PRAGUE – IPv6 Session
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ICANN - Prague, Czech Republic

Chris Buckridge: …representing … IPv6 deployment to all stakeholders in the internet. We're at a point in history now where we're seeing certainly some developments happening quite quickly in terms of the deployment of IPv6 and so we'll hear a few different perspectives on that.

Just a quick run through the agenda, which I don't have on the slide, but we'll start out with an update from Andrea Cima and myself sorry, I'll introduce myself, I'm Chris Buckridge, I'm the external relations officer for the RIPE NCC. So Andrea and I will provide a quick update on IPv6 in this service region the RIPE NCC service region and also from of the other RIR perspectives.

We'll then have presentations from Frederic Donck and Matt Ford from the Internet Society about the world IPv6 launch which took place last month and has had some significant effect around the world.

We then have the public sector government perspective and we have a couple of representatives from Sweden here, Maria Hall and Anders to speak about that.

Then Ondrej Filip from CZ NIC will present on ccTLDs and IPv6 deployment, and will conclude with Geoff Huston from APNIC to speak about the evolving internet and IPv6.

So I hope we also have a chance to hear from people in the audience. Certainly if you have any questions, between speakers or at the end of

the session, please feel free to get up and ask them of any of the panelists.

Okay, so we might start with Andrea Cima.

Andrea Cima: Good morning everyone, as Chris mentioned my name is Andrea Cima. I'm the registration services manager of the RIPE NCC. And I will start this session with just a few slides about IPv6 policy and allocation statistics in the RIPE NCC service reach.

Now the RIPE NCC allocates IPv6 address space. The allocation process is based on policy; this policy is made by the RIPE community. Now according to the current policy in order to qualify for an IPv6 allocation, an organization must be an LIR, meaning a member of the RIPE NCC and must have a plan of making assignments IPv6 assignments to customers within the coming two years.

At the moment the allocation size the minimum allocation size issued by the RIPE NCC is a /32, however the allocation can be larger than that. And the size of the allocation is based on the size of the network of the operator requesting the address space and its customer base.

Now as I've just mentioned the minimum allocation size is a /32 at the moment. This will change very soon because the RIPE community has recently accepted a policy proposal, Policy 2011-04 according to which LIRs can receive a larger initial IPv6 allocation block, meaning a /29. This also means that operators which have received an IPv6 allocation a /32 in the past can request an extension to the larger block of a /29. We are

currently working on the implementation and policy should be implemented in July this year.

Now how many of IPv6 allocations has the RIPE NCC made over time, if we look at the past three years, we can see that there is a slide that's got some growth in the number of allocations issued on a monthly basis. And specifically with a spike it's quite interesting to see from the graph around the end of 2010 and the beginning of 2011 with a peak in February 2011, and this was the moment that IANA exhausted its IPv4 allocation pool and this created some more awareness of the need of IPv6 between our members.

Now if we look at the IPv6 allocations issued in the Czech Republic also on a monthly basis for the last three years, we can see that the trend is more or less the same as the rest of the region and also here very interesting to see we have the same exact spike in February 2011.

Now issuing allocations is just one phase of the deployment of IPv6 of course, it's not everything. So the RIPE NCC in order to monitor the deployment of IPv6, has created a rating system which we called IPv6 ripeness. And this rating system gives one star to every member which has an IPv6 allocation. It gives an additional star if the organization has created the root object in the RIPE database; an additional star is the reverse DNS is set up and finally the last star when the IPv6 prefix is actually visible on the routing tables.

Now, on our website ripeness.ripe.net, we have a list of all the four-start LIRs, but also statistics per country. So that we are able to see what the level of IPv6 deployment is according to the ripeness rating system in our service region.

Now if we look at the numbers, the RIPE NCC has slightly over 8,000 members, we can see that about 50% of them silver stars meaning that 50% has not yet requested an IPv6 allocation. About 1,200 have one star meaning they have requested an allocation. About 500 of them have crate the root object in the RIPE database. About 1,000 have set up reverse DNS, and we have 1,500 members with a four-star rating meaning that they are actually announcing their IPv6 address base.

If we look at the rootness level in the Czech Republic it's interesting to see that the number of members with zero stars is actually lower, so we have compared to the average in the RIPE region we have a higher deployment of IPv6 and also if we look it's quite interesting to see at the number with four starts, it's about 25% of our members in this country. So yes, like I previously mentioned the deployment of IPv6 has a higher level in this country.

Chris Buckridge: I'll continue the presentation. As Andrea mentioned obviously allocation of IPv6 is one aspect and then we also monitored deployment. One of the other important things or important areas that the RIPE NCC and the other RIRs work in is outreach and capacity building. And I want start with the slide here talking about the International Telecommunications Union.

This is not in the context that you've probably heard them discussed in the last few days and over the last few months. In 2009, the ITU council actually established an IPv6 group and this was to look at a number of issues include the ITUs were all in IPv6 allocation distribution. This group actually met several times over the past two years and actually

held its final meeting last month. And it was interesting that one of the only real resolutions that came out of that was an acknowledgement of the importance that capacity building plays in IPv6. There's a quote here from a contribution that the United Arab Emirates made to that final session which says, "Capacity building programs are believed to pave the way for any future successful IPv6 strategies or actions plans and we would like to invite the stakeholders to consider this as a model for smooth transition and better outreach." So in internet governance there is a lot of talk about multi-stakeholderism so I think this is an example of that at work.

And the background to that UAE contribution is work that the RIPE NCC has done quite closely with the public sector in UAE. And this brings us to one of the main capacity building activities that we've been involved in, and this is the IPv6 road show. Now this is an activity that we work with MENOG, the Middle East Network Operator's Group on, and their hands-on trainings running three to five days which are specifically targeted at network operators in the public sector. So this is a reflection of how the industry is structured in the Middle East, so we're trying to engage with the industry there in a way that will be useful and helpful to them.

We launched in 2010, and we've currently had about 12 events, we've got three more booked and a great deal of interest from the countries all around the region. We provided free of charge with the host government or telco providing the venue and getting the attendees, and we are interesting at looking at taking this beyond just the Middle East. As I said it's targeted really specifically at the way the industry is shaped in some of the emerging markets and so we're looking at maybe the

Russian CIS region as an opportunity, we're working quite closely with APNIC as well, so that can work in this sort of Indian region or around there. And we're also looking to partner with AFRINIC to see what we can do in terms of the African region.

And the next step also is a train the trainer program. So this is something that we're looking at which will sort of extend the reach of that program by actually relying and using the talent and the people who on the ground in those regions to spread the education using the material that we've developed.

So beyond that, we're also obviously working closely with regional and national groups, I mentioned the Middle East Network Operator's Group, we also have been really quite instrumental in getting the Eurasian Network Operator's Group established, that's in the Russian CIS region.

