ICANN86 Seville | PF – How It Works: Identifiers at ICANN
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FERNANDA IUNES

Hello and welcome to the How It Works: Internet Identifier session. My name is Fernanda Iunes, and I am a 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.

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ULRICH WISSER

Okay, great. So let me start with this is supposed to be an interactive session. So if you leave this session and you have not asked a question, you're doing it wrong. Okay, and we will end very early if you don't do that. So a lot of questions is the goal of this session. Okay, almost. Oh, yeah.

So I'm Ulrich. I work in technical engagement. And what we do is that we try to come get in contact with the technical community. I do that in Europe. We have people on every continent and we try to educate them on how the internet works and what they can do to improve the internet. And let's see.

So today we are talking a little bit about ICANN's mission. And this is from the original document. And as you can see, it says Ensure the stable and secure operation of the internet's unique identifier system. And well, if you know what the unique identifiers are, then you understand that. And if you don't know, you don't know. It doesn't help you very much. And what the unique identifiers are is IP addresses, domain names, and protocol parameters. And that is mainly the job of IANA, the Internet Assigned Numbers Authority, and that is a function of ICANN. It was started by John Postel.

And in the beginning, you can think of it as John Postel, you know, they had a very small internet. And then when it got and you know everybody knew everybody and they knew who had which IP addresses. And then when the internet got bigger. You know, it was like, oh, maybe we need to write it down. And John Postel

literally had a small notebook where he would write down. Oh, Ulrich has the numbers 1 to 100 and somebody else has 101 to 200 or something, you know, and like this. It was for a long time, but eventually, the internet got bigger and it needed to be formalized and that what is IANA, the IANA function.

Okay, so protocol parameters. There's only one slide for this. There's not much to say what that is, is if you think of any protocol on the internet. I mean, in ICANN context, we often think about Domain names. So, for example, in DNSSEC, the number 13 means that you use the algorithm ECDSA. Okay, and we have to write that down somewhere. We have to write down 13 means ECDSA. That is a protocol parameter and that's one of the functions of IANA, writing down all these parameters for every protocol on the internet. So, good.

And then we have numbers. Okay, and there's a lot of those. So you probably have heard of IP addresses. This is IPv4, the IP version 4, but there's obviously also IP version 6 that we hope to distribute, but IP addresses are, you know, divided into blocks. And the size of the block is given by these slash something and the smaller the number behind the slashes, the bigger is the block. The slash eight says there's eight bits and that make the prefix and the rest is all yours. For IPv6, obviously it is much, much larger. So what does that mean?

So, then there's another type of numbers that we want to talk about first and that is ASN numbers. Okay, so if you think of an

internet provider. They have their own network and the internet is the network of networks the internet in between networks. And all these networks need to talk to each other and transport the packets from one network to the other. And they do that by identifying themselves against others with ASN numbers. So, somebody has to coordinate who gets which ASN number. That's another function of IANA. And it's just a number. This is really just a number. It's just like you are ASN number one and you are ASN number two. The number has no meaning. It's just to identify the networks.

And so how do we do this because obviously there's a lot of ISPs and IANA can only do so much work and that is done by what we call the RIRs, the regional internet registries. Okay, and there is five of those in the world. Let's see if we have them. Yes. So we have LACNIC, the Latin America and Caribbean. Then we have ARIN for North America. Well, let's say we have AFRINIC for Africa. We have APNIC for Asia Pacific and then we have RIPE for all the rest, Europe, Middle East. And I think the Caucasus and Central Asia is RIPE. Okay.

And so how this distribution happens is that IANA gives a block of ASN numbers to these RIRs and if you start an ISP in one of those regions, you go to your RIR and say, hello, I need an ASN number and then they will give you one of the ASN numbers and exactly the same way we do it with IP addresses. If you need IP addresses, you go to your local RIR and say, I need IP addresses, and then they

probably will ask you what you need them for. And then they give you a block of IP addresses.

So if you are starting an internet service provider, they will give you a very large block. If you're a company, they will give you a smaller block and depending on the size of your company, of course. So that's what the RIRs do. Okay, so IANA, RIRs, we distribute the numbers and we distribute the ASN numbers and the IP addresses. IPv4 and IPv6. IPv4 you can't get. IPv4 is finished, whatever you don't get any. I think most of the RIRs have a waiting list for IPv4 addresses, but I don't think anybody's ever going to get off this list. You wait for the rest of your life. Work with IPv6. Good.

Yes, so here we have the IANA function operated by ICANN. The RIRs go to the internet providers and the internet providers give IP addresses. You know, if you have a home router, it gets the IP address it uses from your internet provider, right? So that is how the IP addresses go from IANA to your home, to your devices. In case of IPv6 addresses, you actually get public addresses on your devices. So all the way down from IANA to your devices. It's a fine-tuned system that works actually very, very well.

