ICANN84 | AGM – How the Internet Really Works
Sunday, October 26, 2025 – 9:00 to 10:00 IST

SIRANUSH VARDANYAN: Welcome to the second day of onboarding sessions for Fellows, NextGeners, and all newcomers who are here in Dublin for ICANN84.

Today we will start, actually, with the session How Internet Really Works. Every single time listening to this session, I'm learning something new, and I'm finding out the new ways how actually the Internet works. And it's my pleasure to turn over to my colleagues, Champika and Ulrich. Champika, first to you for the transcript, and then, Ulrich, the floor will be yours.

CHAMPIKA WIJAYATUNGA: Thank you, Siranush, and good morning to you all. Hello, and welcome to this session. This is the How the Internet Really Works session. My name is Champika Wijayatunga, and I am the remote participation manager for this session. Please note that this session is being recorded and is governed by the ICANN Community Participant Code of Conduct, ICANN Expected Standards of Behavior, and the ICANN Community Anti-Harassment Policy.

Please observe the following guidelines to participate in this session. I will also post them in the chat for your reference. Interpretation for this session will include English, French, and Spanish. If you would also like to speak during this session, please

raise your hand in Zoom. When called upon, virtual participants will be given permission to unmute the Zoom. Onsite participants will use a physical microphone to speak. Only questions posted in the Q&A pod will be read aloud during the session as the time permits and when directed by the facilitator of this session. Please state your name for the record, the language you will speak if speaking a language other than English, and speak clearly at a moderate pace. I will now hand the floor over to Ulrich Wisser. Thank you.

ULRICH WISSER Thank you, Champika. Good morning, everybody. You awake?

SIRANUSH VARDANYAN Good morning, everybody.

ULRICH WISSER Yes, good morning. Yes, good. I also barely made it. I totally agree. Yes. So How the Internet Really Works? Yes. So, ICANN's mission, yes. Well, you probably all have heard it a few times. ICANN is really proud of this, and we try to tell everybody about it. And so our mission is we are the Assigned Names and Numbers Corporation, and we ensure the stable and secure operation of the Internet's unique identifier system. And if you don't know what that is, this doesn't tell you anything, and so it's like a little bit you have to know what we do to understand what we do.

Well, anyway, it goes our name relates to domain names, so it's unique identifiers. Then we have numbers, and that is IP numbers

and autonomous system numbers, and we get to what all of that is. Yes. I hope at the end of this session you will understand why we think that this is a really important mission, not only for us, but for the world.

Let's see. Yes, packets. Most of you are not old enough to remember landlines, but once upon a time, telephone had landlines, and it meant when you talked to your grandmother that you couldn't talk to anybody else. There was only one communication on that line, so nothing else would be going on. But today, you have only one Internet connection in your home, and you look at YouTube, and your children look at Netflix, and at the same time, you're sending messages over WhatsApp, and somebody else is scrolling Facebook or watching TikTok videos, and it's all going over the same line at the same time. So, how do we do that? That was a very profound invention many years back, and that is packets.

We have this digital information. It's a long stream of digital information, and we divide it into small packets, and then we put some addresses on these packets, and then we send them over the line. Well, that doesn't sound like much, but now what it allows us is that we can send one packet from YouTube, and one packet from Netflix, and another one from another service, and so on, and so on. And suddenly, if we send these packets fast enough, to us humans, it feels like we do all of it at the same time. And that is how we made all of this happen in a very fast pace. And then, obviously, there is some stuff going on.

Let's see. I need two volunteers. Two volunteers. Somebody in the back. I need somebody in the back. Yes, okay. Oh, you have this gentleman right in the back. Great. Okay. You are one of my employees. We need to make an Internet speed test, and for that, I will send you to the Maldives. Yes. So you will travel to the Maldives. I'm sorry, you will not see the beach. You will go to a data center in the Maldives. And the gentlemen here in front, sorry, you stay in Dublin. Not all my employees get the same treatment.

Okay. So now we have this speed test we're doing, and all you others are guessing. They're sending me a message. Which message gets to me faster? Maldives? Put up your hand if you are for Maldives. Who thinks that Dublin comes faster? You have to decide one of the two, come on. Okay. Most of you think it's Dublin? Dublin is faster? Well, in human terms, no. In technological terms, yes, it may be a few milliseconds, but actually, information from the Maldives comes over a fiber line with the speed of light, and I get it from the Maldives 30 milliseconds later. Can I recognize that? No.