And we facilitate various community initiatives in RIPE. So this first that I have IPv6 requirements in ICT, this is a document that came out of our community, and again it's targeted at the public sector, and particularly public sector or large enterprise who are doing requests for proposals for new infrastructure and this document actually lays out the specifications that they can include in those RFPs to ensure that they have IPv6 compatibility in the networks. We've had really an incredible response from this, and various governments translating the document for use in their own country, and it's actually just been revised by the team of people in the RIPE community who have been working on it.

Additionally there is the CPE survey; this something that we've tried to crowd source to get input on what customer premises equipment is

actually IPv6 compatible, comparing some of the manufacturer claims against real work experience.

And finally we provide a range of statistics and analysis. Andrea already showed the you IPv6 ripeness, there's a range of other tools and statistics that we showcase on our RIPE Labs website, which is labs.ripe.net.

And finally multi-stakeholder outreach, so this is the more broad kind of outreach that we do the public sector and to international organizations. I mentioned the ITU, IPv6 group is something we take part in; the OECD is another forum where we contribute, all of the RIRs contribute there. The internet governance forum the RIRs working as the NRO have done, IPv6 workshop set, I think the last four or five IGF events.

Beyond that we also obviously consult with individual governments we've taken part in a number of government task forces in certainly countries including Katar, Lebanon, Moldova. And we provide a range of online resources. So I've listed IPv6 Act Now here that's our sort of general information site and the RIPE Labs website.

But this next page, this is actually all of the RIR IPv6 resources that are online. So this hopefully you would, depending on your region, this will be able to give you a more specific assistance in terms of getting more information and learning more about what you can do, what events are happening, accessing the educational material.

And so that brings me to the end. Are there any questions for either Andrea or myself? In that case, we might move onto the next presentation is from ISOC, and I think starting with Frederic Donck.

Frederic Donck: No slides. Hi my name is Frederic Donck; I'm leading the effort the Internet Society effort in the European Region from our Brussels-based office. In a few second I will also give the floor to Matt Ford who is just still in the UK, Matt is the technology program manager, he's part of the team, the core team who has coordinated the effort the world IPv6 launch.

So I would like to start with some general information on the impact of this launch. You will see that it's quite impressive actually, we should really be proud of all the efforts and that the internet community as a whole have done for this launch, I will walk you through some figures starting with this one, more than 3,000 website operators contribute the world IPv6 launch in 6 June including five of top six in the global ranking of [Alexia]; so Google, Facebook, YouTube, Yahoo and Wiki page. 65 this is the number of networks operators who participate; among them AT&T, Comcast, Free, Time Warner, Verizon; and then five home routers, vendors among Cisco dealing with (inaudible) and [Zilex]. So truly lots of participation, great results and I will give you some media coverage.

The objective from all perspective was to make sure that the message IPv6 is the new norm now got through press and media and really got perfectly well. We have more than 300 articles on the 19 of June so there is still more coming. Among them are (inaudible) Francais, BBC,

Brisbane Times, Circle ID, CNN, [LeFigero, Pulse, Heist], the New York Time, Times Magazine, et cetera.

We also were very active on the social media side. We have for example 24-hour video rollout via the world IPv6 launch on YouTube. We had about 35 videos that contribute to this effort. Twitter, we had about 3,000 followers on the 6 of June, Facebook about 1,000 likes, we also had Google Plus, YouTube, we have about 7,657 video views and the most watched on the playlist where someone called Vince Cert with more than 500,000 views on the date. Web Matrix over one million paid views for more than 500,000 unique visitors or address, www.worldIPv6launch.org. So truly impressive as I said.

Top locations of visitors well of course the US came first followed by Germany, UK, Japan, China, and we also have Finland among the top 10. Last but not least, as I said I mean the whole technical community contributed to the efforts, RIRs as we know, but also the Internet Society chapters. We have more than 30 Internet Society chapters who enabled their website, held live events or engage in other outreach at national and local level; among them Argentina, Brazil, Cameroon, England, India Chennai, Mexico, the Netherlands, of course US, Venezuela so again also at local level was truly a great success. One more note, our person engaged with press and media in Europe and what was really exciting is that press just got the message and understood very well that this launch was just not something bigger, larger, different than what IPv6 did last year, they just really understood that the internet would change forever and as you can see from some of the headlines it really, really went through, I give you some of those. IPv6 is the new normal for the internet, and this one world IPv6 launch

only the biggest change to the internet since its inception. So really with this I would like to give the floor to Matt, who will present you the measurement and result of this data. Matt, up to you.

Matt Ford: Thanks very much Frederic, I hope you can all hear me.

Frederic Donck: Absolutely.

Matt Ford: Okay, great, well I'm sorry you have to put up with a disembodied voice for this presentation, but I couldn't be in Prague this week, unfortunately. But I'm happy to present to you some of the detailed results from world IPv6 launch as Frederic has described you know we certainly made a big splash in the media, but at the end of the day the real objective was to try and get IPv6 deployment more pervasive, and so I'll walk you through a bit of what we've seen by way of results from the event in that respect. So I could have my next slide please.

So just to sort of quick recap, the world IPv6 launch was on the 6th of June this year, it's a little different to what we did last year with World IPv6 Day which was very much a 24-hour event where we were focusing on content providers and asking them to turn off IPv6 for a 24-hour period. World IPv6 launch is really something that began on the 6th of June will continue and so it's really a different type of event and much broader reach so focusing on trying to get IPv6 as part of regular business and on by default with no special configuration necessary in

access network, home routers vendors or customer premises equipment, and websites all over the world. And so there's those three categories of participants all agreeing to these sorts of headline objectives of o by default.

And the purposes for this were really to accelerate deployment and adoption amongst those that have plans or don't have plans yet to really stimulate the industry and indicate that major players are now turning this on and leaving it on. There's nothing to stop you if you and your business have been watching this for some time and haven't made the move yet, the time is now.

And really to establish as Frederic has described that IPv6 is the new normal for the internet. So those were the kind of headline objectives, and I'll just take you through a bit of each of those three categories of access networks, home router vendors and content providers and walk you through a bit about what we were asking each of those groups to do and what results we saw, so if I could have the next slide.

So for access networks, can we go back please, to the previous slide, thanks. There we go, so our inaugural participants were AT&T, Comcast and Time Warner Cable in the US; Free in France, Internode in Australia, KDDI in Japan and Access For All in the Netherlands. But we had 69 networks achieve a measurable deployment with an average of at least 0.1% on the 6th of June this year. And I should explain a bit about what that means.

