Internet Governance Forum
Hyderabad, India
Transition from IPv4 to IPv6
5 December 2008

Note: The following is the output of the real-time captioning taken during Third Meeting of the IGF,
in Hyderabad, India. Although it is largely accurate, in some cases it may be incomplete or inaccurate
due to inaudible passages or transcription errors. It is posted as an aid to understanding the proceedings
at the session, but should not be treated as an authoritative record.

 >>MARKUS KUMMER: Good morning. We are here, ready to start our main session. Allow me to make a few administrative announcements before starting.
 First of all, we change this program slightly tomorrow afternoon. The media representatives told us that they would prefer to have the closing press conference before we start the session, because Saturday afternoon at 6:00 would not be very good timing for them. So we have the press conference, then, at 2:00, and we start the afternoon session at 3:00, with the discussion on taking stock and the way forward, and the closing ceremony will be immediately afterwards, and we will finish by 6:00.
 The other -- you may have noticed on our Web site, and have seen it in the news, that there is a heightened security alert, and we have been advised by the U.N. security coordinator for India to tell participants to make sure that they're at the airport when flying out well in time. And they recommend three hours before departure. But we keep you informed and updated, should that be stepped down a bit. So keep watching our Web site.
 And last, but not least, I would like to invite you to deposit your comments and questions at our booth in the village where we have computers installed with a YouTube channel. And we would like as many of you as possible to give comments, ask questions, or give your general views on the meeting here in Hyderabad on the IGF or whatever you have in mind related to Internet governance.
 And with this, I hand over to our chairman for the day, Mr. Gulshan Rai, director of the Indian computer emergency response team.
 Please, Mr. Chairman, you have the floor.
 >>GULSHAN RAI: Thank you, Dr. Markus. It's really a pleasure to be here and sharing the dais as the chairman of the session with Mr. Markus.
 The session for IPv4 and IPv6 is an important session in the sense that this is the hardest subject which is being discussed and debated all over.
 As all of you know, that the I.P., that's Internet Protocol, is the -- one of the pillars of the Internet. Protocol IPv4, when designed 20 years ago, was based on those days' requirement and what we thought at that time Internet would look like.
 Since then, there has been a lot of change in terms of the requirement, as well as the technology, which is evolving at a much faster rate than we thought about.
 The question is whether IPv4 will be able to meet the requirement what we are seeing in terms of technology and otherwise. That's the big question, and this is what's being debated everywhere. Everybody talks about the address space, because of 32-bit architecture, 32 addresses. Further, whose addresses are sufficient, they will meet the requirement, and what more we require if we require addresses, particularly when we are moving towards the mobile culture. That's fourth-generation type of a network.

IPv6 has been designed, that's also more than a decade ago. It's a different protocol than IPv4, but it meets the shortcomings of IPv4, and it takes all the features of IPv4. It is a 128-bit kind of architecture and gives you a lot more addresses than what the world has today.

We all have known that in this forum, we have almost more than 3 billion mobile connections and 1 billion Internet users, and they're going to double. So these IPv6 addresses will be sufficient for the future growth. That's what we thought about it. And we will listen from the presentations, as well as the open forum which we are going to have in the afternoon.

Now, IPv6 has been designed to address more features. You have address routing. Address is not the only issue. It gives effective routing to you, gives effective security to you, translations, as well as the mobility, as I said about it. It has many features.

Many countries are working very aggressively to transfer from IPv4 to IPv6. Japan, Korea, U.S., many European countries have worked very aggressively to do that.

In India also, I personally have been involved as my job in heading the education research network, and we made a transition from IPv4 to IPv6, we ran dual-stake IPv4 and IPv6, the first network we had to do.

And the composition was because the network was connecting the educational institutions, and the network was connecting to GIAN, which is a totally IPv6 network and the education backbone in the U.S. network, so-called.

We have our experience. We thought that at that point of time, which was very difficult to make transition, but the experience was so nice, and in the shortest possible time, we made the transition from IPv4 to IPv6. That's the experience.

The educational institutions are having it, because the requirement is to deliver the content (inaudible), and that is what can be met only by IPv6.

Today, we have among us Ms. Lewis, who is the Secretary-General, Caribbean Telecommunications Union, a very experienced person in this area. She will be handling the session. And we have a very good mix of panelists who have experience from industry, government, and they will be talking about all the functions involved in the transition from IPv4 to IPv6, the business case, the importance of technical issues, and other administrative issues.

I hand over the dais to Ms. Lewis, who will be now introducing the panelists and conducting the session.

Thank you very much.

>>BERNADETTE LEWIS: Thank you, Chair, for that excellent overview of our session. And I'd like to welcome participants this morning to this IPv4/IPv6 transition debate panel. And I would like to point out that -- I'd also like to welcome, I'm sorry, the participants who are joining us online. There's a special welcome to you, and, of course, to those who are sitting here with us in the auditorium.

An integral and critical aspect of the functioning of the Internet is the I.P. or Internet Protocol, addressing scheme. I.P. addresses are the numbers that uniquely identify and enable connection of all the devices to the Internet.

Now, when IPv4, with its four billion addresses, was introduced in 1981, it was inconceivable that addresses -- that the address pool it yielded to be exhausted and no one could have anticipated the phenomenal growth of the Internet. And consequently, the methodologies for allocating I.P. addresses wasn't necessarily the most efficient way. So we've come to the point at this time where we are facing exhaust of the IPv4 address space.

Now, the deployment of the new addressing scheme, IPv6, with 16 billion, billion possible addresses, was introduced in 1999. But the deployment has been somewhat slow. So the panelists in this session will consider the imperatives and the issues

surrounding the transition from IPv4 to IPv6. And we will be considering different aspects of the transition. And I'd like to start by introducing our panelists.

Our first is Adiel Akplogan. And he has been the chief executive officer of AfriNIC, limited, the Internet numbers resource registry for Africa since 2004. He has more than 15 years of experience in the Internet technology environment.

Then we have Kurtis Lindqvist. He's the managing director of Autonomica. And he has been involved in the Internet Engineering Task Force. And he has tremendous experience in IPv6 deployment in networks.