Today's Internet is more driven by the speed of light than it is driven by whatever other speed we think of. What is important is how many station hops you have in between and stuff like that. But the basic communication is super fast. That's how we get Netflix and YouTube and all of that, or Zoom, you feel like, well, it's at the same time. It's only when you start singing all together that you see that it's really not. But that's a different problem. Okay. Thank you, gentlemen.

So that is how we make all of this work. Okay. Just to be totally clear, I want all of you, if there's any questions, please put up your hand or put it in the Q&A. If there's any questions, just put your hand up or put it in the Q&A pod, whatever. If you don't start asking questions, this will be a very short session. Okay? We will be done in 20 minutes.

Good. We have our first question. Good. Oh, more questions. Good.

MACIEK PIASECKI

Hello. Maciek Piasecki, I'm a current Fellow. I'm quite surprised that during the whole training and up until now at the conference, I have at no point heard the term OSI layers. I'm quite surprised with that. Because when I was learning about cybersecurity, that was one of the first things that they would try to convey you. I know two mnemonics that can help you with that. I am happy to share with them. If anybody wants to learn more about OSI layers, I'm here for you. So I was wondering how those are relevant for what ICANN does, and which layers does ICANN regulate? Thank you.

ULRICH WISSER

That's a tough question. But okay, first, let me say that I lived through the OSI wars and, well, you could say the layers is a bit like the king is dead, long live the king. The OSI layers are basically dead. The Internet doesn't conform to the OSI layers. But then again, the Internet does have layers too. So, basically, you have the physical layer, and that in itself is a lot of stuff. And then you have

the IP layer where you send the packets. And above that, you have protocols like UDP, TCP/IP, QUIC and stuff. And above that, we have the application layer. So it's not like the seven OSI layers. It's a little bit more convoluted and all in that, but there is layers in it.

ICANN doesn't regulate any of the layers because we really don't regulate, we coordinate. I just put that out there. And then again, for example, if you look at domain names, you have a DNS server, and there's good arguments to be had that DNS server works on layer seven. But then if you look at the Internet as a whole, you wouldn't say that DNS is on layer seven because it's such a basic infrastructure to make everything else work that it really doesn't feel like a layer seven protocol. So, there is nuance to this. You can't just say we regulate a layer or something. It's like there's specific things that ICANN works with, and names is one of them. Yes.

There was another question?

SAMEER GAHLOT

Thank you. First of all, thank you for organizing this relevant session. Sameer Gahlot for the records. I am just tweaking the question, the examples which you have taken. In the previous example you mentioned, supposedly, if the packets are traveling using the fiber cable. Now, consider this, if the packets are traveling using the satellite Internet, which one will come first in that case?

ULRICH WISSER Oh, tricky question. It depends on which satellite you use. In satellites, we're talking about what is called the geostationary satellites. It's 36,000 kilometers up there, and they're called geostationary because they basically stay above one place on Earth, and they turn with the earth, and that takes a very long time. So, even if you have a telephone call over one of these satellites, you will hear the delay. But, for example, if you look at Starlink, it's a minor delay. You can even have a Zoom call over Starlink.

CHAMPIKA WIJAYATUNGA Ulrich, maybe introducing the concept of Internet measurement for—

ULRICH WISSER Yeah. There's a lot of measurements about this, but you know, yes. I mean, you all have probably used a speed test for your home and stuff, and Starlink is—

SIRANUSH VARDANYAN There is a question over here, please.

UNIDENTIFIED MALE We all talk about packets, IP addresses, and DNS, and all those things, but I see that we're not quite aware about the AS numbers and how they work.

ULRICH WISSER We are not there yet. There's more slides.

UNIDENTIFIED MALE Oh, okay. We can get going then. Thank you.

ULRICH WISSER Let's see what we can do. IP addresses. Yes. We start with IP addresses. That's good. So we talked about these packets that we're sending, and obviously we need to send them somewhere, and that somewhere needs to have an address. Even like you send the letter, you need to write a letter on it. You can't just put a blank envelope in the post box and believe that it arrives. It's the same with the packets. You need an address where it goes to, and yourself need to have an address so that people can answer you. And you put the source address, the sender address in the packet, and then you send it on its way.