So networks were being measured by the content providers Google, Facebook and Yahoo and those major content providers had to see a specific amount of traffic from a network in order to be able to

reasonably accurately measure the percentage of IPv6 they were seeing from that network, so unfortunately that did mean that some networks that registered, we weren't able to measure them and consequently they weren't included in these numbers. But we did have 69 measureable deployments showing at least 0.1% of their traffic over IPv6. And so if you asked for the access networks was to give new subscribers IPv6 by default without any special user configuration and the goal was for them to reach 1% of their visits to those major content providers over IPv6 by the 6th of June. And as I mentioned that was measured by Google, Facebook and Yahoo. The results are online at that link there and I think it's important to understand that 1% sounds like a small number but in order for access networks to deliver 1% of their traffic over IPv6 to these content providers in most cases that means that they need to enable IPv6 access for a much higher percentage of their subscriber based because of the levels of support in the CPE but those subscribers are using the operating systems that those subscribers are using and indeed applications and the websites that they visit.

So to get to 1% the access networks had to do a lot more work than that might suggest. So if I could have the next slide please, I'll take you through a bit of the detailed results from the access network piece of world IPv6 launch.

So I don't know how legible that is where you are, I'm looking at it on the screen and it's not legible to me, but I'll switch to my other coffee, but the point here is that on the left here, these are the results that were reported on the 11th of June for the participating network operators and you'll see in this list, there are a lot of academic

networks, which academic networks and the national research networks have been at the forefront of IPv6 deployment for many years, but what's really interesting about this is that we're starting to see major mass market roadband, ISPs come through with really very significant IPv6 deployment delivering really quite substantial amount of IPv6 traffic. So top of the list is Free in France, then AT&T in the US, KDDI in Japan, RCS and RDS in Romania, Comcast, Verizon; and then we get into some of the academic deployments, Chestnut and [Egg] from this list. And you'll see that there's really if you look at the percentage figures for IPv6 traffic, these are by no means trivial or trial IPv6 deployments, this is major, major IPv6 deployment to end users, really all over the globe. I mean you'll see on the right there there's a heat map which is just counting the number is ISPs that we have participate and achieve our threshold and the majority in the US, but IPSs also participating and passing the threshold from all over the world. So I think this has really been a great success of IPv6 launch was to move the access providers to make really substantial IPv6 deployments and these are the results that we've seen.

I should also mention that we plan to continue making these measurements through the end of this year, so we'll have monthly updates to these numbers, and if you go worldIPv6launch.org/measurements, you'll be able to see – you'll be able to see the updated numbers as these progresses. So I think if take away anything from this presentation, it's this slide and these numbers and the fact that major broadband mass market ISPs are deployment IPv6 all over the world and unsurprisingly if you deploy IPv6 you generate large amounts of IPv6 traffic.

So next slide please. So for the home router vendors which is another big sort of challenge for IPv6 deployment, we had initially Cisco in dealing participate and they were joined by three other home router vendors by the 6th of June and again for there, the ask was again that IPv6 becomes part of their regular business. So by that we meant that the majority of their products were shared with v6 on by default, so there's no special user configuration required. You know you buy these products, they've been interoperability tested by the University of New Hampshire and v6 is on by default. So particularly if you're using any of these products with any of those access ISPs you should just have IPv6 connectivity without having to do anything.

This is an area where there is still really considerable work remains to be done both for other CPE vendors really to make this a pervasive feature of CPE on the market today, but also other kinds of consumer devices, televisions, voice over IP handsets and so on. And there's a lot more work there that needs to be done before IPv6 deployment. And the next slide please.

So on the content providers as I mentioned in 2011 we asked major content providers and others to join them in turning off IPv6 for a 24-hour period. This year the ask was to turn up IPv6 and leave it on. We had well over 2,000 websites do that for this year for world IPv6 launch and this is IPv6 being enabled on the main website, so it's not IPv6 dot Google dot com; it is www.google.com. And this means that if you have been given an IPv6 by your ISP you have IPv6 enabled CPE at the edge of your home network, then you will use IPv6 to connect to this content without having to do anything as an end user.

We had as Frederic mentioned some of the biggest websites and content providers in the world are participating, Google, Facebook, YouTube, Yahoo Wikipedia, Microsoft Bing, Netflix and many more. So the situation is that now depending on where you are in the network, but well over 10% the world's…

[break in audio]

Matt Ford: I think a significant achievement in terms of the moving, you know making progress with IPv6 deployment on the content side.

And so the next slide gives you a bit more detail on that, so there's a heat map there that shows you what's the geographical spread of websites that we had participating in world IPv6 launch and as you can see it really was a global effort. We tried quite hard to find someone with a website in Greenland that they were willing to make available for IPv6. As you can see we didn't succeed in that effort. But otherwise, this really was a global effort and I think the message about IPv6 deployment and the tools and the knowledge and the services necessary for folks to do that is also now becoming global so that's really great to see.

The graph at the bottom there is from a statistics tools that Lars Eggert runs the URL on the slide and what I wanted to point out there is that you can see quite clearly the red line is metric for global website IPv6 support, which is the measure of the top 500 [Alexia] sites. And there you can see a spike in June last year where we had – when we held

World IPv6 Day, and then you can also see the much larger impact of world v6 launch right at the far right-hand side of that graph, and you know what's interesting is that that impact isn't transient, right, that's a stat change in the amount of IPv6 content on the network that is now a permanent feature. So really quite a significant event I think.

On the next slide just sort of rolling all of that up, and what does this actually mean for the amount of IPv6 traffic on the network. And this much more difficult to get a handle on, because it really depends on where are you measuring the traffic. What I'm showing on this slide are measurements from a couple of large aggregation points so the Amsterdam internet exchange at the top of the slide and the DE-CIX exchange at the bottom of the slide and here again I mean you can see that there's an order of – but basically a – approximately doubling of the amount of IPv6 traffic at these aggregation points, the graph from DE-CIX at the bottom is for an entire 12-month period, and there you can see something appears to have happened recently so that's good news I think for IPv6 deployment as well, but you know this is much more a function of where you're measuring, what you'll see in terms of the shift in IPv6 deployment. But I think regardless of where you're looking you're going to see increasing large amounts of IPv6 traffic on the network now.

I think this is my final slide, the next slide is really a pointer to work that the Internet Society is doing called – which is our deployed 360 program and sort of following on from what Chris was saying about the need for capacity building and outreach, the need to make the knowledge and the tools and the support required for folks looking to enable content for IPv6 deploy content on access networks needs to become pervasive

and globally available. And so what we're doing with the deployed 360 program is to try and share information both about IPv6 deployment and DNS security, DNSSEC, including tutorials, case studies, training and resources and so on and this content there is tailored for network operators or developers or content providers and so on, and so if you're in any of those categories and curious about IPv6 deployment, I'd encourage you to go and take a look at the resources that we're building there.

And likewise we're also looking to share resources that people have developed through this mechanism, so if you're sort of on the other side of the coin producing IPv6 training or other tutorials and so on, again if you want us to help you promulgate those around our networks, then again please get in touch and we can incorporate that with our program there. So that's all I had. I'd be happy to take any questions from the floor or the panelists if there are any.

