ICANN78 | AGM – GAC Capacity Dev Workshop (7 of 10)
Sunday, October 22, 2023 – 10:30 to 12:00 HAM

GULTEN TEPE OKSUZOGLU: Hello, and welcome to the ICANN78, the capacity development workshop blockchain introduction discussion and applied learning session being held on Sunday, 22nd of October at 8:30 UTC. Please note that this session is being recorded and is governed by the ICANN expected standards of behavior. During this session questions or comments submitted in the chat will only be read aloud if put it in the proper form. Interpretation for this session will include 6 UN languages and Portuguese. Please click on the interpretation icon in Zoom and select the language you will listen to during this session.

If you wish to speak, please raise your hand in the Zoom room and once the session facilitator calls upon your name kindly unmute your microphone and take the floor. Before speaking ensure you have selected the language you will speak from the interpretation menu. To view the real-time transcription, click on the close caption button in the Zoom toolbar. To ensure transparency of participation in ICANN's multi-stakeholder model we ask you to sign in to Zoom sessions using your full name. With that I will hand the floor over to Tracy Hackshaw. Tracy.

TRACY HACKSHAW: Thanks, Gulten, and I hand it over directly to Alisa.

ALISA HEAVER: Thank you, Tracy. Welcome back, everyone. I still see some people coming in so find your seat as soon as possible. We'll be talking further about the blockchain or introduction to blockchains that will be done by Alain and thereafter we'll have an applied learning session as we called it on how blockchain name systems work and that will be done by Paul Hoffman, also part of the OCTO team, and thereafter we have a bit more time for Q&A or discussion on what we've been hearing this morning so a bit more time approximately 30 minutes and so without further ado let's go to Alain and David. My schedule says only Alain.

ALAIN DURAND: Good morning again. My name is Alain Durand for those who haven't met me yet. I work in the Office of the CTO I'm a distinguished technologist and can I have the slides up please? No the first one, title slide. Thank you. So this morning I'm going to talk a little bit about blockchain and some will try to demystify what's behind this. Sometimes all new technology there's a lot of hype, a lot of buzzwords, a lot of acronyms and if you don't really get what's behind it may be carried away. So I'm going to talk about BlockchainS with an S because as I mentioned earlier there's no such thing as the blockchain there are many blockchains and I'm going to talk about them in 12 easy steps.

Next slide please. So I'm going to say it again there's no such thing as THE blockchain. If there's only one thing I would like you to remember from all the session is this one. There is no such thing as THE blockchain. There are many blockchains. They're all different. They're different in their purpose. They're different in their technology. They're different in their governance. But at the core the idea of a blockchain is

based on a specific data structure which is a cryptographically verifiable chain of blocks. I'm going to explain this later.

Next slide please. So in order to explain this I'm going to take a fictional example of a blockchain. As I said there are many of them so I can create my own. It takes elements from different blockchains that do exist so I don't intend this to be an accurate and fully descriptive presentation of what one specific blockchain is. So there are things that are done differently in different places of course. But that gives you the general idea of how things work.

Next please. 12 steps remember. Step one is a block. What's a block? A block contains arbitrary data. You can put whatever you want in it. There's no structure to this. It's just random data. Then this block is cryptographically assigned. What does it mean? It means there's a mathematical function called a hash that applies to the block and computes essentially a summary in a short number. This short number is called the signature of a block. If you change a block you apply the same function you will get a different signature. Even if you change one character in the block the signature at the end is going to be different. Those cryptographic functions are made so that it's really really really hard to find another block that will have the same signature as the initial block.

It's theoretically possible but in practice it's really really really really hard. So if you have a block you want to change it and have the same signature it's almost an impossible problem to solve. If it were possible to solve it, it will mean that this cryptographic function is too weak and we need to get a different one. That's all you need to know about

cryptography today. That's it. So there's a signature associated to this block that guarantees that this is this block not another one. It has not been changed.

Step two. Next slide please. Let's do a chain of us. It's a blockchain. A chain of blocks. There's no magic here. What it means is that you have your initial block called block zero when you create another one. That's the funny thing about computer scientists. When we start numbers, we never start with one. We start with zero. Other people do it differently. The same thing as with different floors. In the US floor one is a ground floor. In Europe floor one is one floor above. But computer scientists use block zero as the initial one. So you have block zero and you have block one. In block one you're going to put this hash, this signature of block zero inside. So when you have block one you have a pointer also to where block zero is and because you have this signature you can actually check that block zero has not been changed.