We have two different versions of those. We have the IP version 4 and the IP version 6. One is 32-bit number, the other is a 128-bit number. They are written a little bit differently. It doesn't matter how they're written, but they have the same function being addresses on the Internet that you can reach. Why do we have two versions? Well, when the Internet was invented, a 32-bit number was a really, really, really big number. My first computer was a small computer, and it had 16-bit numbers, and that was like an invention at the time. So the 32-bit number felt like, wow. That's like it will be enough for all the future. It wasn't. So, 32-bit number

is basically 4 billion, but we are 8 billion people on the planet, so it can't be for everybody. And I guess all of you have at least two devices with you, a laptop and a phone, and maybe a second phone, and then you have something at home. So, one number per person wasn't even enough, so we needed more addresses, and that's why we invented IP version 6.

IP version 6 has a lot of addresses. I can't tell you the number because it's so big that it doesn't make any sense. But what it basically comes down to that, if you have 4 billion countries, in every country you have 4 billion ISPs, every customer and every ISP has 4 billion customers, every customer gets 4 billion addresses. So it seems that it's enough for a while, at least. Okay.

The IP addresses are just an addressing scheme for the Internet. Every IP address has to be unique, because obviously if we had two of you had the same IP address, how would I know who I send the packet to? Or how would you know to return a packet to me if the IP address is not unique?

Yes, microphone is coming.

CHARBEL CHBEIR Hello. My name is Charbel, and I'm a Fellow for the first time. I have a question regarding… Is it possible for the IPv4 and IPv6 to coexist on the same network, and how is that managed?

ULRICH WISSER

Yes. Actually, the idea is that they do. I would guess, if you have a small network at home, that you already have IPv4 and IPv6 in your network. Because nowadays modern computers just start in IPv6, and it will just be a link local, though you can reach the Internet with it if your Internet provider doesn't support it, but you will have IPv6 on your network. So the idea is that, well, we move from IPv4 to IPv6, and then we phase out IPv4. Obviously, it's the end goal where we have IPv6 only. But everybody realizes that that is not an overnight thing, and so we need to have this transition period. And one of the things that we do is we have dual stack, so your computer will have an IPv6 or several IPv6 addresses and at least one IPv4 address. And then you can reach the Internet over these two different communication styles.

There's a lot of work into this, how to do this best and what we do, one of the things is that we have this function called Happy Eyeballs. What it means is that we keep the user in front of the computer happy, Happy Eyeballs. What it does is it will send out a request over IPv6 first, and then it waits like a few milliseconds, and then it makes the same request over IPv4, so that if the IPv6 doesn't work, you get the IPv4. But if the IPv6 works, you're just in business. So you as a user don't even experience the difference if something wouldn't be working, and that is one of the transition mechanisms to make this smooth for the user, but being able to phase out the technology.

CHARBEL CHBEIR: You were talking about real-time Internet speed. Can you explain how routing decisions are made in real time?

ULRICH WISSER: We come to routing. We come to routing, yes. We begin to talk a little bit first about how IP addresses are distributed because that's very important.

UNIDENTIFIED FEMALE: Ulrich, I think there was a question over here.

ULRICH WISSER: Sorry. Yes, of course.

UNIDENTIFIED MALE: I have a question for IPv6 again. And in terms of cybersecurity concept, also in real security concept, IPv6 is specific in the individual address, right? If some malicious guys try to attack you, I want to hide in public, not one by one. I think IPv6 coming with some serious cybersecurity threats—

ULRICH WISSER: No.

UNIDENTIFIED MALE: Because there are some attacks like advanced persistent threat.

ULRICH WISSER

There's cybersecurity everywhere and there's attacks everywhere. But the difference between IPv4 and IPv6 is that, well, when the Internet was invented, we had this idea of the end-to-end communication. So if you think of the old telephone network, your telephone was really, really dumb. You lift the handle and it would make an electrical connection with only a switch. Nothing else happened in your telephone. So your telephone was super dumb. The network had all the information. On the Internet side, we changed that. We said, "Well, all the interesting stuff is in the client, and the network is just sending packets." The network doesn't do anything else. But that means every device needs to have an IP address, so to speak, to be able to speak to all the other devices.

We ran out of addresses and we invented this NAT thing, Network Address Translation. So now you have private IP addresses, and from the outside, nobody can speak to your devices in the network. And some people think that is security. Well, it's some kind of security, but it's not the best one. And then they think, "Oh, well." But with IPv6, we go back to every device having a public IP address, and that makes these devices attackable. But to be reachable, you have to be connected to the Internet, and you go to your router, and your router defines what is connected to the Internet. So you are not reachable over the Internet only because you have an IP address. That has nothing to do with IPv6. It has something to do with how you manage your network.