Chris Buckridge: Thanks Matt. I think we have one question remotely.

Female: Thank you Chris. We have a question from Mark [Lampal], and it's for the ISOC speaker. The question says there is a statement on slide 5 that "The slide says much of the work needs to be done for all sorts of consumer devices." But how much of this work is mandatory to provide at least basic security for internal networks? For example the IPv6 capable routers around without firewall capabilities, is this acceptable given that one is pushed to public routable addresses for internal

networks? And then there was a clarification that followed that said, with consumer devices, I do actually mean the home routers, not TVs or fridges.

Matt Ford: Thanks for the question Mark. There's been a long-running debate about what security functionality there should be in IPv6 CPE and routers. My personal view is that if you want to filter traffic, you should really do that on the end host, but I think increasingly we're seeing CPE support, recent standards that have come out of the IETF which specified the basic security functionality for IPv6 CPE. So I think as the products available in the marketplace catch up with the latest standards coming out of the IETF we will see rudimentary firewalling capabilities you know on by default in IPv6 CPE, but personally I find firewalling the edge of the network tends to cause more headaches than any benefits that you get from it. But you know I agree when consumer devices are IPv6 capable and they don't have any facility to filter inbound traffic themselves then it is necessary to sort of do that by proxy. And there I think the standards are baked in the IETF, it's really just a case of the products available and the market catching up with that.

Chris Buckridge: Thanks Matt. Hisham?

Hisham Ibrahim: Hisham Ibrahim Afrinic's IPv6 program manager. Thank you for the presentation. I just wanted to relay back some feedback I got from some of the ISPs in Africa and the Middle East. A lot of the, especially

the smaller ISPs were IPv6 capable, however most of the traffic was within the country itself, they weren't doing much international traffic because we were either tunneled or you know the international provider couldn't provide them with IPv6 native.

And that caused them a little bit of frustration and through your heat maps you would see for instance at the ISP in the ISP one, you'd find African and the Middle East completely white, why do you find with the website, you'd find a lot of red spots popping up, which kind of means there is IPv6 there so is this something, I know it's not easy to do but it's something you may consider if you continue doing the measurements, consider looking into local traffic as well, peering and stuff? Thank you.

Matt Ford: Yes, thanks for the question. That's a very good point, and then the measurement methodologies for all of this are never perfect. As I mentioned for the access networks we did have this notion of a measurable network and unfortunately that meant that we ended up excluding a number of smaller network operators from our listing. What I would say is that there is an initiative that we've had running for a while now at the Internet Society which is, I'm trying to remember the URL, I think if you go to internetsocity.org/IPv6ISPheatmap.

Hopefully if you search for that online you'll find the website I'm talking about, where we're trying to encourage ISPs and their subscribers to notify us of IPv6 service availability and there, there's no requirement to be measurable in any sense, it's really just, you attest that you provide IPv6 services and you provide a link to where those services are described online, and we'll include you in our database, and so that's a

sort of ongoing tool that we have running and have set up to capture the broad scope of IPv6 deployment around the world.

Chris Buckridge: Thanks Matt, I think we have one more question from remote participation, but if we can answer it quite quickly that would be good, because I think we're running up against time.

Female: So Chris, actually we have two, so sorry, one came in. Do you want me to only read one and save the other for after?

Chris Buckridge: Maybe if you could read both, I think Matt if you could just be mindful in answering, we're running out of time.

Female: Okay, thank you. So the first one is from [Fisel Hesin] from ISOC Bangladesh. It says last year we have IPv6 day, this year is IPv6 launch, what's the next step?

And the next question is [Metsicle IT], I'm sorry if I said that wrong. The question is what about legacy operating systems like IBM, OS2; will they still be supported with IPv6?

Matt Ford: So on the first question, I have a very simple answer which is I don't know what the next step is, if you have suggestions please get in touch.

And I also have no clue about the IBM OS2 but IPv6 is pretty well supported on a mass market operating systems that are widely deployed today, so Microsoft Windows, MAC OS, Linux and so on.

Chris Buckridge: Thanks Matt. I'll move as I say quickly along here. So the next presenters are Anders Rafting and Maria Hall to speak about the Swedish government experience.

Maria Hall: Thank you very much Chris, yes, there you go. Very good. My name is Maria Hall and I work at the Minister of Enterprise and Communication at the Division of IT Policy.

And I saw that Chris had a slide which said multi-stakeholderism in action, and actually I would like to say that me and the Swedish government, we have been working with RIPE NCC since 2004 and by then the word expression multi-stakeholderism wasn't even invented, so we were doing that anyway and so I think it's been very, very valuable for me and also for the Swedish government, and for the recognition of how important it is to actually see all the technical issues actually can make a huge impact on policy activities and vice versa. So that's why I think it's important to manage and that the multi-stakeholder also has to take place, not only in this kind of environment where we go and interact with each other in these kinds of meetings; it'd also have to take place in the day to day business.

Anyway, we can take the next slide. Okay, thank you very, I was supposed to do that, okay, thank you. Anyway in August, well last

autumn actually 2011, the Swedish government launched something that we call the Swedish digital agenda, and that is a very, very broad strategical document that covers a bunch of different policy areas, IT policy areas or from IT policy in healthcare, IT in school, and IT policy in the digital inclusion issues, pretty much everything, also like internet governance issues of course that I'm most working with but also like freedom on the internet and development, freedom of expression and all these kind of things.

But of course one of the fundamental what do you way chapters of the one of the fundamental pieces of this digital agenda covers IT infrastructure, and that is all from broadband issues how to promote or grow them, it's a frequency policy and every standardization of these kind of things. And one of the things that I have been saying to my Minister and to the politician for the Swedish government and to my colleagues is there's going to be a day very soon when we're going to have the first citizen in Sweden that is only going to have IPv6. So of course it's very important that we make our e-services, our public e-services available for all citizens. And the Swedish public e-policy deployment is it's a very, very strong and very important area for us, and I have many, many colleagues that have been working with many different guidelines, many different strategically plans and so on for the Swedish public e-policy deployment. And we have many, many authorities in Sweden that are very successful in this, but of course one of the things, one of the fundamental things is actually the technical reachability, which of course one of the very important things is the IPv6 deployment. We can take the next slide.

So this goes back through a long – for a long time in the Swedish IT policy. So a couple of years ago in our public e-services strategy we said that we need to promote IPv6 by buying or in the public procurement have demands that we have to – the software you buy, the hardware we buy has to be prepared for IPv6. So in 2010, we gave our regulatory authority the PTS – Anders is sitting next to me – an assignment to write some guidelines, how to do this, if you're a public authority in Sweden you should have like some kind of guideline, or some kind of document that it could read how to do from – really from ABC and follow a kind of bullet point list how to do this. And of course in combination with having the demands in the public procurement documents, having a guideline to follow how to it, that too very important things. But what we also saw is that, that is not enough. We need to do even more actually to really, really promote the spread of IPv6, the use of IPv6 among our authorities. So we can go to the next slide.