Then we will be hearing from Jonne Soininen. He's the head of Internet affairs of Nokia Siemens Networks. And he also will be talking from a vendor's perspective on some of the challenges that vendors face. He will give a vendor's perspective. And he has also been involved in the IETF.

Tulika Pandey, she is the additional director of the Department of Information Technology of the government of India. And she will be addressing some of the social and economic issues.

And then we Satoru Yanagishima. He's the director of Internet policy from the government of Japan.

Finally, Professor Milton Mueller, professor of Syracuse University. And he is also one of the founders of the Internet Governance Project. And he is going to be talking a bit about the changing roles of the Regional Internet Registries.

So having introduced our distinguished panel of speakers this morning, I'd like to start with Adiel, who would be -- and I'd ask him to begin the discussions by laying a foundation of understanding and explaining some of the I.P. addressing scheme issues, and also to give some insight into the nature of the transition to IPv6.

Adiel.

>>ADIEL AKPLOGAN: Thank you, Bernadette.

I will be speaking in French.

So (No translation for scribes).

Okay. Seems like we are having a little bit of a problem with the transcripts in English.

So I will probably switch back to English.

Okay. Good.

So I was saying that as original Internet registry, we face, and the reality of the exhaustion of IPv4 addresses, because we know, we are seeing how the pool is shrinking, and we are also seeing how the IPv6 takeup is happening.

So what is the real problem here?

Ten years ago, study already shows that IPv4 will exhaust, the Internet will grow, and there was an assumption at that time that when IPv4 will be exhausted, IPv6 will have sufficiently take up so that there will be no issue. And that's why IPv6 has been defined ten years ago, to allow operators to move to that new protocol.

But what really is happening today is that, yes, Internet has grown. Yes, IPv4 is exhausting. But, no, IPv6 has not been implemented by network operators, has not taken up.

So the question is, well, what will happen, really, when we will exhaust IPv4, during that period where IPv6 (Microphone feedback) -- okay.

So what will happen, really, during that transition period where IPv4 will be exhausted and IPv6 will be taken up? What will really be the situation?

There are several -- of course, several speculations in that area. And what is interesting also is that through the bottom-up process for developing policy in various regions, there are a lot of discussion among the community to define policy that will soften, as much as possible, this transition period.

Two issues have been addressed by the area community. First is how to make IPv6

allocation easy for operator, how to help them, how to support them, which policy do we need. That's one aspect.

A second aspect which is being addressed through the policy development process is, how can we make sure that when the central pool of IPv4 address will be exhausted, we still have the ability to allow newcomers to have at least a minimum I.P. address to start up their network, while transitioning to IPv6. So those issues are being addressed in various policy development areas, and shows how the community is reacting to this specific issue.

So today I think we will try to raise different aspect of the issue in this panel and be able to address them from different perspectives, vendors. And I will be giving some perspective on what is the status of the deployment. Just to give a number, about 15% globally of networks are IPv6-ready or are doing something about IPv6 today.

So you can see from there that there's a vast majority of networks which are still using IPv4 address. And we are envisaging that the two protocols, IPv4 and IPv6, will coexist for a very long period of time before IPv6 will take over IPv4.

So I will stop here for now.

>>BERNADETTE LEWIS: All right. Thank you, Adiel.

Could you -- is there a projection based on the current rate of allocation of IPv4 in terms of when this exhaust is most likely to come about?

>>ADIEL AKPLOGAN: Yeah. There are several studies done to try to anticipate when we will run out of the central pool of IPv4. And globally, it's around 2011, 2010, 2011, where we will completely run out of the IPv4 central pool. But there will still be at the area level some IPv4 which will be managed. But the IANA, which allocates I.P. address to areas, I run out.

>>BERNADETTE LEWIS: Thank you. Thank you very much, Adiel.

And since Kurt has had the experience of implementing IPv6 on a number of networks, I'm going to ask him to describe some of the challenges that operators face in doing their implementation and introducing IPv6 into the networks.

Kurt, please.

>>KURTIS LINDQVIST: Thank you, Madam Chair. Ladies and gentlemen, good morning.

I'd like to share some of the issues and development that's happening in the operator world and from an operational perspective when it comes to the transition between IPv4 and IPv6. There are a number of obstacles and a number of problems that operators looking at this has to do with the migration from the view of the operators. The most obvious and the most cited one is that there is actually no, of course, real customer demand for a transition. The only thing customers want to do is run their applications, as they do today. They want to run their peer-to-peer applications, they want to access their Web sites. And they have no notion of I.P. transport. And they don't really care, and they shouldn't have to. IPv6 doesn't enable any new services for the end users that we can't deliver today. The only thing it does is address the shortage of V4 addresses, something that users are happily unaware of.

So what are the operators doing on this? Deployment of the IPv6-capable equipment in the core networks, in the operators' networks, is happening incrementally as the operators go and procure new equipment, deploying hardware or software as part of their normal upgrade cycles. The reason it's taking time and happening so slowly is, obviously, there's no differently revenue for providing V6 services. You can't charge extra because you access your favorite Web site already from a different I.P. protocol. And that is one of the reasons why this is taking time. And it's also a reason why forced upgrades on the operators will make very little economical sense because they doesn't carry any additional revenue with this.

In this regard, it's interesting to see that the operators in both the developed and the developing world are probably facing exactly the same challenges. There is lack of commercial drivers. But they are still faced with the upgrades and. The main driver is the runout of the V4 address space. Because we still need to address our end users and our customers as the customers grow, customers numbers grow.

And the problems that the operators face in the lack of drivers is the same also for end users and enterprises at residential equipment and hardware.

In the developed world or in the markets that are fairly mature and fairly saturated, in order to deploy V6, the operators will have to have an upgrade of all their home computers, hardware, software, cable TV modems, home modems, gateways, firewalls. There's a large set of deployed base that will have to be upgraded. And one might argue that here the developing world or the less markets might even be at a disadvantage as most new or modern equipment being sold is actually already supporting this.

The core equipment in the carriers' networks and the operators' network in the backbones is already supporting V6, most of the equipment being bought today does support V6.