UNIDENTIFIED MALE What I mean, in Turkey, for instance, we are sharing our IP address with our neighbors, so that cyber threats or any other guy will be able to specifically see my IP address and attack it. It's hard, by the way. It can do it, advanced persistent threat, it means this. But IPv6 is very specific. But you know your address, it's come and—

ULRICH WISSER But you can't be reached from the outside. It doesn't work like that.

UNIDENTIFIED MALE But is it?

ULRICH WISSER Yes, it doesn't work like that.

UNIDENTIFIED MALE If you're connected to the Internet?

ULRICH WISSER It doesn't work like that. Your router will not let the packets in. I have IPv6 at my home. I run it myself. If you share IP addresses with your neighbors that is IPv4 and you have a CGNAT in front of you—and that is even worse, because if your neighbor does something stupid, the police will knock at your door. So I prefer IPv6 over that every day.

UNIDENTIFIED MALE Yeah. By the way, it will be. We have to get some new addresses because we want to use Internet. But the problem is router can't prevent it. Of course, we can have some security functions on our router, but it's not enough because we have more devices and threats and threat bets and this kind of stuff is increasing. How much devices we have and it increases the threat level. By the way, it's my thought, if the IPv6 integrated our lives, it's not very common nowadays, but getting day by day, we will see more and more cyber attacks because of this specific other stuff.

ULRICH WISSER No.

UNIDENTIFIED MALE We will see. We can discuss it later.

ULRICH WISSER Not because of the addresses. I can assure you. For example, T-Mobile in the U.S., they're running an IPv6 only network for all their mobile phones in the U.S. for almost 10 years now, I haven't heard of any that T-Mobile customers are getting scammed more often than any other or that their devices get hacked more often than any other, and they're running v6 only for almost 10 years. So that's not how it works.

UNIDENTIFIED MALE: I think this is because cyber attackers are just only focusing on the—most people are using IPv4 right now. When they're just turning in the IPv6, they will change their direction. Yes, we will see in progress in the future. So, we can discuss it later.

ULRICH WISSER: Let's continue with our—

CHAMPIKA WIJAYATUNGA: Okay. I had two questions over there. Let's start with the first one. Just hold on.

SAMEER GAHLOT: Sameer Gahlot for the record. Just to revert to what my friend, my colleague, was mentioning. If IP address will increase, the risk will also increase. But that is not the case because there is a diversification in the addresses, and if numbers are increasing, then it is not compulsory that the attacks will also increase.

IGNACIO SÁNCHEZ GONZÁLEZ: Good morning. This is Ignacio, ICANN84 Fellow. My question is from the not technical perspective. I always thought that the IPv4 and IPv6 phenomena was a thing of the private and technical community agreements. They need to get to an agreement to operate that way. But once I saw that LACNIC, which I see you're going to address it now, LACNIC had some workshops and meetings with the Pacific Alliance, which is a regional state

organization in Latin America. This organization has four countries, and they were promoting IPv6. So, my question is, what is the role of the states in this case, I mean governments, and international organizations in adopting IPv6 and new developments like this?

ULRICH WISSER

Yes, we always have this discussion, what can countries do? And obviously, basically, we don't want them to regulate, but on the other hand, we want them to support the development in some ways. For example, governments can incorporate that in their procurement. If they buy equipment, they could say, "We demand an IPv6 connection to our next Internet connection." Any Internet provider who wants to provide the service needs to have IPv6 running. Obviously then the country shouldn't do that overnight. Then they have to say, "Five years from now, we demand IPv6 so all the Internet providers have a chance to do this and so on." But there should be a plan, basically. A lot of countries have IPv6 implementation plans for their agencies and stuff like that. I think that is one good way to support this.

As we said, these Internet addresses, they need to be unique. Every one of us needs to have a unique Internet address to be receiving packets. So how do we make this? This has a history. So in the '70s, when all of this was invented, and then people said, "Yeah, well, we do this IP address thing." And they started to, "You get one, you get two, you get three," like this. And then somebody said, "Well, how do we remember all of that?"

There was John Postel. He put up his hand said, “I can make a registry for that,” and that is how IANA was born, the Internet Assigned Numbers Authority. He did run that for a very long time, but nowadays the IANA Function is run by ICANN. So we distribute IP addresses to the world, and we see through that every IP address is only distributed to one party. But we don’t distribute them to end users, so you can get IP addresses from us.