Now we're getting to the technical bits here. Does anybody of you have a clue how routing works? No? Okay, let's make an example of how routing works. So, routing works this way. We start with you. You have IP addresses 0 to 9, you're 10 to 19 and you are 20 to 29.

Okay, so let me see your name again. Houwa? Okay, so you talk to Rûm and say hello I have an IP address 0 to 9 and Rûm will tell you well I have 10 to 19. So now if you want to send traffic to 15 you know who to give it to, right? Okay, but now you want to send one to 25, but you don't know 25, right? But Rûm does, because she talks to Salsabil, and they both have also told each other, you know, you have 10 to 19, you have 20 to 29. Okay, but now Rûm is going to Rual, and is going to say, well, I know this other girl, she has 20 to 29. And now you know how to get the traffic. You give it to Rûm and she gives it to Salsabil. And that's what routing is.

And you distribute that. You can see the whole. We can go through the whole table, make that work. And then at some point, Rual is going to think, well, that's really, really slow, right? So she will make an extra cable going to Diana. And then her traffic to Diana will be much, much faster because she can send it over that cable. And to everybody behind Diana too, because she can send everything to Diana and she will distribute it further on.

So that's how we make routing work. Once you understand how it works, it's really quite easy, but it's just people talking to each other. And if you think of that in a really large scale, it makes you wonder how does that ever work, but it does. It converges to a stable picture of how the internet is connected and that makes us the routing work and obviously there's large networks and so but you get this all the routing makes these packets go from one to another.

But then you probably have heard that we have sometimes there's what we call IP hijacking or route hijacking. The most biggest example here is that at some point in time, Pakistan decided that they wanted to block YouTube and they blocked it in routing, but to some internal error it got distributed to the rest of the world. And so the rest of the world started sending all the YouTube traffic to Pakistan, which is a way to DDoS yourself. So don't do that. So, sometimes errors happen. It's mostly errors. It's very seldom that it's really attacks, but we don't really like those errors. I mean, we want to see the cat videos. Right?

And what do you do? Well, there is a technology that we call RPKI. And what it does is that you have your ASN number and you have your IP addresses and then you make a certificate that says, I really have these IP addresses and my IP addresses can be routed to these ASN numbers, can be several, not just one. And then you distribute that information. And now when you want to make your route table, you go to this year. It's the RPKI validator and you download all that information.

And when you get a false information you see, well, wait. The certificate says you can't. You are not YouTube. I don't believe you. And then you don't send the traffic to that person to that network. And that's how you know that there has been an error, and you can ignore it, and you send your traffic still to the right network that is called RPKI and it protects IP addresses from being hijacked and operators for making errors.

And let me finally come to names. And that is of course domain names. And domain names, well, we have top level domains, you probably knew that. You can meet a lot of the operators here. We have two general kinds of those, the country codes and the generic top level domains. The country codes are those with two letters. To get one of those you need to get in the ISO standard. It's not that easy. It took the EU over five years to get into the ISO standard. So they have the easy form, this the ASCII form you have a second level and top level domain. I mean, you all know that, I don't need to explain that. But then we have these other types. And that is what we call IDN, internationalized domain names. They are written in different scripts.

Does that look like Thai to somebody. ,Can somebody inform me. Well, I think looks like, but it can be different things. It's Arabic, Hebrew, Thai, Chinese, Cyrillic. There's a lot of scripts that you can use. They have two forms. They have this form like this, where it's human readable and then there is an another one that is only an ASCII and it starts with xn -- and then you know that that's an internationalized domain name, but in the machine-readable form.

By the way, I think there were some people were working with underdeveloped regions and stuff like that. So the IDN stuff is really important for that because, I mean, if you think of the people that are not online yet. They most probably don't speak English and they most probably don't read English either. And how will they come online. Most probably it will be as cheap Android phone. And what is the first thing you have to do on that phone. Register

Google account. How do you do that if you don't speak English. So, maybe it's a technical question sometimes, but it's also a question of inclusion, democracy and fairness on the internet.

Okay, so the DNS is what we call a hierarchical system. If you think of it, we have the route which we in the DNS is always designated with a dot. It's just the dot that the route. Okay. And that is actually managed by IANA again. And then we have the top level domains. Here we have the xn version, the machine readable version of an IDN domain. We have the top level domains. We have second levels and then third levels that you can do this many, many times. But usually I mean for the human readable part, we use two or three and not more because then it gets a little bit tedious to type them in. But for machines there's people that use 10 levels. And for the machines, obviously, it doesn't matter.

When you think of the DNS, people usually think of the DNS, the name servers and stuff like that. But the whole ecosystem is a lot, lot, lot bigger. So what we have here is we have, for example, for gTLD especially, we have ICANN and AINA here. We run the root. So even for the ccTLDs, they need to somehow get into the route. They need to talk to IANA. Then you have a registry operator. I mean, obviously somebody needs to run the registry. Then you have registrars. Oh, we have the service providers. Yeah, so some registries actually have external service providers for the registry, for DNS, for signing. You know, there's a lot of stuff that a registry needs to do.