What is becoming an issue and a critical point to address at the moment is getting operational experience deployed into the field, finding what pieces are missing from the architecture, from the protocols, what is lacking in terms of operational tools that the operators need to run this, both in terms of software, configuration utilities, et cetera. One of the things that we have faced in deploying IPv6 is that products might support V6 for actually forwarding the packets, but they do lack imperative when it comes to operational needed support tools for full management, troubleshooting, et cetera.

Another aspect that vendor pricing has actually currently charged the operators extra fees for V6 support. And that hasn't helped. But all those are the set of negative issues. There are very positive signs regarding this. Most of the vendors are starting to ship this as part of their normal product offerings. And a lot of the operational tools, the support tools, are being migrated to IPv6 support as well.

The other thing that's happening or what's affecting this is, which is actually most of the work on the standardization front, and then maybe also the concerns in the operational community today, is, when we start deploying this, we will still have end users out there in the developed and the developing world that simply have equipment that won't support IPv6, it will only support IPv4.

These users must still be able to get connectivity. They must still be able to connect to the Internet. And how do you support them?

And also, if we start having end users that might be running both V4 and V6 in parallel, or in the future maybe only running V6, how do they get to the V4-only services today? Some services might not choose to migrate to IPv6.

And the Internet Engineering Task Force, the IETF, is currently working quite actively and very hard on developing translation mechanisms between the two protocols which are not compatible otherwise so that you can reach services and that we can support these last customers who will run IPv4.

I personally think that we will see IPv4 and IPv6 in coexistence for at least all of our lifetime.

And this is actually a key issue for the operators to get these type of technologies deployed in the network.

The other thing currently operators are working and pressing hard for is getting the IPv6 support into the customer premises equipment, DSL modems, cable TV modems, middle boxes, firewalls, et cetera, is a category that so far has been lacking in V6

support. And the operators are pushing very hard to get this. They have so far had very poor support. But the good news is that they are catching up very fast. They are realizing they are missing a critical component, and they're working hard at this.

Most modern software today that you use and the operators use, by the way, supports V6. And on occasion might still need to be migrated, but we're seeing that people like Oracle, et cetera, et cetera, are looking at doing V6 migrations for their products.

These legacy applications will be around for the foreseeable future and we need to handle them as well.

I think I'll stop there. I think that the key issue currently is this -- that's where the operators are working currently.

>>BERNADETTE LEWIS: Thank you, Kurt, for that intervention. It was quite interesting that he spoke about the vendor support that is extremely critical.

We do have a vendor here, Mr. Jonne Soininen from Nokia Siemens network.

And perhaps Jonne could give some idea on the availability of IPv6 equipment, the support that Kurt referred to, and the whole transition process from a vendor's perspective.

Thank you.

>>JONNE SOININEN: Thank you, Bernadette, ladies and gentlemen, very good morning.

Yes, I am working for a vendor, working for the Nokia Siemens Networks, and I'm also here representing Nokia as well. So I hope I can give you a somewhat (inaudible) view on how this looks like from the vendor perspective.

As general, for vendors, I think that the transition from I.P. version 4 to I.P. version 6 has been already ongoing quite some time.

I'm going to a little bit talk about what that means in the past and what has -- what is the status today and what I see for going on, then, in the future.

This has been a very long process, both for operators, but also for vendors, which has included actually getting the technology ready. So getting I.P. version 6 ready in the standards and the technology itself, and then getting that implemented in different products.

Like Mr. Chairman said in the beginning, IP is the core of the Internet, and that is also, then, for this reason, IP version 6 or the transition to IP version 6 does affect a lot in the products. It affects almost every product and everything, at least everything that speaks IP.

So this has been a painful process that has made us go through many of our products, and think about also how do we want to transition from v4 to v6 and how we want to enable v6.

For a company like us who has where its roots are in the mobile industry, the need for v6 came imminent very early on when IP became important for our products.

It was clear for us that we are now talking about more than 4 billion mobile phones in the world and looking at the IP version 4 address space, how much of that is left, it's clear that we have to do something.

And it was clear already from the beginning.

It also has been very important for us to be early in the market, and being early in the standardization phase and the technology creation phase which allows the vendors to understand what actually has to be done.

It's not that clear if you don't understand the technology for all its details.

And that's also one thing that many vendors like us have noticed, is that you need quite a bit of experience in this.

And most probably the first time you do it, you don't do it right, and you need a little bit of operation experience as well, you need implementation experience. You need to

see how you can introduce it, that it doesn't, like Kurtis says, the end user doesn't really care about that, so how we can introduce it in a way where the end user doesn't have to care about that.

In general, what we have done is basically we have introduced IP version 6 pretty early on in our products, both on the handset side, in our phones, in the categories that we think would be needing that first, and also in our network products in the parts that we think that the operators will need it first.

Basically what we have thought about, how to do this, is to get the IP version 6 to the end user as early as possible, and then look at the other parts of the network after that. This allows the operators to transition to v6 and start v6 service as soon as they wish to.

In general, also, it's not only us, of course. Also our peer companies have introduced v6 in their products from some time ago, and many of them have a lot of experience already with that.

The PC manufacturers and the operating system manufacturers have introduced v6 support, and maybe some of you already are running v6 without actually knowing it. But of course, there is still a way to go.

Everything like this needs experience. We are going to do some mistakes. There are certainly challenges ahead of us. But I am sure that we are on the right way, though a little bit slower than what we expected.

The good thing is that it seems that the operators are now waking up and noticing that they have to deploy also v6, and there is more and more, so to say for us, as a vendor, customer demand on v6, and that part has been at least partly solved.

>>BERNADETTE LEWIS: All right, thank you, Jonne.

It's quite interesting, the last two panelists pointed to a need for a certain amount of cooperation between the vendors and the operators in that Jonne just mentioned that in deploying, you are going to make some mistakes. And there must be mutual support of the process going forward for implementing IPv6 in a network.

Perhaps Kurt could give us some indication as to the cost implications for deploying IPv6 in the network.

>>KURTIS LINDQVIST: As I said, I think that most of the investments will happen as part of the normal upgrade cycles. And I think that's true for training of staff, too. The real cost will come with the actual man hours that have to be spent doing the configuring. That said, I do think this is actually easier than people think. That's what I have seen as well.

>>BERNADETTE LEWIS: Great. Thank you.