There’s five what we call the Regional Internet Registries, and you see them here on the screen. It’s ARIN for North America. We have LACNIC for Caribbean and South America. AFRINIC for Africa. RIPE NCC for Europe, Middle East, and some parts of Central Asia, I think. And then we have APNIC for the Asia Pacific region. And they get huge address blocks from ICANN. There’s some rules around this, but basically they get these address blocks when they need them. And then, as an Internet provider or a large company that runs their own network, you can go to one of these organizations and say, “Hello, I would like to become a member of your organization and get some IP addresses.” And if you only want to have IPv6 addresses, that’s totally fine. If you want to have IPv4 addresses, well, bad luck. Those you can only buy on the market. Currently, the prices are down, so that’s not that expensive. Currently, I think it’s like $15 an IP address. There used to be some time ago, it was 60, so cheap right now. But still, IPv4 addresses are hard to come by. But IPv6 addresses you can get that way.

Then from your Internet provider, you get assigned IP addresses to your home. For IPv4, you get only one. For IPv6, you get a whole

network. I think usually you get a /56 which means at home you can have 256 different networks with 4 billion addresses each. So you have something to go around at home and divide them to all of your devices. That's how IP addresses are divided, distributed into the world and to all the devices so that we keep them unique.

Networks, yes. Oh, we have questions over here.

SINA ROSTAMI Hi. Thanks. It's Sina, ICANN84 Fellow. Regarding to the previous slides, you mentioned there are some rules about how IANA allocates prefixes addresses to these Regional Internet Registries. I was just wondering, what are the factors that IANA takes into account to make sure that these addresses are evenly and fairly distributed between the regions? Thank you.

ULRICH WISSER If you look at IPv4, it is not evenly distributed, so there is no questions about it, but that is a historical function. In the beginning, the Internet wasn't even a thing everywhere, and so they assigned huge parts of address spaces to universities in the U.S. and to companies and stuff. So, IPv4 addresses are very unevenly distributed.

But IPv6 addresses is a different story. Oh no, you're putting me on the spot here. What are all these numbered organizations called? No, no, no, no. The NRO and the Number Resource Organization and the… All these five organizations together meet and they

basically discuss among themselves what rules they want to have, and in the end, IANA implements them. I mean, with IPv6, we have so many addresses that it's basically no question. We don't allow anybody to get so many addresses that the others can't get any. But on the other hand, if you want to have a trillion, why not? We have so many.

TINUADE ABOSEDE OGUNTUYI Thank you so much. Tinuade Abosede Oguntuyi, Nigeria, ICANN84 Fellow. I thought you are going to address my question when he asked. If we have assigned IP addresses, especially IPv4, unevenly before, is it possible that we have, if you don't use, we can take it back? Can IANA do that? I will say why I've said this. I work with AFRINIC, for instance, and I know if you apply for IPv4 now, they will tell you maybe it's not available. I know that from IANA point of view, being you from ICANN, have you really exhausted IPv4? Can we withdraw from people that are not using it? Or maybe they make justification for the use, but now they are not. Thank you.

ULRICH WISSER IANA will not pull back any IPv4 addresses from anybody. That's easy. And then what the five RIRs are doing is dependent on the rules of the RIR. And these organizations are member organizations. They have a community that discusses the rules and decides on the rules, and they have actually different rules. So, I

can't answer that. The whole IPv4 discussions in AFRINIC is above my pay grade. I'm sorry but—

AHMAD UMAIR SUHAIDI: Hello, Urich. Thank you for your presentation. So when we talk about IPv4 exhaustion, there's been like an import and export of IP addresses within the region. And according to a data I found on the Internet from Geoff Huston, he said that it is recorded that around 67,328 IP addresses were recorded as exported from the USA to Russia in 2024. So how does this work? Because I understand that there's been sanction between countries, USA and Russia. But why is it still happening, like selling import and exports of IP addresses? Is the sanction only applicable to other things but not IP addresses? Does ICANN has—you know?

ULRICH WISSER: First of all, that is stuff that is happening at the RIR level, and that is nothing that ICANN has to do. We only give IP addresses to the RIRs, and that's it. It's just a registry function. We don't even make the rules around that. The rules of the RIRs are very different. So some RIRs allow you to transfer your IP addresses. You can transfer them between users. So, let's say we are both members of RIPE, and you have too many IP addresses, and I could approach you and say, "You have these very nice IP addresses. If I pay you $20 a buck, would you sell me some?" And then you could sell me your IP addresses, and then you would transfer them in the right database to me, and then they would be my IP addresses. So if we live in

different countries, you would see this in the IP addresses are transferred from—I don't know where you live, but I live in Sweden. So then suddenly Sweden has a few more IP addresses.