And then we have the registrars. It's those that actually sell domain names to the public. And some registrars even have resellers. And then in the end, we have the people registering domain names, people, companies, whoever, you know. So this whole ecosystem is a lot bigger. And there's obviously a lot of agreements and contracts that need to be written and policy that needs to be written on all of these steps between all of these participants in this ecosystem. And everybody needs to do their stuff to keep it secure, keep it working.

And then we have the DNS. This is, after all, a technical session. And so, the DNS works a little bit, you know -- well, if you would invent it today, it would probably work differently. But when it was invented, computers weren't as powerful as they are today. That is why people thought that, well, the computer you have on your desk, because at that time laptops weren't a thing, so the computer you have on your desk is not powerful enough to do all this work on the network. So we need some other powerful machine that does that for us. And so that's why we have a resolver.

So if you want to go to icann.org, you write that in your browser, icann.org, and then your machine, your phone, laptop, whatever you're using, will send the DNS request because it needs the IP address, right? So it needs the IP address to connect, and it will ask for the IP address. It will send that question to the resolver. It will not do the work itself. It will go to the resolver and say, hello, resolver, please tell me the IP address of icann.org.

The resolver obviously is just a machine on the network, so how would it know? Remember the hierarchy? We have the root servers. And what it does, it goes to the root servers. It goes to the root servers and says, hello, root server. I need the IP address of icann.org. And then the root server obviously doesn't know.

The root server will say, well, I have absolutely no idea. But .dot org has these name servers. You see that's authoritative name servers you go to the root then we go to the TLD to .org and we say hello .org server I need the IP address of icann.org. and the.org server will say again I don't have any idea but the name servers of icann.org are here. And then the resolver will do the next step and it will go to the name servers of icann.org and it will say, icann.org, please tell me your IP address. And finally, ICANN will relent and send back the IP address. And then your resolver will send it back to you.

Well, all of this obviously takes time. Nowadays, it takes very, very little time. You know, nowadays we have fiber cables everywhere and the stuff. So it takes very little time. But still, comparatively long time to go to all these servers.

So what the resolver also does is it has a cache, and it will take the result and will put it in your cache. And so if somebody else now sends the same question to the resolver, the resolver will look into its cache and will say, well, I already have the answer. Here you go. And usually when you go online, you will use the resolver of whoever is providing the network for you.

So in case today, if you're on the ICANN network, there will be an ICANN resolver somewhere. And if you ask for the IP address of icann.org, you will get the answer in, I would say, under two milliseconds. And that is obviously, it didn't go out to all of the other servers in under two milliseconds because it's in the cache, right? But even if it had to go out, every of these steps maybe takes 100 milliseconds.

So for a human, we don't recognize the difference. I mean, if it would take 300 milliseconds to get the answer, I wouldn't really recognize. So the DNS is, in general, a really fast system. and it's obviously fastest with the cache. Okay, so now we come to the question part. Go ahead.

UNKNOWN SPEAKER: If you could please explain a bit more about the IDNs, because, yeah, I was just wondering how they work, because there was a bit more explanation. Like, how was that made? And it uses characters, but not all scripts have characters. So how does that work?

ULRICH WISSER: Yes. So how that works is, so we can look at the technical side first. So the technical side is that you have the script is in Unicode. Okay. And then Unicode has a special encoding, which is called UTF-8. But even in UTF-8, you can encode the same characters, glyphs they are called in Unicode, but you encode them in different ways.

So, for example, in German, there's an A, it's an A with two dots above. And there is a glyph for that. But a code point in Unicode for the A, but there's also a code point for an A and for the two dots. And so you can combine these two and you get this. It looks the same to you, but to a machine, it's obviously not the same. Right.

And then in Unicode, there's a next step where it's called a canonical representation. So you go from the string that you have, and you translate it to a consistent encoding. So that the A is always in the same encoding, because when you write it, you want to go to that one domain name. It shouldn't be two different ones. So it's canonical name. And from there, it is then translated to what we call Unicode to the xn -- because the DNS works on ASCII characters. And because the DNS is really used everywhere, it's really, really hard to change. So that's why people then choose that the IDN characters will be encoded into ASCII, and then we can make it work.

So, technically that works very well. Yeah, there's no question about it. But the problem is now that the work that the DNS didn't do, now all the applications have to do, because your browser now has, you write in something with an A in it, and your browser has to translate it to the xn, and then ask for it. Okay. And when it gets an answer back, well, it has to translate it back and show it to you. And your email program has to do that. And everything in the flow has now to support this different encoding. And that has shown is not so easy.

You know, especially for email, it's a big problem, because email is so important. But for a personal email, it's not so hard. But if you think of larger enterprises, they don't have just one email server, they have like a lot of email servers, and they have like service providers you have a ticketing system. Now the ticketing system must know how to interpret email addresses. So there's a lot of work involved in really supporting it, not just making it technically work. Because the technology is there, but you need to make it work in the daily life of a company.