And we are going to move on to the next panelist. It's clear that the transition from IPv4 to IPv6 is really a shared possibility, and the various stakeholders and communities have to work together in enabling a smooth transition from IPv4 to IPv6.

And I think that the transition should be a well considered, cooperative endeavor, and it must involve mechanisms, incentives for the rapid adoption of IPv6, and we also need to look at the social and economic implications and to develop appropriate policies for the migration to IPv6.

So our next speaker, Tulika Pandey, who is from the Department of information technology of the government of India, she is going to be talking or telling us a little bit about some of the social and economic implications for the transition.
Tulika.

>>TULIKA PANDEY: Thank you, Bernadette, and thank you, Chair. But, oh, my God, after yesterday's party, this really doesn't sound so interesting. We seem to be full of issues to deal with if we want to continue to have a party.
Internet is a place to have a party.

We all wanted to join together. Whether we knew the Internet dance or not, all of us got together, and we were able to enjoy what we had there.

Internet has to be -- has to remain that for all of us.

India here can give an example of how we can do.

The issue that has been put forth for me, I will try to put my thoughts and address it under three different dimensions that I foresee here. The technological, the social, and the economy.

If I look at the technological aspect, the request to most of us, most of our team, would be to have a mechanism and a standardization for coexistence of both protocols to avoid unacceptable service interruptions and any plausible damage to critical distributed applications. Many of which have were not well designed to benefit from the new functionalities enabled by IPv6.

What is not globally acceptable, as I understand, is a large-scale deployment of the new IP architecture, to provide any disruptive services or applications or innovations. But what is generally acceptable to us is a gradual interoperability and coexistence between IPv4 and IPv6.

If I take the case of the service providers or the network handlers, what they would prefer, they would prefer to preserve the heavy investments that they have made to run and deploy the IPv4 networks.

So their plea would be to allow the time for them to transition from IPv4 to IPv6, and not a translation.

It was realized well in time and we had IPv6 addresses available to us before the IPv4 address space got exhausted. So what most of us understand, that IPv6 is here to complement and supplement the existing IPv4 address space that is still there with us.

But one common perception that most of the service providers of the developing countries have is that the new protocol is very similar to the existing protocol. But for an improved routing, auto configuration capability, and an improved multicasting and efficient infrastructure. Would that be enough a business case for them to make investments to upgrade the network and application services to reach out to the consumers for whom these do not matter?

The advancement of the IP may not -- may be transparent to most of the end users.

They would just demand services from us.

Tomorrow, we see that the mobile Internet would be the call of the day.

Here, one issue that is very important for us to put forth is to check whether we have included backward compatibility off the IPv6 protocol with IPv4.

If not, we have to address that.

If yes, well, the party is on.

And last but not the least, the business case for IPv6 that all of us agree with is the Internet itself.

We want the Internet to continue. And for that, we need addresses.

Socially, we can all be very happily telling our end users that the IP address is an addition to your personality, in addition to your name, your, address, having an IPv6 address is an addition to the personality that you have. And maybe that would make a big business case.

In the end, I would like to just put forth what we have tried to do in our country, in India. We have the second largest number of service providers, and yet we have attained only one /8 usage of IP addresses until now. That implies that the demand for IP -- for services and Internet and Internet penetration is yet to happen in this country, and the cultural diversity and the need for localized content is something which will be very, very essential to push the case for demand for more IP addresses.

The government of India has taken many initiatives, and one more core program is the

national e-governance program where we are trying to reach out citizen services for people to realize the benefits that they can gain from Internet, per se.
Edutainment, education and entertainment, is another social requirement which may push the case for a demand for IP address, is what we see here.
I would now like to close my comment and maybe come back later. Thank you, Bernadette.
>>BERNADETTE LEWIS: Thank you very much.
So we have had a number of different perspectives on the IPv4 to IPv6 transition. Now, in my own experience in the Caribbean, we hear there are a lot of myths about IPv6 and all the wonderful things that it's going to do, and I would like to invite some of the panelists to debunk some of these myths, some of them concerning security, some fantastic claims of, you know, your refrigerator and your dog collars and all of these things. Perhaps I can invite some panelists to make comments on some of the which I'm sure you have heard which are definitely not true pertaining to IPv6.
Okay, Adiel is going to start.
>>ADIEL AKPLOGAN: Yes, Bernadette, there have been a lot of stories about IPv6, but what we have to understand is IPv6 is the continuation of the Internet. It's not a new Internet. It's the continuation of what we have today. For sure the protocol has evolved, including some future, but it won't make the Internet safer, it won't make the Internet more secure:
We have only a future which could probably make deployment of some feature of the Internet easier, but if we take, for instance, the auto configuration, it is something very, very good, but with IPv4, too, you can auto configure a network.
The way it works with IPv6 is different, slightly different from what IPv4 does, but the end point is the same. Same for security. There are mechanisms today for securing IPv4.
In IPv6, those mechanisms are included, but you will still do the same thing and have the same attitude in securing your network on IPv6 and IPv4.
And of course, IPv6 will come with its own challenges which are different from IPv6.
One thing is sure, it allows more address, unique IP address, it will allow more connection to them, more equipment to be connected to the Internet, will enable applications which will allow different kinds of possibilities, making challenges,, for instance, of security, for instance, because we will have large connection of equipment.
>>BERNADETTE LEWIS: Thank you. Jonne.
>>JONNE SOININEN: I would like to echo that, what Adiel already said, but say that there -- I think somebody put it very nicely. So what -- that I.P. version 6 brings three new features, that's address space, address space, and address space.
And that is the main driver there. We are talking about a situation where we are running out of I.P. version 4 address space. And I.P. version 6 addresses that.
There are many good things about I.P. version 6, like address (inaudible) configuration. But like Adiel said, those can be added to V4 as well. But the main thing is the address space. And there, the main item of the address space is that how Tulika put it very nicely, is that it allows to party on on the Internet.
So if we -- when we run out of address space in V4, that, of course, doesn't mean that the Internet itself would stop existing and the V4 addresses would vanish. No, that doesn't mean that. The network will still be there.
But it -- the growth of the Internet can be hampered quite a bit by not having enough address space to grow. I.P. version 6 allows that.
Also, the bigger address space might allow us to do things better, more efficiently, than the small address space that we had.
And maybe there is something new that comes out of that fact that we can have not

only an address per host or address per user, but maybe have multiple addresses per host, multiple addresses per user, at least enough addresses.