When you do block two you do the exact same thing. You point back to block one and then you have a signature of block one. So you can like this recursively check all the signatures and then check the integrity of the entire chain. That's what a blockchain is. It's a data structure. Now people have built systems on this to put interesting data but at the core of it a blockchain is simply a computer science data structure. The point that is really really important is that those chains here, there are two points I want to make. First one is anybody wears a chain can go and check the signatures as I just explained and can verify the integrity of the entire chain. So any observer in the world can do that. Those chains are public. The data in it is all public.

The second thing is because you have this signature you cannot change anything in it in the existing blockchain. Once block one is created and then block two is created right after you cannot change block one anymore. Whatever is in there is in there. You cannot delete it. You cannot update it. You cannot change it. So if you want to do something about that, let's say that you have a bank transaction that is recorded in there and you want to change it to cancel it because you realize that it was actually wrong. You cannot go in the block and say delete this transaction. All you have to do and the only thing you can do is to create another block and reverse the transaction in the other block.

So when somebody is going to take the old chain from the beginning to the end you will realize oh there was a transaction but it was reversed. So this is a fundamental property of blockchains. There are some good things about it and some not so good things about it. Well, the good thing about it is you're guaranteed that nothing has been changed. Everything is recorded. Nobody can mess with the system. The not so good thing about it is when something is recorded you cannot change it. There's a mistake. You have to create another entry to cancel out the mistake. You cannot correct a mistake really. So there are some impacts on people sometimes because there's some reputational issues. There could be some other problems with it but the point to remember here is you can add information to a blockchain. You cannot change it.

Next. Step three. We have what we call miners and the question is who is really allowed to add another block and anybody can maintain his local copy of what is a blockchain up till a certain time but to add a block we have those specific people called the miners who have a right to add

a block. So let's try to figure out how it works. Next slide please. Those miners they form a peer-to-peer network meaning they're all connected to each other. If you want to get a copy of a blockchain you ask any other miner and you get a copy. They all have the exact same copy. That's an important thing to understand here. They all have the same exact identical copy of a chain. Now let's say one of them.

Next slide. Let's say one of them wants to add a new block. Again, this is an hypothetical blockchain. This is not how it works in real blockchains but this is here to simplify the process. This new block is going to be added at the end of a blockchain. Remember we cannot update anything inside of a blockchain. Frozen. All we can do is to add something at the end. Let's say that we have a new block to add. Next slide. What we're going to do is to send this block to everybody. All the different miners. So they have the same block and each of them is going to compete on how to actually link it to the rest of the chain.

Next please. Step 7. This is where the magic happens. All miners are going to perform the exact same computer intensive task. This is where all the energy is burned. And here we are talking not about a small amount of energy but a huge amount of energy. You may have seen there were articles a couple years ago that were saying that the total amount of energy taken by one specific well-known blockchain was the same level of consumption as a big European country of electricity. This is enormous. What do they do with this computation? They're not doing any complicated really mathematic difficult things. What they're doing is, as an example here, they pick a random number. They apply the same well-known mathematic formula to this random number and they get a new number.

And they look for example, it's just an example here, if this number the result of a formula is smaller than the specific predefined target. If it is, they win. If it's not, which is most of the time it is, they try again. So all those miners do to burn all this electricity is to pick a number, try a random number, try a mathematic formula on it, see if it fits the target. No, try again, try again, try again. That burns a lot of electricity. This is what is called proof of work. That's what most blockchain use, not all of them. Some use another technique called proof of stake. I'm not going to go into the details of it, but that has a potential to reduce its energy consumption problem. So this is a race, I said. At some point one of those miners is going to find this random number that fits the formula, that fits the target.

Next slide, please. Step eight. One of them found this.

Nine. Next slide. Miner is very happy to propagate the solution to everybody else.

Next slide, please. Step 10. All the miners are going to verify that this is the correct solution. They apply this mathematic formula and they should arrive to a number that is below the target, exactly the same. Everybody has the same formula and they say yes, it actually works. Then they could use this number to actually create this hash and link it to the previous chain.

So next step, 11. Next slide, please. Thank you. Now with this number, they're going to all add this block to the chain and create this hash of the entire chain and have exactly the same thing in the end. They don't do this in random order at random time. They typically do it at a pretty

fine time. For example, every six hours we add a block. Every 12 minutes we add a block, depends on the chain.

Next slide. Step 12. And that's the important one. The miner who got the answer right, who solved this complex puzzle of finding a random number, applying the formula and hitting the target, gets a reward. That's how you incentivize people to become miners and participate to the system.

Next slide, please. And that's it. Comes the next block, repeat, repeat, repeat. So it's not an extraordinarily complicated mathematics or computer science or cryptography, simply taking random numbers and trying to apply a mathematic formula to them.