And one of the things that people usually ask is, yeah, but how will I write an email to somebody who has an email address in Thai? I'm like, fair question. But if you don't speak Thai, how will you talk to the person only speaking Thai? Well, if there is somebody only speaking Thai, you don't have anything to say to them. So why would you send them an email?

So, we're talking about people, we want to bring online people that don't speak English. The ones that speak English, they can have two email addresses, one in Thai and one in Latin script. You know, it's not hard to have two email addresses. But for the people that don't read Latin script, it's really, really hard to have a Latin script email address. So that's why it's so important to make that very clear. It is important that we do this work.. So did I answer your question? I hope. Sure. Go ahead.

PETER JIA WEI CUI

Hello, this is Jiawei from Taiwan. I'm a TW Unique Academy fellow, and I really like the sharing of How it works identifier. Actually, this is my second time to hear like that, because it is actually very complex systems. And I think it took actually longer time for me to fully understand that. And since I'm from Taiwan, I think one unique issues that we have is that we have the Mandarin domain name. It's unlike the English domain name is a Mandarin one. So I wonder like how it works behind the Mandarin domain name. Is it like a mechanism you just show it on the screen with the slides like that, or is it kind of like different?

ULRICH WISSER

Oh, no, it works exactly the same way. You know, you encode everything in this xn stuff. But there is sometimes registries will like bundle domain names so you have like different scripts and you get the name in all the scripts, even if you register only one, they will block the others for you.

PETER JIA WEI CUI

Yeah, another question I have is that even though some internet browsers are allowing these kind of like non-English domain names to exist and you can actually guide you to the right website. But if you are doing, for example, you are doing Word and you are trying to add in the hyperlinks into the documents, but you cannot actually add in the hyperlinks from the non-English domain name. I wonder why these kind of reasons.

ULRICH WISSER Yeah, that is because if you do the hyperlink in Word or something, Word has to actually recognize it. And they don't, right. So that's what I'm saying. It's like we have done in the DNS, we said, well, we can't do UTF-8. We have to do the xn stuff. But now that means everybody else has to do the translation stuff. And if they didn't do that, well, they didn't do that. Yeah, sure.

PARI ESFANDIARI You mentioned RIRs. I wonder how they are selected and how they are evaluated, credited, and discredited.

ULRICH WISSER Oh, my god. Is my boss here? Well, this is a really, really good question. The answer to that is ICP2, the Internet Group Policy Number 2. And it's currently under review. And actually, the RIRs and ICANN together are reviewing how that is actually going to happen in the future, because there is currently no clear policy on how to do that. And so that is unfortunately the only answer I have. So, yes.

So, historically, people just have met and decided that they wanted to do this. You know, in Europe, the RIPE people was just university people who would meet sometimes. And after some time, they were like, well, we need to make this an organization. And then they made RIPE. And then after a few RIPE meetings, they said, well, you know what? We could distribute IP addresses in Europe.

Why don't we do that? And they talked to IANA, and that's how they became RIR. But that was a long, long time ago. And that's not how it works today. And how it works today is currently under review.

CHARBEL CHBEIR: Hello, my name is Charbel Chbeir. I have a quick question. You mentioned the RIPE, NCC, IANA, and ICANN. What's the difference between the three of them? And what is the role of everyone? Because it's cross between them.

ULRICH WISSER: Yes. So, we can say IANA is the Internet Assigned Numbers Authority. So, they do this, the protocol numbers, they distribute the IP numbers, and they do, let's say, manage the root zone.

CHARBEL CHBEIR: Because they take it from ICANN and sell it, or from IANA and sell it?

ULRICH WISSER: No, that's IANA. That's what IANA does. And IANA then is actually a part of ICANN. There is some a little bit complex. It's its own company, but it's owned by ICANN. There's some oversight questions of this. But ICANN is a forum for to manage all the policy questions around how to run all of this how to run the gTLDs, how to run who should get which top level domain. You can think of this when the DNS was invented, all of this was run by the IETF. And they have this, they have an RFC, or the RFC is the standards that

the IETF makes, and it's the standards that decide what runs on the internet.

And they have an RFC that says, well, you can go to the DNS working group, and then you can ask for a special use domain name, basically. But people came to the IETF and asked, well, can I have this special domain name? And the IETF was like, we are a technical standards organization, how would we know? And that's basically that's why the where the idea comes from, though. So that is something that was sent to ICANN and say, well, you take that discussion. And so ICANN takes a lot of these discussions that are not technical discussions, but that are still important discussions, right? So that's what ICANN does.

And so ICANN has developed to this a little policy forum for all of these questions. And then the RIRs, their main purpose is to distribute ASN numbers and IP addresses in their region. Yes. You think of it, there's all the IP addresses, IANA have them, and then the IANA gives blocks of those IP addresses to the RIRs, and the RIRs give them to internet providers.