And then maybe somebody will come up with a great innovation of using that fact. But the main thing of the I.P. version 6 is really the address space.

Thank you.

>>BERNADETTE LEWIS: Any other comments from the panelists?

Perhaps we can field one question, one or two questions, from the audience at this time.

If you have a question, could you make your way to the microphone in the center and at the sides of the room. Okay. I don't see -- yes.

The roving mikes, please.

>>:Thank you. And I would like to thank the presenters for those presentations.

My name is Patrick Mwesigwa. I'm from Uganda. I work for a regulator in Uganda.

From the discussions we've had so far, it has me a little bit concerned whether we should have a deadline after which we should discourage production of IPv4 equipment.

Do you think there is a need for an international agreement on kind of timelines we can have to continue using IPv4? Or since IPv4 equipment can operate properly independently of the IPv6, there probably could be no reason why we should have a deadline for ceasing to use IPv4.

What guidance on that aspect?

Thank you.

>>BERNADETTE LEWIS: All right. I think I am going to ask Adiel to make a comment, and then we'll take --

>>ADIEL AKPLOGAN: I will make a comment. And as we have an equipment vendor here, so he could give his perspective.

But, yeah, that could be a simplified way of seeing the thing, by setting a date. But I'm sure that this is something that will be taken care of by the market, because what will happen is that, more and more, people will now be asking for equipment which are IPv6-compatible. So a vendor -- and that's why it is very critical to see that the business model of IPv6 is really the continuation of doing business, in reality. Because vendor will be first to propose equipment which are IPv6-ready by themselves, because they want to sell them. They cannot continue selling IPv4-compatible equipment when the next generation of the Internet is IPv6.

So it is -- awareness campaign is very important, so that user operators know that when they are planning their network, their integrate IPv6 factor in their future that they request from their vendor.

So having a deadline will probably not solve the issue that is raised here.

>>BERNADETTE LEWIS: Thank you, Adiel.

>>:The development that is happening in the standardization field is trying to make sure that this equipment can coexist for the foreseeable future. Doing forced upgrades doesn't carry any economical value, because there is no additional revenue, as we said before. There is no new services that you can provision over IPv6 that can pay for a forced upgrade. So from a financial point of view for the operators, that doesn't make sense. Working on the technology for having these two protocols coexist and interop is where the operational community is going and where we're seeing most of the technological development at the moment.

>>BERNADETTE LEWIS: Jonne.

>>JONNE SOININEN: Thank you. Yeah, I would like to echo the previous two speakers.

So the -- I don't think I don't think we need a deadline. At least from the vendor

community, we feel that we will have a deadline. That's when our customers won't buy anything that is only V4. So I think the market will take care of this.

In addition, I would find, though, interesting the idea of regulating when V4-only equipment is available -- should not be sold anymore.

I would find that problematic, because where would you put that point?

And if somebody actually needs V4-only equipment, even after the addresses have run out from the address pool because they happen to have a V4 network, why wouldn't they have the right to buy that.

In addition, I would like to really echo that what Kurt has said, which is, in IETF, we are working very hard to make sure that we can make the V4 and V6 networks coexist.

So, really, I don't think that there is a need for such a deadline, as such. The market will drive the need. And it seems to be driving it currently quite well, actually. Thank you.

>>BERNADETTE LEWIS: All right. I'm sorry, we would not be able to take any more questions at this point in time.

I believe our secretary is going to be circulating some of the forms so you can document your questions, and he will try to handle them later on. There will be further opportunities for interaction with the audience.

I would like to ask now our -- Satoru Yanagishima from Japan to give the Japanese experience on the policy developments and policy issues that have been raised and what they are doing on the policy front to deal with the transition from IPv4 to IPv6. Satoru.

>>SATORU YANAGISHIMA: Thank you, Madam Chair.

Good morning, ladies and gentlemen.

I'm Satoru Yanagishima, working for the Ministry of Communications, Japan, and responsible for Internet resources issues.

Today, I will talk about the Japanese action plan for IPv4 address exhaustion. We are thinking about making IPv6 the standard Internet service for Japanese customers.

Internet users have been growing on the (inaudible) basis. As a result, IPv4 address use is also expanding. In fact the global communication rate of IPv4 addresses has doubled since around 2004.

Taking into consideration the fact that the international stock of IPv4 addresses is running short, we held a study group on Internet Smooth Transition to IPv6 from August 2007 to June 2008.

There were three items on the agenda. The first is to estimate the exhaustion date of international IPv4 addresses and the problem this will create.

The second is to examine the measures for IPv4 address space exhaustion.

And the third is to examine the programs in the introduction of the measures and solutions.

The study group estimated that because the consumption rate was unlikely to decline here, IPv4 pool would be exhausted between mid-2010 and early 2012. Consequently, IPv4 address allocation in Japan was assumed to become impossible between 2011 and mid 2013.

When IPv4 addresses are exhausted, the Internet at that point can be maintained, but its further development will be impossible, because IPv4 addresses, which are required to connect devices to the Internet, will run short, it will have an enormous amount of negative influence.

Transition to IPv6 should be eventually carried out as a basic action. But it seems unlikely that all players will support IPv6 by 2010 all over the world. Therefore, the study group concluded that it would be appropriate to utilize NAT/NAPT at the same time.

These actions are to be carried out through three stages. Nows support only IPv4. Up to 2010, networks and services are to prepare for IPv6. At early stage of exhaustion, all users will be allocated IPv6 addresses as a standard service.

While new users will be allocated private IPv4 addresses, existing users can still continue to use global IPv4 addresses.

At middle stage of exhaustion, as global IPv4 addresses will run short to use NAT/NAPT, existing users will be required to move to private IPv4 addresses.

The study group created the action plan consists of 68 items. And the study group also created a schedule of the strategy for each player to implement the action plan by 2010.

As for the government, we will publicize the Japanese policy both domestically and internationally, and monitor the progress. Also, we will consider tax exemption for promoting introduction of IPv6-compatible systems as well as capacity-building programs for engineers.