Not all of the RIRs, but some of them allow you to transfer IP addresses to a different RIR. So I could say, well, maybe ICANN wants me to move to the U.S., and though I want to take my IP addresses with me, then I would go to ARIN and would say, "Hello, ARIN, I have this nice IP addresses in the RIPE database. Can I transfer them to your database?" And then I could transfer my IP addresses to the different RIR.

AHMAD UMAIR SUHAIDI Thank you. Just for the record, I'm Umair, a NextGen participant. So these RIRs, they are bounded by contract with ICANN, right?

ULRICH WISSER No.

AHMAD UMAIR SUHAIDI No? Okay. So they have very independent power of selling and buying IP addresses.

ULRICH WISSER Yes.

AHMAD UMAIR SUHAIDI Okay. Thank you so much.

SAMEER GAHLOT Sameer for the record. I have one quick question. So these IP addresses, when they are being transferred by the ICANN to these RIRs, are they being transferred in a pool or on demand basis? What is the process? If you could clarify on that part. When the IP addresses are being transferred from ICANN to these RIRs, are these being transferred in a pool? Or whether they are being transferred on demand basis?

ULRICH WISSER Yes. We come to that. We're talking never about single IP addresses in this context, we're talking about huge blocks of IP addresses. So, for IPv4, it's usually /8s that get transferred. Not any longer. And I think it's /20 or something or even bigger for IPv6. So, huge blocks we'll be talking about.

That's good. Leads us to networks, because IP addresses is nice, and we all can have one, but then obviously we need to know how to get to this IP address because we are all distributed over the globe. Well, if I put a number on a packet and say, "This has to go to IP address number five." So how do we know where IP address number five is? And that is what networks are for.

First of all, we never distribute IP addresses, just addressed by address. We do this in blocks in what we call networks. If you have a IPv4 network at home, you probably have, you usually have a /24

we call, and that is 256 addresses in one network, you have three bytes of the network address, the prefix, and one byte for the devices on your network. And in IPv6, it's usually you have a 64-bit prefix and a 64-bit host interface. So that gives you, I don't know how many, but over a trillion network devices on your network. It should be enough.

But anyway, these networks talk to each other, and they talk to each other by a protocol that is called BGP, the Border Gateway Protocol. And that's a very important protocol. It's a routing protocol, and it works a little bit like this. But I say, well, I have IP addresses 1 to 100,000, and then Champika has 100,001 to 200,000, and Siranush has 200,001 to 300,000. You get the idea. Then I say to Champika, "Hello, Champika. In my network, I have the IP addresses 1 to 100,000." And then Champika says, "Oh, yeah. And I have 100,001 to 200,000." Okay. So now if I want to send an IP address and pack it to IP address 150,000, I know to give it to Champika. Very easy routing.

But how do I get to 320,001? Well, Champika will talk to Siranush, and she will tell her IP addresses, and then he will come back to me and say, "By the way, I have a connection to Siranush, and she has 200,001 to 300,000." Then I know, okay, if I have a packet for her, I can give it to Champika, and Champika can give it to Siranush. And if you continue this thinking about how we are connected, and maybe Champika gets a new fiber cable to one of you, and then we can…

That's how the Internet finally converges in how do we send packets? So there's a huge mathematical theory behind this graph theory. If you ever go to university and study that, graph theory is what BGP does. It's supposed to converge on the shortest paths between two addresses on the Internet. This protocol runs all of the Internet. Everybody needs to be in these networks. And these networks identify each other by autonomous system numbers. So I told you we'd get there.

And these autonomous system numbers is another number we source that needs to be unique, and that IANA distributes to the Regional Internet Registries, and the Regional Internet Registries then give out to their members. Yeah, that's what we do.

If you think about routing, and we had a easy explanation, the RIPE is the European Regional Internet Registry, and once upon a time, they had a working group that actually did make a map of the Internet. And this is the map for the European Internet in 1991. And that was the last map they produced, because after that, nobody could figure out how to fit it into a map. They gave up on this. You already see here, if you see who talks to whom and how to send a packet, that's not the easiest decision to make. So then you know why there is all this mathematics behind it and why we need BGP, because all these networks need to talk with each other and distribute information about who can reach whom and where to send packets.

Good. Okay. Now we talked about our networks exchange information. I'm actually German. I moved to Sweden in 1999, and at that time, interconnection wasn't that good. So when my Internet provider, actually the only other connection they had to the outside world was via an American company. So all my traffic would first go to New York, and then it would come back to Sweden. Let's say transatlantic lines at the time weren't the fastest, so not the best Internet speed, and then beside being really uneconomical. So, people thought about, how can we make this better? How do we make this better? That is called an Internet Exchange Point.