CHARBEL CHBEIR So we have ICANN is the board of directors, IANA is wholesale, and RIPE NCC is the sales.

ULRICH WISSER Yeah, but it doesn't work so easily. Actually, the distribution of IP addresses is, the RIRs sit in the Address Support Organization, and

the Address Support Organization of ICANN makes the policy for how the IP addresses get distributed, right? So it's not like Kurtis does decide who gets IP addresses or anything. It's the ASO, the Address Support Organization, and the members of the ASO is the RIRs. So they, basically, they make their own policy, and then IANA implements the policy.

A question? Oh, yes.

GANON BROWN

Thank you so much for your presentation. Thank you. My name is Ganon Brown [ph]. And the question that I have, I want to go back to the IDN. I was just curious to know, like, how far along are we in covering so many different languages? I mean, in Nigeria alone, it's like almost 300 languages. And how do you determine which language to focus on next?

ULRICH WISSER

We don't. So there's a lot to unpack here. So first of all, we don't cover languages, what it covers is scripts. There is a difference, because if you think of Cyrillic is spoken is used as a written language in many different languages, right? Or even the Latin script is used in all over Europe, but you know, the Spanish don't speak Swedish. So it's scripts that we focus on.

And then all of that work is done in the IETF, the Internet Engineering Task Force those that make the internet standards. And so, and that is voluntary work. So people have to go there and

say, well, we want to standardize this. And then you can get a standard for that. And for IDN, there has been working groups for different scripts and there were meetings over many, many years to get to what is allowed, what is not allowed.

The question is not so easy, because we have all this, it's called homonyms. So like, if you think of it, for example, in Cyrillic, they have an A in Cyrillic, that looks basically like the Latin A. And so, if you would allow Latin characters and Cyrillic letters, then it's very easy to make misleading domain names, right? So you have to not only to look at the script, but you also have to decide which characters do we allow, which don't we allow, and so on, so that we don't open up for all the cheating on the internet, basically.

So, it's a tough question. And obviously, you need not only technical experts, but you need language experts for this. And I think that is the biggest problem to get language experts are usually not interested in technical questions. Yes. So, yeah. Yeah, sure.

SAMWEL KARIUKI

Thank you. My name is Samuel Kariuki. I'm an ICANN fellow. And my question is, you've talked about the IPv4 and IPv6 version. I would like to know, I know that many regional internet registries have reported exhaustion of IPv4. When are we supposed to fully migrate to IPv6?

ULRICH WISSER

Yeah. Yeah, well, good question. If you ask me, better yesterday than today. There's a little bit of a problem here, because, let's say, in a lot of European, in Europe, and in North America, they have a lot of IPv4 addresses. And so the pressure to really switch over is not there. And on top of that, we have this, what we call NAT, the network address translation, which then makes it even less pressure to really switch over.

But it is absolutely possible today. I mean, for example, let's say that T-Mobile in the US, they run an IPv6 only network for all the phones in the network since almost 10 years. So it is absolutely doable. But people like what they know, and so they don't switch over. It will take a long time to switch over, unfortunately.

SAMWEL KARIUKI

Okay. Maybe a follow up question still on IPv4. I have seen some discussions, which are not formal on IPv8. Are we going to see IPv8 being introduced in the next near future?

ULRICH WISSER

No. The easy answer is just ignore it. So what the proposal was, the latest proposal of IPv8 is just not going to work. Whatever they have proposed, they haven't thought it through. If you think of it, the biggest problem is IPv4 that we try to solve is that we need more addresses. So you have to change the addressing.

And then you can think of, okay, if I have a bigger address, how do I reach the old addresses? And we do that in IPv6 by having not 64,

and we can actually reach from an IPv6 machine, we can reach IPv4 addresses by doing address translation. And you don't need to have IPv6 for this. You can think of any other addresses scheme. You will need to use this translation service. Otherwise you will not get to the old addresses, right?

And then the other way around, again, if you want to reach something from IPv4, then that is only on new addresses, you will again have to use some translation device, some device that will receive the old traffic and will switch it over to the new network. So you can't get around that. It doesn't matter if you call it IPv6 or IPv8 or IPv8bc, you need these functions. And well, we already have these functions in IPv6, why would we switch over to another system? I think it's hard enough to switch over to IPv6. So we just let us not confuse us anymore. Yeah, sure.

PETER JIA WEI CUI I want to follow on these questions because currently there's a, I think IPv4 and IPv6 have been a long-term questions and about whether other people do not want, whether IPv6 is not as popular as ICANN members expected. Also there's a lot of like discussions on the advantage of IPv6 versus IPv4. But I think that the transition is still very slow and the popularity of IPv6 is still not really popular like that.