We studied cooperative project of Japanese associations of Internet and telecommunications industry, which is called the task force on IPv4 address exhaustion. The task force created the scope of work for each association. The task force would like to give some messages to the stakeholders.

For example, there are four messages to ISPs. The first is, ISP must carry IPv6 packet in order to provide the network connectivity for IPv6-only users and service and so on.

Japanese anticipates that such approaches could serve as best practices for other communities. It's time for action.

Thank you.

>>BERNADETTE LEWIS: Thank you very much, Satoru.

I think the fact that you've put together a task force points to the requirements for a multistakeholder approach to this problem. It is not in the purview of the government alone. It's not for the private sector. It requires a combined approach to getting the implementation of IPv6 on a national basis.

Excuse me.

Right. I would now like to call on Professor Milton Mueller. He has had tremendous experience with the IGF project. And he is going to tell us a bit this morning about the changing role of the Regional Internet Registries.

So I hand over now to Milton.

>>MILTON MUELLER: Thank you, Bernadette.

Yes, as the lone civil society panelist here, I would not talk about I.P. version 6 person say, but about the regional Internet Registries and address management policy more generally.

So when I say RIRs, I'm referring to the Regional Internet Registries. And I think Adiel explained what those are and a little bit about what they do.

The RIRs handle an area of Internet governance that is becoming increasingly important, but many of us know very little about it. My comments here are based on a longer paper recently released by the Internet Governance Project. And you can obtain copies of this from our booth or from our Web site at Internetgovernance.org.

Basically, we see two transformational problems, two problems that are really changing the nature of the RIRs. One of them is IPv4 scarcity. And you've heard a lot of discussion about that.

The other is a demand for more security on the Internet. And I'll be telling you a bit about that.

Now, with respect to IPv4 scarcity, most of the other panelists have talked about how that creates a pressure to migrate to I.P. version 6. And, of course, that's correct.

What I want to focus on is how it changes the practices and policy-making processes of

the RIRs.

The policies of the regional address registries was based on the existence of the free pool and on the idea of assessing the need of different companies for their I.P. address applications.

Those practices are no longer relevant once the free pool is gone. There are all kinds of ways -- which I don't have time to enumerate here -- in which scarcity will change the procedures of the regional registries and the economic stakes of their decisions. For example, you may have multiple players who all have equal needs for the resources competing for a fixed number of addresses. And the RIRs simply are not in a good position to make those kinds of decisions.

Another key issue is that we would want to establish a mechanism for transferring resources from people who don't need them anymore to people who do need them. For example, suppose that an I.P -- Internet service provider makes a major migration to I.P. version 6, and then they could get rid of all their addresses and give them to somebody else.

The current system is based on the idea that they would do this voluntarily. They would simply return them to the RIRs. But some people have spoken about a stronger policy about instituting market transfers of these resources, in effect, allowing people to buy and sell address blocks in the IPv4 space.

Another big problem for the RIRs is a need to reclaim address resources that are unused. In fact, as much as one-third, maybe almost half of the address space was allocated before the RIRs existed. And those so-called legacy address resources are sitting out there. Sometimes they are not used. And we have no contractual authority over their holders, so the question becomes, how do we gain control of those resources or do we need to worry about how to do that.

Of course, most of the controversies center on the transfer markets. And people talk about the impact of market processing on access to addresses. They worry about the emergence of black markets or gray markets if we don't legalize these transfers. And they worry about whether instituting a transfer market would slow down IPv6 migration. Really don't have time to take a position on any of these. It's just an issue that we can discuss either this afternoon or at the end of this panel.

A few quick words about security.

How much time do I have left?

So the system of address governance is a very loose self-governing system formed by membership associations of Internet service providers. For example, it's perfectly possible for you to just jump on somebody else's addresses, and if they're not using them or they don't notice, you could use those addresses for a long time, and some spammers and criminals have done this. So now we're talking about ways of authenticating address blocks, instituting what's called the RPKI, which would allow you to identify who was a legitimate owner of an I.P. address block.

It's also true that in the current system, routing objects are voluntary and decentralized. And there's some talk about instituting a secure routing protocol that would authenticate route objects.

So in the past year, there have been proposals submitted to ARIN, APNIC, and ripe, to develop address registry-based routing registries that combine global RPKI authentication of address assignments with route object authorization information.

This would provide the ability to authenticate not only what autonomous system was using a particular prefix, an address prefix, but also what roots it announced to the Internet.

The interesting thing is that implementing this kind of a system also raises major governance issues. It could fundamentally change the role of IANA and the RIRs,

because it could be used to link control of I.P. number resources to control over what is routed on the Internet.

Now, up to now, the RIRs' function of registering and rationing address resources has been only loosely related to the routing practices of Internet service providers. But RIRs could become a point of more centralized control. And that could attract all the political problems that we now associated with ICANN.

But these changes might also make address management more efficient and help fix some well-known security problems.

This means that we need to think more broadly and comprehensively about RIRs as institutions and about what they do and what they should not do.

In general, I would advocate that we need to maintain the regional Internet registries as neutral, transnational technical coordinators, and we should not try to load up their activities with public policy functions.

Thank you.

>>BERNADETTE LEWIS: Thank you, Milton.

I just had a question with respect to your talking about the changing rule.

Adiel had pointed to the fact that the policy process is a bottom-up process. And, essentially, the community sort of dictates how things unfold in policy development. But then you've just mentioned this issue of, now, a greater degree of control by the RIRs.

How -- I suspect that there's a certain tension between those two positions.

Could you just expand on it for me, please.

>>MILTON MUELLER: Currently, the RIRs are basically membership associations of ISPs, and the people who participate in them are basically technicians.

We would like to see that maintained. But the problem is, we're afraid that because they are open, people could come into them with policy agendas and try to manipulate their functions in order to achieve policy regulatory objectives. And this would fundamentally change the nature of RIR membership and would -- it would make the whole process more complicated and more difficult for the RIRs.

It's fairly easy to come to consensus and agreement when you are dealing with a homogenous community of technical experts who are operating ISPs or hosting sites, but when you have got a whole heterogeneous set of advocacy groups or governments, policy interests, you can have a lot bigger trouble, as we learned in ICANN.