Next slide, please. Now you're going to tell me, well, what if some people do not cooperate? What if some of the miners decide to do something else? I said they all have the same content, the same blockchain is replicated on all the miners. What if some of them decide to change it? Well, there's this rule called the 51% rule. It's essentially if you look, if you are a client of a blockchain, you get the chain from all of the different miners. They all should be identical, and if they are not, you need to decide which subset of miners you're going to trust. And the rule here is you're going to trust the group that has the largest share of the same information, so 51%.

The idea is that if somebody wants to compromise the chain, he will have to compromise at least 51% of the nodes, which is a really, really tall order. If you compromise only one or two, then you will be voted out. So you can look at this as a poll tax. If you were to try to

compromise it, you will need a huge amount of resources to have more than 51% of the participants.

So this is a system in the end that begs the question of who do you trust? In a system like this, there is no centralized source of authority. There is no route, as in the DNS where David explained earlier. But in order to make sure that you have consistent information, you need to apply rules like this, and then you're going to trust whoever has the most coherent copies of the information with 51% rule.

And next, please. So that was the last slide. Again, this is a very high-level overview. This doesn't claim to be a truthful representation of how every single blockchain works, but it gives you an idea of what is the technology underneath. Now, I'm going to hand it over to Paul, and then we will take questions at the end on both presentations. Paul is going to talk about, in practice, how does this work? And in practice, how does this relate to naming? So Paul, it's back to you.

PAUL HOFFMAN: Greetings. This is Paul Hoffman. I'm also part of the Office of the CTO. I don't know if you can see me. I turned on my camera, but I'm not sure if that's visible. But the most important part is the slides not seeing my smiling face. So next slide, please. I can see that my giant head is there. Sorry about that. So as Alain just said, what he covered is how blockchains work. The next, say, 45 minutes, and we'll have plenty of time for questions at the end, is going to cover is how blockchain name systems as we know them today works. So what you've already seen, David earlier showed you how the global DNS works. Alain showed you how alternative name systems work and how blockchain works.

I'm going to be describing blockchain name systems and some of the technical aspects of them. There's lots of policy questions. We won't be covering those. That's for you all to do. But the technical things you want to know with a name system is what you get when you resolve names, the type of data that's there. I will go extensively into the variety of blockchain name systems because there are many of them now and it would be valuable for you all to understand the variety so that you don't get locked up on a single one. And also then what to expect in the future.

Next slide, please. So as Alain covered earlier, the question is, well, why would anyone create another name system? And the primary reason that the people who make the blockchain name systems say is their motivation is to have an easy mapping of a user-friendly name, which looks like a domain name, into a wallet address. So there's another motivation, which is secondary but is something that gets mentioned a lot. And as Alain just covered in the last presentation, since you can never change anything that's already written into a blockchain, another motivation for blockchain name systems is that you've got a name system where everything has been written into a blockchain so that people can go and find the history and such.

That turns out not to be how many of the name systems are in fact implemented, but it's stated as one of the main motivators. But really the main motivator is to go from a user-friendly name to a wallet address. Just want to be super clear here, David explained earlier this morning that what the global DNS is for is for IP addresses, going from a name to an IP address. Here, when we say a wallet address, a wallet address is really like a bank account identifier. It's not an IP address.

It's not a name server address. It really is like a bank account identifier. So I've given an example here of what bank accounts, how you would identify them. A wallet address, as Alain said, is just this giant jumble of numbers and letters.

But these are the things that people want to identify because in your blockchain wallet, you might have digital assets like cryptocurrencies, we've heard about NFTs and such. You have generally money in your bank account, in your wallet, in your blockchain wallet. You have cryptocurrencies, plural. You might have different ones. You might have NFTs. There's other things you can put in as well. But you want to be able to say to somebody, this is how you can get to my wallet.

Next, please. So because the main mapping that we care about is going from a name to a wallet address, the reason why you want someone's wallet address, like I said, is cryptocurrency, NFTs and such. You generally want to move them between one wallet and another. So it's not just, I care about your wallet address. You might care about mine as well so that we're exchanging cryptocurrencies. Wallet addresses can also be what are called smart contracts. So you might want to associate your wallet with mine because I've got a smart contract that's doing something interesting. So once we have each other's names and we want to turn the name into a wallet address, you have to have an application that resolves the name using the associated blockchain.

As Alain said earlier, there's lots of blockchains. There's lots of blockchain name systems. So that resolution is going to be per blockchain. And I'll show you an example in a moment of how that goes for one blockchain. But this is super important is that in the DNS, there

is exactly one way of resolving names. Everyone knows it. You can wave your phone around and say my phone has a resolver in it, my laptop, even my IoT devices, your refrigerator, your dishwasher, all know how to use the global DNS in a certain way because there's only one name system.