So what I said in this digital agenda that we launched in the autumn, we said that 2013 our Swedish public authorities has to be reachable by IPv6, so now in June 2012, after just me and Anders came here. We gave our (Inaudible) Telecommunication Agency, PTS, another assignment, that's going to last during this year 2012, but also next year, to make sure that what we said in the Swedish digital agenda is going to make through actually, that our Swedish public authority is going to be reachable, the e-services need to be reachable by IPv6. So this is something I want Anders to talk about a little bit more, but this assignment has a couple of steps actually, one is actually try to have these guidelines that were written in 2010 to make sure the public authorities really use them, but also like a follow up thing or a follow up

activity to see that it works. So we from day to day or week by week can see that this is really happening, and that is something that Anders is going to talk about a little bit more.

In Sweden we have a – the government can't demand the municipalities, but I know that all the 290 municipalities that we have in Sweden are very interested in what's happening on the state level. So I'm sure that this assignment and these activities that PTS is going to do is also going to cover the municipalities. So that is actually something that we also in this follow up activities in this assignment can see and follow how it's going on that municipality level as well. So by saying this I give the floor to my colleague Anders Rafting from our Post and Telecommunication Agency, thank you.

Anders Rafting: Thank you Maria and good morning everyone. I'm going to talk about our message to encourage the public [uptake] of IPv6 in Sweden, and especially directed to the public sector. PTS is the [postal territories in the Swedish], that's why PTS is the telecom regulator in Sweden which consists – we have five departments and 260 people working with making everyone to have access to efficient, affordable and secure communication services. Myself I work at the Network Security and Information Security Department within a unit called Robust Communications while together with operators try to make the infrastructure for electronic communications more robust and more robustness than the market will do.

So what we have done back in the years we already back in 2009, we made our website accessible by IPv6. It was not very hard to do that, so

it was to be in the forefront, to set a good example for the other authorities in Sweden. And now others have followed our example.

We also be in the publishing special services at the link shown on the picture, that is reachable by IPv6 and of course the domain and service are reachable by IPv6 and also the email server since a year back. I also made a [derohume], and that's a thing – that's IPv6 related but it's important thing to do we become more and more dependent on the telecommunication connections that's the thing to think of, that's an important provider of information and services in the public sector and also the private sectors you see. And the word [derohume] means that you have one connection to – you have two different connections to two different operators to be able to stand the severe strains on the [hyper level] for example. So both those connections, both IPv4 and IPv6 are connected.

We also use something called direct access which you know what it is and it's uses IPv6, works very well, I should say, so that's a [VPIN] connection of IPv6. We also tried to convince the public sector to take the decision to start deploy IPv6, because they are as Maria said that's very important consumer, and buyer of equipment, so if they can require IPv6 support in all the equipment they buy, it's a very good help to make the IPv6 ball start rolling.

So we arranged seminars. We invited the public sector from the different authorities and boards, municipalities and also vendors and ISPs and operators of different kinds. And we succeeded in the convincing around 300 participants each of these time, 2010 and 2011 it was. And for speakers from the government from the RIPE, ISPs and the

vendors– so we had all the stakeholders on place on a very good discussions. So that's the way to try to convince the public sector.

We also, as Maria mentioned, got an assignment more than a year ago to provide a practice guide, this guide is the content, the very content of it is written by a guy with his own practice experience on how to install, and run and test, evaluate IPv6 in all kinds of equipment. So what's written in this report is one way to do it, there might be other ways. I guess it's a kind of a religion, obvious perhaps; this is one way that works. So the main [takes prize with legitimate authority] to do this, and there are appendixes and access with detailed configuration advice. So the leading IDs and the guidance is to try to make the Board for the authority to take the decision and to which in time, so not to become in a hurry and be short of time. That also tends to be expensive when all shall have access to expertise at the same time.

So the device is to deploy in four phases, to take stock to see what you have and what you need and the address plan, activate, evaluate and test and then manage. Of course you shall keep your IPv4 connection unbroken and deploy a v6 in parallel. That's the idea way to connect to the internet. Stopping a small [stain] with a website? That's not so difficult. And when procuring new equipment, preferably it's good advice to use RIPE 5001 recommendations for IPv6 and all other ICTs that we say in that report also.

And you can find this guidance on this link, and we would very much appreciate your comments and improvements, feedback, either to me or Erika Hersaeus who is the project leader for this. So we will continue our IPv6 work and now we have gotten, as Maria mentioned the new

assignment to carry out the promotion, the follow up, the deployment of IPv6 and we are also already, almost ready to deploy IPv6 on our local, both the wired and the wireless network on the authority on the private network, and authority; so very slowly it can reach the whole internet, and I think that's an incentive for other authorities, so that if you ask them, do you want to reach the whole internet, or only a part of it, of course you would like reach the whole internet, buy IPv6.

Now way today actually we publish a list on public authority support of IPv6 for the web, for the DNS, for the email on our website. So that would be a spur to hurry up. And this is how it could look like. It was before I really knew how it looked, but we'll be around this week, we'll see who has IPv6 domain name, who has the Amex records in the email service for IPv6 and we have DNS service reachable by IPv6.

And at least I have this picture, it's food for thought we must be mindful that still there is two-thirds of the world's population that does not use internet daily, so I don't think anything knows exactly how these are going to be connected, but they're some that are connected via proxies, some are via [nats], some were calibrated [nats] – they are perhaps native IPv6. And so gradually the will turn to IPv6 to native IPv6, and the black areas here, or the dark blue areas who already have the balance of IPv6 addresses, IPv4 I mean since long have been using internet, should be loyal and to learn to speak both languages so to say to provide content to all their work.

So thank you so much.

Chris Buckridge: Thank you Anders and Maria, we're a bit under the gun in terms of time, but Louie if you've got a short question.

Louie Lee: Thank you Louie Lee, ASO Address Council Chair. Just real quick, this gave me an excellent idea for offering a suggestion for the next IPv6 type event, is to focus on specific sectors and starting with the public sector, maybe you can take this success story as a road show to other areas, other countries for them to focus inward, invite the government authorities, the municipalities, counties and also the ISPs that are learning to do v6 and the local ISPs that already have v6, they can exchange information, work with the government at the same time and perhaps promote some inward local rather than the whole like a world focus. So get that started so that at some date, they can all feel like they can all do this at the same time and feedback to everyone else.

Chris Buckridge: Thanks Louie, I think we have one question on remote as well.