>>BERNADETTE LEWIS: Thank you. Adiel, did you want to add to that?

>>ADIEL AKPLOGAN: Well, what I will just add to that is, the risk is there, but again as the whole process itself is a bottom-up process, we believe that those experts and the members who form the majority of people who deal with RIR policy will quickly react to that. And we have seen a situation like that where the community have very quickly identified those things.

However, probably with the change of the environment, this will become more and more.

And I personally believe that the bottom-up approach will -- is an advantage to try to contact that risk, because the reality is that we have to work keeping in mind the stability of the Internet, the continuation of the business of our member, who are the network operator and ISP. And I think that we'll continue to watch it and for, again, any capture of the process.

>>BERNADETTE LEWIS: Thank you. Any other comments from our panelists?

All right. Then I think we can certainly open the floor now to some questions.

I see Paul from APNIC. Can you identify yourselves, please, for the benefit of the audience.

Perhaps, Paul, we will come back to you while we sort that --

We will go to the center microphone, and we will get back to Paul.

>> Thank you very much. My name is Laura Denardis with Yale Law School, and I have a question about some of the new translation techniques that are being developed by the IETF.

My understanding is that eventually, when we can't do dual stack anymore, when we run out of IPv4 addresses, that will have a certain group of individuals that are IPv6 only, and then other servers and individuals and technologies that are IPv4 only.

So may I ask those on the panel that are involved in the current activities of the IETF to say a few words about the translation that's being developed, how long it may take to develop that and, once it's finalized, how long it will take to get into products and where does it need to get into products.

Thank you very much.

>>BERNADETTE LEWIS: Perhaps we will take the second question, but I will have Jonne and Eric respond to the first question.

Paul, are you ready now?

>>PAUL WILSON: I think so. Thank you. Paul Wilson, I'm the head of APNIC, the Regional Internet Registry for the Asia-Pacific. Am I being heard here? It sounds strange for me.

I am also the chair this year for the Number Resource Organization which is the coalition of the five RIRs.

So I can speak to some extent for the five RIRs here.

In particular, in following up Milton's point and his interesting concerns about the RIR system and preserving and protecting it, which I appreciate, some of what he said seemed to indicate that the RIRs as membership organizations and formally the formal bodies of the RIRs all are membership associations, would be, as such, subject to some sort of capture and some sort of decision-making scenarios that might happen. The implication to me, to my ear, was these things might happen behind closed doors in some manner.

I would like to distinguish between the formal RIR organizations which are legal structures and the wider policy development processes that each of the RIRs has. And in every case, the policy development process is open to all newcomers and all comers. And that does, as Milton said, open it to all sorts of outside interests, outside of the traditional technical communities.

But those policy development processes are also designed very conscientiously and consciously to adapt to the pace of decision-making in a widely distributed manner. So all of the RIRs make, through those policy processes, make great efforts to open them up to remote participation to allow comment periods and inputs to come from whoever might have some concerns.

So I think the implication of Milton that somehow some rapid closed-door decision-making might happen is actually not possible under the current open systems that all of the RIRs adopt. And I would just like to reassure you of that.

But other than that, I think Milton's comments are very valuable and I find very little there to disagree with.

So thank you.

>>BERNADETTE LEWIS: Thank you, Paul.

So I'm going to let Eric and Jonne respond to the first question.

>>KURTIS LINDQVIST: So if I start addressing the technology, it's clearly that the ultimate goal -- I mean you said that one can no longer run dual stack. The driving factor of these translation mechanisms in the IETF is for the people who can't run dual stack. If they could already run dual stack, it means they are already capable of handling v6 or v4 or both.

So the translation mechanism that IETF is looking at it is doing it from v6-only networks into the legacy v4 networks or the other way around, enabling hosts that can't get v6 to access the operator's core network. And depending on which of these two scenarios you are looking at, the translation at two different points. But it is clear this will still be a capability in the operator networks. This is a feature for the operator networks. It is not a feature for the end user has to worry about.

As for the time line, it's always very dangerous to predict IETF progress.

It's probably one of the topics being worked on most at the IETF at the moment. I have been wrong before predict the pace at which the IETF can develop shall, so I will refrain from that so I will note it is very urgent. How long it takes to get to the market, Jonne, I think you know more than I do.

>>JONNE SOININEN: So, first of all, I would like to echo what curt Kurt has already said. IETF process will take its time. But I think this is one of these items that is really -- the time line is well understood in the IETF and people are actually very seriously working to get the technology out as soon as it's possible and hopefully as soon as it is needed.

On the availability of products, like Kurtis said, this is not something that will affect all of the equipment in the Internet. So the new kind of translation is not something like v6 has been where you have to update everything from the operating system to the application.

But this is something that can be added on as a separate product.

I'm not going to give any predictions when these products will be in the market, but of course, at the time that the standards are mature enough and the market is ripe, I'm sure that the products will be also available.

>>BERNADETTE LEWIS: Thank you.

Before I take the next question from the floor, I have one from Deepak Mahesh Swari and I think this one will most likely be for Tulika. He says India announced in 2004 that the migration of IPv6 would be done in 2006. But even at the end of 2006, IPv6 adoption is still at a fledgling stage. Hence, creating incentives may be one of the things that has to be done. And he is suggesting here a mandate is neither pragmatic nor desirable.

Perhaps -- yes, I will ask Tulika to respond to perhaps the first part and then our chairman will make an intervention as well.

Thank you.

>>TULIKA PANDEY: Since I would be saying the same that my chairman would like to say, may I give the Chair a chance to take this question.

Thank you.

>>GULSHAN RAI: No, I have been involved at the policy stage for the implementation of IPv6.

I was heading the education research network at the point in time.

We starting working in 2004 practically for the transitions, and we said that we progressively do the transition.

The deadline for 2006 was never kept over there. It was -- the 2006 date was there.

The more and more transition will happen by 2006 because there were issues in terms of availability of hardware, there were issues in terms of the understanding of transition over there. And then far more important, there were issues in terms of applications over there.

So 2006, that will be in a smooth path for the transition but not that we will complete transition by 2006.

>>TULIKA PANDEY: And if just to add to that, if I may be permitted.