ULRICH WISSER

Yeah. Well, it depends on where you are in. In a lot of places in the world, IPv4 is really hard to come by. So if you look at India, I don't know, their IPv6 penetration is by 90% or something. Other countries are not there yet, but if you work with networks, IPv6 makes everything easier and especially if you switch over to IPv6 only, it makes everything so much easier in your network.

But I mean, obviously people have large IPv4 networks, and if you have enough IP addresses, there's no need to switch over and that's why they don't do it. And there's no internet police that forces them to, and that's a good thing, that's a good thing. But that's how it is. Yeah, sure.

SIMONE CATANIA

Hi, everyone. Simone Catania, board member of EURALO and IONOS Group representative. So I want to look in the future, and we know that domain names are designed for being human readable, but with more AI edge and taking over internet traffic, I was asking myself if there is a greater demand, do you expect a greater demand in the future for a machine-centric identifier? And if the technical community is talking about this topic, thank you.

ULRICH WISSER

Yes. Well, so there's two levels. So the business level of this is AI going to use domain names? Well, AI is using domain names. AI is not surfing on only on IP addresses, you know. But will the domain name business change? Most probably. You know, I think I have

talked to people, and what they say is, well, if you target humans, you want to have short domain names, and you want to have really good names, right? Like car.com is a really good domain name. But if you're talking to an AI, you might want to be the best car dealer in the San Diego area as a domain name, because the AI will read that, and will take that as a context.

So, maybe the use of domain names will change, actually. You know, we don't know yet, but could be. So that is for using domain names. And then on the technical level, well, first of all, right now AI is using the DNS as it does, but currently there's a lot of work going on about discovery. You know, how if you have an agent, and your agent wants to use some other function, how will the agent find that function?

So today, if you like, if you want to print something, you will hit print on your machine, and then it will tell you, oh, I found these three printers on the network, which one do you use, want to use? And that is actually what discovery does. You know, it tells you, well, this is available, which one do you want to use? And people want to make like the same function for AI agents to say, well, these are the AI agents available, which one matches what you want to use? And there's a lot of work going with that. So, there's work in the IETF, the Linux Foundation has a project for that. So, there's a lot of work around, especially discovery currently.

UNKNOWN SPEAKER: I wanted to ask the question regarding the multilingual problem of domain signing, because we have many identical letters in Cyrillic and Latin alphabets. So, how do we prevent, for instance, homograph attacks when you can register the same domain, for instance, on paypal.com, just using Cyrillic letters instead to redirect users on the source?

ULRICH WISSER: So, what most registries do is that they don't allow you to mix scripts. You either have Latin or you have Cyrillic, but you cannot have both, because then you have exactly all these attacks that you can do and you mix and you get a PayPal, something that is not really PayPal. PayPal, they were the first one who did that. It was a problem for many, many years. Yes, but not mixing scripts is the answer to that, because then you can't really do that. But not everybody is following the rules.

ADRIAN BLOCK: My name is Adrian Block and I have a follow-up question, because you said registries or some registries do not allow mixing up scripts. Is there, in general, a policy about how to handle Puny code? And, for example, does ICANN allow or does it not allow using emojis in domains?

ULRICH WISSER: Okay, yeah. So emojis, I have a really nice presentation on that one. So emojis, for example, that was actually discussed. And emojis are

not allowed, because emojis don't have a uniform display, right? So, the same emoji looks different on an iPhone, on an Android phone, on Windows, on macOS. So, you wouldn't even recognize that it's the same domain name.

And then you have an additional, you have, for example, for all the human emojis, they have different skin color. And if you see them beside each other, it's really easy to see, oh, it's different skin colors. But if you see only one of those and you have to decide if it's the correct skin color for your domain name, that's a really different question. Because it's so easy to make people click on the wrong thing that it was decided emojis are not a domain name thing.

So, that said, there is actually top-level domains that allow you to do emojis. Because in the gTLDs, obviously, all have contracts with ICANN, they can do that. But the ccTLDs can do whatever they want. So, yes. Was there another question? Then there is rules about what you can do with domain names and which scripts you can use and stuff. And actually, when the gTLDs applied at ICANN, they had actually to specify which scripts they support. And there's actually testing that they actually support these scripts in the correct way.

But there's only so much we can do. And as I said, the ccTLDs do whatever they want. Which is a good thing, by the way. You know, I just want to add that. It's a really good idea that the ccTLDs follow the rules of their country and not about anybody else. Go ahead.

SAMWEL KARIUKI

Thank you. We have talked about DNS for a long period of time. And there are very many discussions going on DNS abuse. My question is, are we going to see reduction in the various types of DNS attacks? Or maybe in this case, DNS abuse in the near future?

ULRICH WISSER

Well, so, DNS abuse has obviously, like, two parts. One is the, let's say, I would say technical abuse. We all have heard about DDoS attacks. You know, it's like you send a DNS query and the DNS query usually has less than 100 bytes. You send it to a server and then the server answers with, like, two kilobytes or something.