Female: Thank you Chris. This question is also from [Fisel Hassan] from ISOC Bangladesh, you mentioned about the IPv6 guidance manual, I think that's a very good initiative to motivate and guide governments. Is it available publically?

Anders Rafting: Yes, it's available publically.

Chris Buckridge: Okay, it's also on the slide.

Anders Rafting: It can be found on the following address www.pts.se/deployIPv6. I repeat www.pts.se/deployIPv6.

Chris Buckridge: Thank you very much. We'll move straight along with Ondrej Filip.

Ondrej Filip: Good morning, my name is Ondrej Filip and my task is a little bit to have some presentation about the position of ccTLD in this kind of game. You know ccTLDs are not public so therefore they don't have any hard possibilities of how they can really direct a community, but they are center institutions with a very special role in this environment. Next slide please?

So while waiting for the next slide, I think I will start a little bit talking about –

Male: The slide advancer is up on that table.

Ondrej Filip: Oh yes, sorry I didn't know, it's much better now. So the registry itself, of course there are – I don't think I will [speak] about it too much but there are certain ways that the registry has to do to be really IPv6 ready

and since I said, it's sort of unique institution, has a special role inside every country, this registry should really one of the first who implements IPv6. It's not just about you know bring connectivity to the DNS servers which are the software that usually run DNS services [user ready]; but there is most of inside the registry system.

The registrar has to ensure that IPv6 [query codes] can be included into the database, so and IP address is on many places in the registry system. So it's about just database, WHOIS, the zone generator, and EPP which is the protocol that the registry speaks with registrars. So there is a lot of places where you IP address is used and the registrar has to ensure that everything is perfect, so that's a lot of work that has to be done, but it has to be done first in the country to help the country to have the country [do] IPv6. And if you can look at those numbers, the situation doesn't look so bad. Nine of 13 root servers and of course not just servers but clouds are ready for IPv6 so that's more than enough to really deploy IPv6 widely. That's ensure a stable function of IPv6 at the DNS protocol, and also was the majority of a couple other domains is ready for IPv6 or at least has one of the name servers on IPv6.

I tried a simple test two days ago, and at that time it was 267 our 311 TLDs that do support IPv6 at least at the name servers. Specifically in the ccTLD world, it's 211 out of 249, so roughly the same number 85%. So that's about root level and top level.

Now a little bit about the domain itself, how the TLD can measure progress of the users of the domains, so if we are speaking about ccTLD we can a little bit say country. What the top level domain administrator can do, he can measure quad-A records inside the zone, so he can check

all the www.somedomain.theTLD if there is a quad-A record; of course also if MX points to some final to some quad-A record and the same applies for the name servers. So there is a lot of metrics that can be taken to really measure the progress.

An example from this local country, if you go to the URL and I see that (inaudible)/IPv6, you will see a lot of graphs how we measure progress in our country, or in our domain. And there is also a very nice side from Hurricane that tries to summarize many top level domains or does provides the zone file which not all of them, but some of them are included in this report. So it's very nice if you want to get a very quick overview.

Another thing which can be really measured is the percentage of DNS queries, that's also something says about the readiness of the country to IPv6, usually the DNS protocol, or let me rephrase it, the percentage of IPv6 and DNS protocol is a little bit higher than in the other protocols, because DNS is by design proxy servers, so the clients are asking some DNS servers, internet service provider side and you know the core of the networks are usually IPv6 ready, so that's why the percentage of queries or packets of DNS is usually higher than in case of the other protocol.

And there is also one little thing, the fact that there is a DNS record, quad-A doesn't mean that there is also the service running. That was especially the case before those IPv6 days both, because that is exactly the – some people just things that starting IPv6 is just to include the record into DNS, but there is a little bit more that has to be done, so sometimes there are problems and several [sides] that forget this.

This is a local situation in the Czech Republic; I think it's pretty good so far. We have roughly about 30% of web servers that uses domain.cz IPv6 ready, that's the measurement we do every month, so you can see there is a high progress caused the IPv6 launch. This is the same situation that we are talking about the mail servers, a little bit lower number which surprises me, it should be easier but still there is a visible progress. But you know it's not bad. And this is the percentage of domains that have at least one DNS server IPv6 enabled so it's roughly 50% and that means that many of the domains are hosted by professional companies, by registrars or DNS hosting providers; and again those companies, the core networks are usually ready for producing much more than the edges.

There is something I discussed a little bit earlier. This graph shows the percentage of IPv6 DNS queries in Czech Republic very IPv4. So it's much better than it has to be before – there is some green line visible and it's in the peaks about 10% of queries, so that sounds really good, that's not bad. That means in many ISPs in the country at least their core networks seriously implemented IPv6 and also connected DNS resolvers to that.

Another methodology which is very interesting, you know measuring number of IPv6 enabled web servers in a domain is interesting but you might for example face the problem that all those – that IPv6 enabled are not important so it's much importation to make sure really use the website. So IPv6 Observatory has their own methodology and they usually test IPv6 reachability of [Alexia's] top 500 websites in the country, so that gives you much better picture how the country is ready for IPv6.

They update the website every three months and they do a measurement every day, so that's very, very nice overview of how countries progress. They are focused on European Union but IPv6 also include US, Canada, China and India and maybe some others, I'm not sure. If you want to see it online there is URLIPv6observatory.eu. And from those they thought they can make that great nice maps, you can see Czech Republic really well, it's one of the darkest so you can see the borders and there's the country, you are here now. So not surprisingly Czech Republic is one of the first I think today is a little bit more, it's 14.4%, so that's quite nice progress, and that mainly the result of all those IPv6 events that happened in this country.

So a little about that. As I said the roll of TLD is a little bit special, we cannot do much like forcing people to adopt IPv6 but we can do a lot with communication. So we do a lot on that side. We for example as we have in academia, we did a lot of training for professionals. We really tried to spread information about IPv6 in the media. We also printed a book about I think IPv6. And we are very lucky that we chose June the 8th, 2010 as the first seminar about IPv6 or for the big conference, we started communication about IPv6 and we had a huge panel of ISPs and local service providers about IPv6; and exactly one year later, World IPv6 Day was announced so we again used that opportunity to have another conference just focused on IPv6 and again we'll try to bring government people, ISPs and also content providers together to discuss what are the difficulties of IPv6 and the same happened on June 2012 and has amazing results because some of the ISPs were starting to support IPv6 and on the last conference, the largest, the incumbent provider has announces that it's going to start to

provide services on IPv6 to the end users, so using DSL and things like that.

And last but not least we have also IPv6 text laboratory, it's a laboratory where everyone can come and test if the device is real ready for IPv6 there is IPv6 only network without IPv4 with (inaudible) and everything. So really all the CPE devices can be tested. We also provide some of the tools, one of them which the [HD] mode widget, you can see it on our homepage that we [run], nic.cz, and it's a widget that informs you whether your ISP support DNSSEC validation and also IPv6 protocol and you can also measure IPv6 if you wish. And it's an open source if you want to use it, you can download it and translate to your language and so on.