What Internet Exchange Points do is that usually they are local, it means maybe only your country or only your city, and the local Internet providers connect. When I am in Stockholm, and I want to reach some other resource in Stockholm, well, my Internet provider has basically a very short connection to these other resources in Stockholm through the Internet Exchange Point. This is a very important function because you don't have to send all this traffic through the whole world to reach people that are very close to you. And it's also a resilience function, because even if you are cut off from the rest of the world, you can still reach your peers that are close to you because you have a local Internet Exchange Point.

For any further questions, I refer to these three gentlemen here. We are representative of the Swedish Exchange Point. Yeah, we have questions.

OM PRAKASH SHARMA: Hi. This is Om from Nepal with NextGen program. Just a comment on Internet Exchange. It's so fascinating how the ISP in Nepal, they came together to form the Nepal IX. It's really good. And then we started doing the local Internet traffic within local place. Although they are businesses doing and doing their business with the ISP, we have the Internet Exchange that's so fascinating. And I would like to have your feedbacks on how we can connect. There are few places in Nepal that's not connected because of the geographical reason. So if you have some kind of connections of people doing these works, I would love to talk to them. Thank you.

ULRICH WISSER: I don't even know. I don't think I have an answer for that. Yes?

UNIDENTIFIED MALE: We're creating an IXP in Lebanon, but we have concern regarding centralizing risk because of single point of failure. What do you think of that?

ULRICH WISSER: You don't only have to have one IXP, but then an Internet service provider has to have other connections. They cannot connect only through the IXP. So you always have other ways to send your traffic where you want to send it and not send it through the IXP. The IXP

is just for the local traffic. You don't get what is called transit through the IXPs. With IXP you only exchange locally.

UNIDENTIFIED MALE: Okay. Thank you.

DAVID: Hello. I'm David. I'm Canadian. My question is more about how data gets transferred between IXPs. For example, my hometown is Vancouver. And in Canada, I know that if data is getting transferred between Vancouver and, let's say, Toronto, on the other side of the country, it often sort of boomerangs down to the U.S. and then boomerangs back up to Canada. So I'm wondering, how do those decisions get made in the background, in the innards of the technology?

ULRICH WISSER: The easy answer is BGP. That's how the decisions get made. I mean, a lot of the traffic decisions ISPs make are based on money. What's the cheapest way to send traffic? And the American companies are often cheap? That's the short answer to this. Yes, I agree to what you… It would be nice if the traffic stayed in the country, but usually it is cheaper to give it some large provider and they transport it to you. And then the next question is why does BGPs think that this is the shortest path? And that is, obviously, you have a large provider, they have a short path to the other network. And you could do this in the country if you had better connections in the

country. But then I know that Canada has these patches in the middle that are not very populated, and it's not very economical to put a lot of fiber there, so that's problems you have to think about.

SADICHCHHA SILWAL

Thank you so much. Sadichchha for the record. I'm from NextGen program. I'm from Nepal. I would like to ask a question, as we are talking about the IXPs. As we know, it is for a local transfer of network. But as we are talking about the local networks, what if some country have a provision or some policies that manage to have a single national Internet gateway? How does it work and how the whole routing and the IPX will work for that example, for that case?

Why I'm asking this question is the Nepal has recently got its very first National Cybersecurity Policy, and one of the provision is related to having one national Internet gateway. It is similar kind of provision that in 2019 Cambodian government wanted to implement. As the policy needs some kind of law to implement it, and Nepal Government is working on that. As this scenario is changing in Nepal, we are not sure whether Nepal wants to have that one Internet gateway to control all the incoming and outgoing Internet. So how the whole ecosystem will be affected by that provision? I want to ask this question. Thank you.

ULRICH WISSER Okay. Personally, I have an opinion. But I'm on the stage and it says ICANN Org on my badge, and we don't comment on the politics of Nepal. Talk to me over coffee, brothers.

SIRANUSH VARDANYAN Ulrich, just a reminder, we have five minutes left.

ULRICH WISSER Okay. Yeah. Let's see. One direction. DNS. Oh yeah, we have a little bit covered. So we come to the last part of what ICANN does. Five minutes left there was.

The DNS, the Domain Name System, you all know it. You all have seen domain names. You all know the gTLDs. You all know the ccTLDs. How did that come to? It's the same way as the numbers. At some point, we needed to decide who has what name, and we needed a registry. And so IANA got the registry for the top-level domains, and so it resides with IANA.