So, that means, if I can spoof my IP address and make it your IP address, then I can send, like, 80 bytes to a server and the server will send two kilobytes to you. And so, then I have it's more than 20 times the traffic. So, if I have one gigabit, it will send 20 gigabits to you. I guess I can push you offline, right? So, that's how a DDoS attack works, basically. And that is obviously an abuse of the DNS, right? And there's some other stuff that you can do technically for DNS abuse.

And then, obviously, we have all the other kinds of DNS abuse that that are more devastating to people, I would say, because when you use the DNS for malware, for phishing, that is obviously you don't just hit network operators or people that work with the internet. Everybody hits your grandmother, basically, and tries to

get her money. And that is obviously something that is more devastating to people. And there's a lot of work to do around that. Here at ICANN, you're at the right place. There's a lot of work going on around DNS abuse and how to fight it.

And ICANN has Domain Metrica. You can look that up. Domain Metrica is a platform that we provide where actually everybody can log in and look at the data where in which top level domain is how much abuse and stuff. So, I can't really recommend it. And yes, there's a lot of work going on. I mean, it's hard. I mean, I think we will never win over the fraudsters, but we can fight them like we have for all of the history of humankind. And hopefully we fight a little bit better tomorrow.

Good. Are we at the end of the session or no? Oh, okay. Great. And you have to ask more questions. Yeah, sure. Go ahead.

PETER JIA WEI CUI I wonder, as a technician, how you see current proposals on DNS abuse, because currently I hear the sessions in GNSO in the morning, that the session is about they are drafting the DNS abuse mitigation policy and they are undergoing this kind of PDP1 session like that. So, I wonder, as an engineering background, technician background, how do you view it like this? And how do you think that you can really solve the problems about the DNS abuse?

ULRICH WISSER

Well, I work at ICANN org and we really don't comment on the community work because we are this multi-stakeholder process and we actually, it's the community that tells us what to do. So, like the community has decided that ICANN should do this technical engagement work and that's why I'm here. So, if the community decides how to fight abuse, that is what we will do and what will be implemented. You know, I think nobody has found a golden bullet against the abuse and we will talk about this for a very long time and surely we implement something now and we will see how it works and then we will improve on it in the future. Questions?

EDUARDO TOME

Yes, I'm Eduardo Tome from Honduras. IPv6 adoption has been very low in Latin America compared to other regions, mostly because like ISPs don't really see like the need for it and in LACNIC they always tell us that IPv6 basically pays for itself. How can you do that in emerging markets?

ULRICH WISSER

Obviously we don't have enough IPv4 addresses. I mean, everybody agrees on that, right? So, at one point we will have to switch over and the question is just when. And there's nothing to do but then just talk to people and finally get them to do it and it will take a long time. You know, I don't dream about that I will live in a world where there's only IPv6. That will never happen. You know, that will at least not in my lifetime. We will have the dual

stack for a very long time. You know, we all wish it would be different but it's not.

And I think it's a lot is about education. You know, if network engineers would actually realize how much easier their life is with IPv6, we would get a better uptake. You know, if the management would realize how much less work the network engineers would need to do to keep the network running with IPv6, that would be really helpful, I think. Because in a lot of companies it's money that rules. You know, why would I invest in it if I don't get anything back and if you see, well, you don't need to hire more network engineers, that's a good reason to do it, right? But we're not there yet and we just keep pushing and see what happens.

I have one for you. This is over Zoom, right? Okay. The presentation is on this computer. Does this computer have a connection to the machine over there?

UNKNOWN SPEAKER Can you elaborate your question, please? Yeah. Can you elaborate the question?

ULRICH WISSER Yeah, yeah. So, Zoom, this is displayed via Zoom, right? The presentation you're seeing is on my computer, okay? So, it is distributed from this machine and the projector machine is over there connected to this, to the projector. So, does my machine have a connection to this machine?

UNKNOWN SPEAKER I think when you are on the network, everything is connected to each other. If you are connected to the Wi-Fi here. Yeah. I can hack it.

ULRICH WISSER Okay. So, who is for, yes, it is connected.

UNKNOWN SPEAKER Not connected directly, it is connected to the Wi-Fi.

ULRICH WISSER Who is for, yes, it is connected. And who is for against? Come on. Yes, it is connected. Okay. And who is against it? Who says no, there's no connection? There is no I don't know. Come on. You have to decide. Come on. So, on the internet, nothing has a connection, right? Maybe you are connected to the network, but all the machine does is sending packets. It is never connected to a different machine. It only sends packets. And the packets go somewhere. And the packets make it seem that, whoa, hello, grandmother, I can talk to you. We have a connection. But we are never connected. And that is really important to understand, especially if you make policy about the internet. You are never connected. There's only packets that are flowing over the internet. Good? Well? Oh, more questions?