The last thing I would like to [elaborate on] is the router catalogue. It was mentioned I think in ISOC presentation that there is probably CP devices that not all home routers, cable modems, DSL, whatever you want to call it do support IPv6, so we wanted to create a website that should help the images without buying new hardware to buy a proper one IPv6 ready one, so there would be sure that they wouldn't change it later. So all the IPv6 features are tested in our [laboratories] so we really guarantee the results and publish protocol how we can see that, and some [issuers] helped us through that so they're providing us new devices and we are testing them.

And we created a website, there's an URL on the screen if you interested in where really you can look at, you can try to find the router, there is not much of them because there are just a few of them really support IPv6 but we believe that the base is going to grow and now we

could be able to provide much more information. But good for the Czech people here is that CPEs in the database are readily available and everyone can really buy it and use it. So this is just example you can have a field to search, so we can search for whatever feature is important for you and of course you can also make comparison of two different models.

So that's the router catalogue and that's a brief overview about activities that we as a ccTLD can do locally in this country to help this IPv6 forward. Thank you very much.

Chris Buckridge: Thank you Ondrej. I'd like to – any questions maybe we'll save them till the end, we might pass right on through to Geoff Huston's presentation.

Geoff Huston: Good morning, my name is Geoff Huston, I'm with APNIC, I have exactly 10 minutes and 42 slides, so that's 14.4 seconds per slide, so I'd better move on.

This is s a glimpse into the future, it's a very personal glimpse but it actually ties in a lot with IPv6. But before you try and look at the future, maybe it's actually useful to look backwards, I have a secret to share with you; I'm older than I look. Because I remember these dinosaurs, I remember these bastards. They were huge. This was a ripper; this was the latest one from Digital. These were so special they had their own room, they had their own air. And this one was even planned to have its own water, the water cooled monster, but they couldn't make the

water work. This was the last of an era. This was the end of the dinosaur mainframe.

The point I want to make is that if you think 20 years ago was only yesterday, almost nothing from that era survives in today's internet environment, not the operating systems apart from Unix, not even the protocols, apart from IP, and certainly not the hardware. Very, very little of 20 years ago is today. What about 10 years ago. What about if we'd look just 10 years ago. The world was full of PCs and they were ugly bastards weren't they. The word designed just didn't exist in that environment, this was the snappiest thing from HP and God it's ugly.

Separate screen, massive bastard, it's a video screen; we hadn't done flat screens then. The box was a huge noisy box it had 5 inch floppies, anyone still have one of these, get rid of it. It only cost you $50 to buy a new one. So even 10 years ago, it's a different world. What about today? This is from March of this year. Tim Cook said something really quite special that I think is reverberating. It's not the world of the PC anymore, like the mainframe, they're both dinosaurs, the world we're living in is truly a post-PC world. So let's just see where you are on the dinosaur scale. Is this you? Do you have one of these at work or at home? Your own special place you go to, up here in the hotel on the floor above you is the internet access room. So the internet is something you go to, it has its own power, its own lighting, its own wired bandwidth, these big comfy chairs and big comfy screens, it has privacy, the internet is a destination.

All of you have one of those? You better not because that's old stuff, because the world is changing phenomenally, massively and almost

everything we understood about this environment is changing. Because the internet now is what you do when you do other things. It's anywhere and everywhere. It's no longer reliable power, it's battery power. It's no longer a full sized keyboard, we've got it down to one thumb and button and gestures. Connectivity is by radio. It's trivial. It's commonplace. It's abundant and it's not a destination, it's something else. It's what you drag out of your pocket when you're lost in Prague and you're trying to figure out whether to turn left or right.

Truly it's changed that much. We don't ask for paper maps anymore, the map is in your pocket. Email is constantly with you if that's what you want. If I'm having an argument over coffee over what a word means, I don't go home to a dictionary; I bring out my little device and look it up then and there. The internet is now trivial. The internet is now everywhere.

And by God, we've been working; we have been working bloody hard. There really are 2.5 billion internet users. How many were there 20 years ago? There was nowhere near it, this has been a phenomenal story of amazing mobilization, worldwide. Of course there's a bigger target out there, because we're managed to flog off 5 million mobile phones, so we're getting there, inexorably we are getting there, because now 750 folk are mobile internet users and the numbers just keep on going up. And what about tomorrow's predictions in this market. You might think the domain name business is fun and wonderful and full of boundless opportunities with numerous gTLDs in the future. But the prodigious future of mobility is far greater than that. Our expectations of massive growth continue for almost every

magazine, every source of information, everything you find on the internet predicts a prodigious future. Is it true?

I like this picture; this is an [alabore] in the middle of Australia. Australia is a very big continent, but most of it looks exactly like that, so you don't need to go there, you've seen that so take it off.

So anyway 2017 just five years out, so pretty close yes, pretty close, what's it going to look like? I think the wired world from an industry perspective is now a ghetto, a slum. The whole reason why public programs are taking the onus of trying to do fiber wiring is the private industry has no incentive to invest. For them the wired world is a ghetto. Everything is…

[break in audio]

Geoff Huston: …is mobile. How many mobile units did we ship yesterday, 270 million units, God the mainframe industry would have had a heart attack trying to make that many units?

How expensive is a mobile phone to manufacture? Less than $100. What about the software, all that's easy, Android's free. What about content? Oh damn it, let's just use the web. All of a sudden all of this stuff just comes together; nobody makes large high-powered chips anymore. We're all about quad core chips that run on 3 volts and have 7 hours of battery life, because that's volume. Volume is there in your pocket now. The world is a mobile world.

Look at Apple's numbers, that's $600 billion company, the largest by stock valuation company on the planet. Quarter three 2010, 8.4 million iPhones, the next quarter it tripled and even iPads, everyone loves

them, again tripled. Profit 7.3 billion. And in the final quarter of 2011, whoa 37 million iPhone, 15 million iPads, 13 billion dollars of profit. If that isn't a clear signal that it's not about domain names, it's not even about you know wired stuff. This is about mobility; this is where the internet is.

So let's look at the address plan, because everyone needs an address, packets don't work without them. We can plot demand, that's the red line. And in v4 we can plot supply, that's the blue line. Asia Pacific ran out last year, Europe and the Middle East you've got four weeks, and that's if you will behave nicely and then no more. Even the North American continent served by ARIN, early February at the moment according to predictions.

So within four years the short fall, the excess demand we can't service with new addresses is going to get close to a billion units, close to 25% of the old IPv4 unit. If you think address markets will see you through, the future you're looking at is a remarkable small one, it's only going to buy you time, not a future. Because address exhaustion, no matter how you look at it is inevitable. It's not a fate you can negotiate with.

