often portrayed.

**Steve Song** – I want to tie some comments together. Starting with the question about the UN resolution. I think one of the key things is understanding that spectrum is a multidimensional resource. So if I'm speaking loudly up here and someone is having a whispered conversation in the back, those are two different kinds of use of spectrum in a way. A radio that whispers versus one that is loud can coexist in the same space. The radio that I'm using in Joao Pessoa doesn't effect the one I'm using in Rio de Janeiro. The radio that I turn on at night doesn't effect the radio that I turn on in the morning. There are many uses of spectrums that could be used. It doesn't make sense to divide it into chunks. The other point is to open standards and the importance of open standards. It draws a distinction between similar uses of technology, the RRBS, rural broadband in TV white spaces and the statement you can make is that TV technologies are spaces based on IEEE standards, which encourage industry associations and builds momentum around manufacturing that creates the same kind of *momentum* that we have seen develop around WiFi and that's a critical distinction. And lastly, I want to emphasize Harold's point that there's a lot to learn here and we deeply need Civil Society to get involved in this process, because if we don't, you know, spectrum will be taken away from us.

**Catherine Middleton** – I think just reinforcing the need for Civil Society, but also the enormous challenge there is to have this massive industrial complex, which is the existing system. Supported by the regulatory environment, supported by massive corporations, and that's the way it is. So I just don't see how we get to this point of change. That's just a fundamental observation. What do we do? We have got one direction driving us towards

sharing. One looking it down and they they seem to be fundamentally incompatible.

**Veridiana Alimonti** – Yes, of course, there is a scarcity logic. For us, as an organization that studies the regulation on communication, there's a law in Argentina that did the divide one-third one-third one-third. But it's not applied in broadcast, in special. Because on the Internet this discussion – of spectrum allocation for the Internet doesn't even exist. It wasn't advanced. But of course with the new technologies, and with the digitalization of information, the artificial scarcities, it's now more visible than -- well, it existed before, but now it's more visible and then we should do the discussion inside this context. But until it doesn't happen. This is a -- well, this is a standard that we keep in mind. But, even though we talked about a portion of spectrum to be allocated to private companies or to private services, to state services and to public services, it doesn't mean that the spectrum in a way -- in total it is a common resource. And even if it's a company providing services in there, they have to do that in a public interest way. So... it's only the agents that are providing the services that are using the spectrum and it is not in the nature of the way the spectrum is being used, to be a public and a common resource.

**Adriano Belisário** – Just a brief comment about surveillance. And I believe that this idea of a free spectrum can point to some technological possibilities to escape from surveillance. And we know that one of the big problems with the surveillance in the Internet is that we do not have control of the material infrastructure, where the data flows. When we are talking about spectrum, if we are including encrypted communication into the spectrum, things change. So it's a great point to develop.

[end of roundtable]