SAMWEL KARIUKI

One more question. My name is Samuel Kariuki, ICANN fellow for the record. You have talked to us about the translation, that is network address translation. And particularly in IPv4. I would like you to elaborate what are the challenges of network address translation in relation to VPN? Does it slow down the encapsulation process? Or how does it affect the VPNs?

ULRICH WISSER

So, network address translation is something, so when you're at home, for example, you have a router at home that connects you to your internet provider. And so, inside your network, you have what we call private IP addresses. So, the IP addresses that will not work on the internet. They work only in your network. And then your router has one IP address that is on the outside of your router.

And when it sends traffic to your internet provider, the source address, the sender, must be that IP address. And so, what happens is that your laptop, phone, whatever, sends a packet to the router, and then the router will pull off your private IP address and will put in the public IP address, and then it will send on the packet. And when the answer returns, it will do the exact opposite. It will pull out the public IP address, put in the private one, and send it to the inside of the network. That is network address translation.

So, what a VPN does is basically the same thing. It just does it with public IP addresses. So, you send something to a VPN server somewhere, somewhere, somewhere. And obviously, the packet has the address of the VPN server it is. So, the VPN actually, it puts

your packet in a packet. And then the VPN server will pull away the outer packet, takes your inner packet, and puts in its own IP address and sends it on.

And with that, you appear to be that VPN server. You are somewhere else. Because for everybody else on the internet, it looks like you are this VPN server, right? But the VPN actually sends it over the internet. That's something that your local router doesn't have to do, right? And there's a little more steps involved. But it also, it masks your IP address.

GANON BROWN: Ganon Brown again. I know I can probably go to ChatGPT, for this. But I do have you. Are you saying packet, package? And can you spell what you're saying? Packet? Non-technical person.

ULRICH WISSER: You see, a VPN has this function that -- so, we go back to not what I do in my network, okay? So, I say, again, you want to go to icann.org, okay? And then your machine gets the IP address of ICANN. And in the packet, it will put in the destination. And it will put in the source, its own IP address. And when you come to the router, well, the destination is still icann.org, so we don't need to change that. But the source is obviously not a private IP address. We need to put in our public IP address.

So, the router will just change that and will send the packet on. And then the answer gets back to your router. And then again, because

now there is this public IP address, but you wanted to go to this machine with a private IP address, you just write in the private IP address and send it on. Okay. That's what network address translation is.

GANON BROWN So, packet, P-E-C-P-I…

ULRICH WISSER P-A-C-K-E-T.

GANON BROWN P-A-C-K-E-T?

ULRICH WISSER Yeah, like a postal package.

GANON BROWN Sorry, jetlag. So, then when the gentleman said that he can hack, right? Like if you're connected. We had that questionnaire, right? I failed it, by the way. I did say that we are connected to the Internet. I mean, you're connected. So, but you said we're not connected.

ULRICH WISSER No, we only send packets. There's no connection from me to you. There's only packets that I give to somebody, who gives it to

somebody, who gives it to somebody else, who in the end gives it to you. But I don't know all the people in the middle, and neither do you.

GANON BROWN: Right. Okay. Thank you.

UNKNOWN SPEAKER: Hello, [inaudible – 01:08:58]. My question is related to who regulates Internet service providers, in providing context to the question. So, we have the ICANN that develops the policy, and the IANA has the numbers of the IPs. Then those IP numbers are delivered to the regional registries. And then the Internet service provider just comes and asks for the --

ULRICH WISSER: Yes. So, the RIRs have their own policies, and actually the different regions have different policies, how that works with the IP addresses. So, the RIRs have a block of addresses, and then if you are an Internet service provider, you go to your RIR and say, well, I need more IP addresses or something, or you start a new one and you say, I need IP addresses. And then they will ask you about your business, and how big the business is, and how many IP addresses you need, and then they will give you a block of IP addresses. And if you ask for IPv6 addresses, that will probably be free of charge. If you ask for IPv4 addresses, you will probably not get any.

And what you can do with these IP addresses is highly dependent on which region you are in. It's dependent on the policies of the RIR. For example, I know that AFRINIC has a policy that you can't use your IP addresses outside of Africa, because Africa has such a small number of IPv4 addresses that they don't want them to travel to other parts of the world. Africa doesn't have enough anyway, so why export them to Europe?

But other regions are not that restrictive. RIPE, the European one, is one of the more free RIRs. They allow you to transfer and sell and do your IP addresses, whatever you want. The RIRs are very different, and it's a community like ICANN. It's a community and a multi-stakeholder process that decides their own policies. So it's a multi-stakeholder process. You were from Latin and Caribbean, right? LAC, Mexico, yes, LAC. So LACNIC, you can go to there and contribute to the policy questions.

Okay, yes. Then with that, I say thank you very much. I hope you all asked questions. I didn't keep tap, but thank you for all the questions. Thank you, everybody, for coming, and see you tomorrow at the career session. Thank you. Please stop the recording.

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