And look at that blue line from APNIC. When this industry panics we're professionals we panic bloody well. So by 2017, there v4 left anywhere. In the next five years, we have to cope with this. And what we're going to do is start trading, the aftermarket is inevitable, but we're playing with stuff we've never played with before. The last time we tried auctioning off spectrum in Europe for 3G, we sent companies bankrupt, because in the euphoria of outbidding their competition, their imaginations far exceeded reality. If the price goes too high, we stuff up

the network badly, it fragments and dies. If the price is highly volatile, who the hell wants to invest in something that's highly volatile, bank bonds anyone?

Private investment like surety, not volatility. Volatility increases the risk and pushes the away investment. If we want this internet to cover those other four billion folk, we need stable investment platforms, stable technologies and stable environments, and we're not it. We are pushing this away, this is bad. This is really bad.

And you might have thought from the last few speakers that there is choice; sorry, there isn't a choice we've made it, v6 is the future. But in reality it's not. There is a choice out there. About 1% of the world's users actually use v6 every day and the other 99% cannot. It's on their machines, Microsoft has done a great job but the last [mile access] providers are not delivering; they're still doing v4 and they are not committed. They see that there's still a choice. Because they think that it's viable, an option not to do 6, to squash everything into http and recycle private address space in v4. Didn't we just see 100.64 going back to the carriers to eke out another few more days of desperate existence? CGNs are what they see as a future, and they are not committed to 6. This is an industry that is deeply divided over where we are going. And nobody is in control, because what's going to determine this is actually those precious in the private investment market. What determines this is actually market forces, rather than regulatory impasse. We liberalized, we deregulated, we passed this over to markets.

So that's five years, funny, let's go further out. Let's push it out to 10, just to see what's going to happen. Quite frankly, if anyone things that v6 days and transitions and the transition industry has a long term future, and that's where they're going to base their career, I have some awfully horrible news for you.

Either this transition happens within 10 years, the next slide is going to happen. We will not run v4 forever. Look at what happened to DECnec, look at what happened to SNA, look at what happened to dear old Appletalk, wasn't that a brilliant protocol, and of course X.25. When it dies, it dies overnight, there is no long term future if we're going to v6, we can't afford that kind of dual track system. CGNS have no future, they scaled for about a year, and then all of a sudden the bill gets intense. After that you're driving into application over gateways and heavily fragmented networks. So if we have a network in 2022, it's v6. If we're doing what we're doing now and prevaricating say goodbye to one internet, it won't be there, because we can't glue a network of four billion folk to together in 10 years' time, no matter how you try and do this.

We don't realize how brittle commonality is; the internet is a very unique phenomenon. In electricity, I think I'm a world of 220 volts, over the other side of the Atlantic, it's 110 volts. You use funny little pins that are round. In Australia we use flat pins that are angled, my God this is easy stuff, how did we get it wrong.

Even radio spectrum we all use different ones, there is almost nothing that we've done in this work that's all been the same. Even the DNS we've gone down the IDN root, we'd love local variation. We'd love to

adorn, fragment and break, and we're going to do that with the internet if we don't do 6. So if we manage a 6 network, let's be nice about this and let's be optimistic, after all I've only got minus two minutes. It will be radio, spectrum will be everything. The spectrum will be a heavily contested resource and if you think it's under a lot of competition now with 4G, you've got another thought coming. There will be a whole lot more femtocell cellular services, we're going to squash down the distance and increase the intensity of use.

I suspect that five is just a black hole to last mile radio; because it's so convenient having everything in my pocket, having everything on my luggage tag, having everything in [RFID] and we will go there, because silicon is a volume industry and it loves to chatter.

Current stuff about Cloud, it will be over in ten years. Quite frankly we've seen this industry centralized, decentralized, centralized, decentralized; at the moment we're all in data centers, it's highly fashionable, at some point we're going to distribute it back out again. Look at Skype it doesn't actually run a data center; it just makes everyone else run it for them. All of a sudden we're going to go back to that model, once we use up Cloud and so on, so it's old fashioned.

Almost at the end of the continent, seen at the other end, 20 years out, wow, I can't do it. I'd be lying. I have no idea of 20 years and neither do you if you're honest. This is a remarkable thing, have a look at it afterwards in detail. It came around a couple of months ago, and it looks at the spread of technical things over the last century and the pace of adoption. So it talks about the telephone, the refrigerator and the stove. My parents had a wood-burning stove, this whole electricity

stuff is recent, and you look about even clothes washers, and it goes onto air conditioning and the cell phone, the slopes get more vertical, we adopt technology worldwide at a fantastic pace and we recycle faster and faster and faster.

Thankfully I won't have this crappy old laptop anymore, I'll have a bright shiny new thing and I won't even be a laptop, and I'm not even sure that it will fit in my pocket. I think it might even fit in something smaller than that. Or maybe it will be a bunch of devices that interact with the environment and where I am, but I know one thing for sure, it will be different.

And I also know another thing which is really quite remarkable. 20 years ago, the phone service determined what the service was, and it was the phone company that determined what was going to happen. They were in control of the future of this industry. That doesn't exist anymore. Because when deliberalized, when we deregulated, when we blurred the line between applications, computation and communication, we actually empowered the user. It's a post PC world where computations, storage and communications are just abundant commodities. It's not a high value job, it's just a commodity, utility, it's like water, what's going on now, is it's these mass produced consumer devices that completely shake the world. And the innovation is one of refinement. And if we want that future, if we want a future where the internet just disappears into the fabric, the one precondition we need, the absolute one precondition is a single embracing and likely refined consistent single technology. I can't deliver that to you in v4 cannot, you won't get there. Unless this industry figures out that it's long-term future and the long term interests of you and I as consumers are

recognized, unless they move to v6 within the next three years, and make that 1% 100% and stop looking at transition as a long-term career path that is something we just have to get done and get over with. Unless we do that, we might as well all give up, because when the internet fragments, those domain names are useless too. Thank you.

[Applause]

Chris Buckridge: Thanks very much Geoff. As Geoff noted I think we've slid in just over the wire here so apologies to anyone who has any questions. I think we might have to wrap it up. Thank you to all of the panelists here who have taken part today and provided some really useful, valuable insights. As moderator I'm going to use my privilege here just to make one final note, announcement. There is actually a global IPv6 deployment survey in the field right now so basically that's something that anyone can fill in, certainly everyone in this room I think would be a good person to fill that in.

I don't have the URL, so I'll give you I think the easiest thing to do is to say NRO.net, that's the Number Resource Organization website, under the news and announcements section on the home page, there is a link to that 2012 global IPv6 deployment survey, so please go there and fill it out if you have any time.

Okay, thank you, as I said to all of our panelists to everyone here today and to all the people who asked questions. Thank you.

[Applause]

[End of Transcript]