The role of governments world over is to take initiative to roll out new technologies

which the industry is still wanting to check out but not ready to invest for.

So this was initiated, but it does it not mean that the entire onus of the transition belongs on one stakeholder itself.

So from here we can say that please join us.

To transition from IPv4 to IPv6.

Thank you.

>>BERNADETTE LEWIS: Thank you. We will take a question from the gentleman in the middle.

>> Thank you for providing the opportunity to speak here. I am (saying name) from telecom in Switzerland, and running the IPv6 project, collaborative project between Europe and India as well.

I have to add to many of the panelists comments from the starting point, we are saying that IPv6 is ready but not ready, there is always a discussion about. But from my point of view as we heard yesterday's session, the technology is ready, the standards are ready, it's only decisions and deployment which is missing at the moment.

From my point of view, though I come from India, I am working in Europe now, the best way to go is bottom-up, as many people said.

But the people also said the vendors are ready with terminals, with mobile terminals. But they will announce it. If I go and buy any terminal Nokia Ericsson with IPv6, the vendor doesn't know there is an IPv6 capability.

And if I go to any ISP who is currently major ISP, the ISP marketing people, they don't know IPv6.

And if I go to the exchange people ask if they know, they don't know IPv6.

So there is a lack of information about IPv6, the lack of skills of operating IPv6. And then also, the network policy decisions to make it happen, particularly from the third world countries or developing countries or the emerging countries, where the (inaudible) is so high they are ready to pay billions of dollars to have a 3G deployment, whereas they can't invest a few million to deploy IPv6.

All these emerging countries have hardly any IPv4 addresses allocated to them. All the (inaudible) addresses, for example, are unused all belong to U.S. or Europe. Whereas the IPv6 address space, there is plenty available, and ISPs for the emerging countries, they don't have IPv4 addresses, so they can go to NIXIs which are being deployed to interconnect as autonomous systems unless you have a chunk of IPv4 addresses, as Deepak identified, actually. Unless the ISPs have the chunk of IP addresses, they cannot go to NIXI to make it efficient networking operation.

So there is a complicated issue. From my point of view, the bottom-up approach coming from the emerging countries to deploy IPv6 and to create the content, that is the view Europe has taken of late is to have all Web sites from the public sects IPv6 compatible. The first thing to do. Many users will go to use, to surf the Web for information. If it is available as IPv6 compatible information, content, then users will look for IPv6, they will know of IPv6, but there is awareness to be created. I don't want to go on.

>>BERNADETTE LEWIS: Yes, please. There is a multifaceted question and I am going to give panelists time to respond to it.

I think certainly one of the issues is that of public education, awareness, and training. That came out very clearly.

So perhaps Adiel would start, then with Kurt.

I don't know whether Satoru -- Very quickly, please. Could you just respond and we invite the other people with questions to write their questions down and come back to the afternoon session.

Very briefly, please.

>>ADIEL AKPLOGAN: Yes, I will be very brief. And I will agree with the previous speaker about the need of awareness and training. And I will just give an example of my region which AfriNIC serves which is the African and Indian Ocean.

We have seen this at the beginning of AfriNIC whereby we have only two IPv6 network in the region where we start. But by doing training, by informing people, we have seen a very tremendous growth in IPv6 usage.

So training and information is critical in this process, and this has to be done not only by RIR or by people who are specialized but it's a task that everybody, at every level should do to encourage people to move to IPv6.

>>BERNADETTE LEWIS: Kurt, quickly, please.

>>KURTIS LINDQVIST: I will do this quickly but I thought I would end on a positive note and give you an example of one of these bottom-up real deployment and show this is actually happening. There is a French ISP who is getting some famous -- becoming famous because of their deployment. There have 3 million DSL subscribers. They own their own CPs, developed their own CPs and there are have been able to actually deploy v6 through a protocol or through a mechanism they actually invented themselves. And today they have 250,000 subscribers that actually choose to use IPv6. And they actually did this by themselves.

>>BERNADETTE LEWIS: All right. Thank you very much.

I'm sorry, we would not be able to take any further questions at this point.

There are issues pertaining to the roles of the stakeholders, the governments, private sector, operators, consumers, and we hope to address some of these issues this afternoon.

So if you would please write your questions down and come back to the afternoon session, we would be happy to entertain it and to delve, drill deeper into the issues we have presented.

I would certainly like to thank our panelists for this, the excellent contributions this morning. And I am going to turn over to our chairman to give some closing remarks. Thank you.

>>GULSHAN RAI: Thank you, Ms. Lewis.

It's a very excellent and stimulating session where the panelists made very interesting remarks and brought their experience for the actual implementations in all areas.

The transition from IPv4 to IPv6 is not that difficult today when you talk about the hardware. Because I have done it four years ago.

I realized at that time that problems were there.

The actual challenge comes when you want to really enjoy the potential IPv6 and make a transition in terms of applications.

There are certain myths that panelists have talked about that are no more issues there. Madam Lewis also talked about it.

So all we have to do is that we have to collect the references which are happening worldwide, large networks are getting converted, migrated to IPv6. Put those references and case histories on the Web so that those myths are not there and people get more and more experience and more and more they get encouraged to migrate.

In my view, there is no escape. We'll have to do data migration very soon, maybe couple years, three years it will start happening over there.

I want to take the proximity of this session in the presence of Mr. Markus, which I took his permission to raise, is that the U.N. has set up centers for training, giving training in e-governance and many other areas. It is for him, I tell him I want to propose that those centers should also take up such transition, the case of dissemination of information, how the various countries, how the various service providers, large network from each quarter has migrated to the IPv6. And I'm sure it will bring a lot

more information and a lot more easiness among us to meet our mission.

Thanks, Mr. Markus, whose presence itself is stimulating, gives a lot of stimulation to us and the panelists.

I thank madam Lewis for conducting the session exceedingly, and I thank all my panelists over here for making excellent presentation.

Thank you very much.

[Applause]

>>MARKUS KUMMER: Thank you, Mr. Chairman. Thank you, panelists and moderator. As before, we make a flying handover.

May I ask the new panel to join us on the stage and we thank the panel while they are leaving the stage.

Thank you very much.