There's a lot of policy to be made. Who gets names? How to get names run and stuff like that. So you are here at the ICANN meeting. All of this is, I think, in your schedule somewhere, or you have to read about it, how all of this works. There's a lot of groups and Advisory Committees and Support Organizations that feed their input into how we should run this whole namespace, okay? So just to be very clear on this, this is a community that makes all these policy decisions. It is not ICANN Org, the organization ICANN, that

makes these decisions. We are the secretariat of the community. We implement the decisions that the community makes.

Let's see. The DNS is a hierarchical namespace, you could say. Traditionally, the root zone is identified as dot in the DNS, just a convention. And then you have the top-level domains. We have the second-level domains, the third-level domains. You get it. You understand the levels. And some countries have even in the second-level is in these countries is defined like you have gov.uk or co.uk, and the UK has given the CO function and now does names under UK, but other countries don't. Other countries still have these divisions into different parts of the society and say they have one for universities, one for schools, and so on.

These levels are usually run by different authorities, you could say. So the root is coordinated or managed by the IANA Function. And then you have the top-level domains that are managed by the top-level domain registries. And this depends on generic top-level domains, country code top-level domains. It's a lot of different organizations. And then they usually sell second-level domains to end users, companies in your country, all over the world. And those companies then administer their own domain name and run their own domain name. They have their own servers for it. So these have different authorities that run these levels.

So, a little how does all of this work. Well, we have this side that asks questions, and then they usually go to a recursive resolver that is usually a function that your ISP is running for you, and then the

recursive resolver asks all these levels in the DNS about information, and in the end will return the one you asked for to you if it exists. One of the little fun side stories that we can make.

We have the root zone. We have root servers, we call them, that we run the root zone on, and they get a lot of questions. So there is this answer in DNS that says NXDOMAIN which says the name doesn't exist. So what would you think is the percentage NXDOMAIN answers that the root servers give? How often do they get asked for domain names that don't exist? What do you think? Above 50%, below 50%? Who's for above? Okay. Who's for below? Okay. If you take above again. Yay. I give you a little hint. The second here in the front, he's a root server operator. He had his hand up. So yes, it depends a little bit on when you look, but it can be up to 70%. In some years it was 70%. I think currently we are around 50. Well, yeah, you know. But yeah. And then I think we have the last question.

SETH ADJEI GYIMAH Thank you very much. My name is Seth Gyimah from University of Ghana, an ICANN84 Fellow. Thanks so much for your presentation. I really enjoyed it. But from your presentation, there is one thing that keeps echoing to me, and it is simple, that much of the Internet technical infrastructure they are developed and they are located in the Global North. Much of them are not located in developing regions. So, my question is what is ICANN doing to support capacity building and then the local technical expertise of developing

regions to ensure that the Internet operations are globally representative?

ULRICH WISSER I can't speak for all of ICANN, but what I can say that I work in a team that is called Technical Engagement. And what we do is we meet the technical community everywhere in the world and talk to them, talk to them about distributing knowledge about the technical infrastructure of the Internet. And we have people. I do this in Europe, Yazid does this in Africa, Champika in Asia Pacific, and we have Nico who does it in South America, in the Caribbean, and David Huberman who does it in North America. So we try to be everywhere. We can't be everywhere. But we try to get around and tell people about this infrastructure, and try to bring them to the process, be it ICANN or the IETF or the meetings of the regional RIRs so that you know they can participate in this development.

SIRANUSH VARDANYAN So, Seth, make sure you talk to Yazid. Okay? Thank you. We are not able to take more questions because we need to close this session.

ULRICH WISSER We meet in the hallway. Yes, I will be around.

SIRANUSH VARDANYAN You can stay here for this break, and if you have time to stay here and talk to them, that's okay. Otherwise, they will be here for the

entire ICANN84. Please remember their faces so you can talk to them during the breaks. But we did need to stop this. I know we can talk about how Internet works forever, but it's also good to know that there are fun things with how Internet works so we can hear also those fun things. But thank you, guys. Thank you for this interactive session, and thank you for the great start of Sunday morning. With that, just thanking our presenters with all of your hands. Thank you very much.

CHAMPIKA WIJAYATUNGA Thank you. Thank you for all the questions.

SIRANUSH VARDANYAN Yes. With that, this meeting is adjourned. Thank you. Can we stop the recording, please? Thank you. Fellows and NextGen, if we can have you for two minutes—

[END OF TRANSCRIPTION]