In blockchain name systems, you have to know which blockchain name system you are using in order to resolve the name, to turn the name into a wallet address. And as a side note, and I'll go into this in a little bit, blockchain name systems have other types of data, not just wallet addresses. So they're just like we have in the DNS. So some people use those, but mostly the valuable mapping that people use is from a name to a wallet address.

Next slide, please. So let me give you an example of how resolution happens. And again, this is just how it happens in one blockchain name system. It's called the Ethereum name system. It's one of the common ones that people are talking a lot about these days. And for those of you who haven't seen these kinds of diagrams, imagine time going from the top of the diagram to the bottom. You've got on the left-hand side, your user code, it might be your browser, or if you're running an application that uses wallets, in the middle is the ENS registry and on the right is a resolver.

So the first request that your user code does is you actually ask the registry, please tell me the resolver for this name that I care about. And the name here is foo.eth. So this is you saying to the registry, I'm going to want to resolve this. And I know you don't know what is the wallet address, but you will know who has it. So the registry that's in the

second line says, here is the address of the resolver. Now, the third horizontal line is when you ask the resolver, hey, I know you're responsible for this name, please tell me the wallet address. And then on the last line comes back, here's the wallet address. So this is a two-step process in the theorem name system.

In other blockchain name systems, it's a one step process that the blockchain itself or a contract on the blockchain knows all of the addresses. In different name systems, it could be a multi-step system. But this is an example of a common one now, so that you can see really what you're asking is, how do I find out where to ask the real question of how do I do resolution? And then once you find that out, please, I want that address and you get it back.

Next, please. So let's compare that to what you learned earlier from David and such. In the global DNS, what you want to do is change a name to an IP address. You want to know the internet host associated with the name. And then once you get that, once you get the IP address, the next thing you normally do is you start communicating with the host. If you're in a browser, you get a web page. If you're on a mail client, you're able to send mail, things like that.

In blockchain name systems, what you're trying to do is go from a name to a wallet address. And remember, wallet addresses, think of it like your bank routing. You want to know the wallet associated with the name. And then after you get that wallet address, the next thing you do is you transfer funds or you move around NFTs, or you create a new contract, things like that. Very different between the global DNS and blockchain name system.

Next, please. So as I said earlier, it's not just wallet addresses that are in the blockchain name systems. And for example, in the DNS itself, our global DNS, we mostly talk about IP addresses, but not exclusively. There are lots of other pieces of data in the global DNS that we use. There is data to help you find services. There's data that holds the cryptographic keys associated with a domain name. There's even wallet addresses. So these are the kinds of additional data things other than IP addresses that we see in the global DNS.

Blockchain name systems also have additional data. Remember, most blockchain name systems were developed in the last five, maybe seven years. So they had the 40-year long DNS to look at. So they've added things like an avatar picture. It's a cute little picture of what you want to look like on the blockchain. You might have an address of a non-internet webpage, a webpage that is stored not on the internet, but in a blockchain blockchain-based system for distributing webpages.

Again, not like we have in browsers, but additional webpages. It might have your personal name, that some of the blockchain name systems let you say, I am Paul Hoffman, or things like that. So these are all things that you might have, and in the future there might be for the blockchain name systems, some important uses. But the thing that's most important is that, like the global DNS, in the blockchain name system, these things are evolving.

In the global DNS, for the first maybe 10 or 15 years, not until probably past the year 2000, so 20 years almost, IP addresses were the only thing that anyone cared about. But then we started adding things, like I say, for cryptographic keys, for finding data, stuff like that. Today, if you

take your cell phone and you actually say, I want to go to a certain website, your resolver in the phone will ask the upstream resolver, please find me the IP address of that website. That resolver will, in fact, not just ask for an IP address, but it will ask upstream for you, what is the best way of finding that service? You don't know that that's happening.

The result is an IP address, but that's something that has been added to the global DNS. So in the blockchain name world, they're starting to add some additional services. So for right now, today, in a blockchain enabled browser, if you type a name into the address bar, you don't want to get the crypto address because that doesn't help you in your browser, but you might get a non-internet web page that the name owner fills in.

So again, the main point here is the blockchain name systems are following behind the global DNS on adding new services that might be relevant to you in the future. We have no idea how that's going to go. Just in the same way as if in 1995, you said, well, where is this DNS thing going? Most people would say, it's just going to be IP addresses. And then we added other valuable things.

Next slide, please. So again, let me just do a quick recap there. In the global DNS, you maybe wanted to go from a name to a preferred host. You ask the question, which is not for the IP address, but preferred internet host associated. And then your next step is to actually communicate with that hope. In the blockchain name system, you might say, I want a non-internet web page. And again, you might do this

in a browser. So that's a different lookup, but it's going to the same name. And then your browser might display that web page.

Next. So the next three slides that I have, this is where we get into the confusing parts. I apologize for that, although I'm not the one who created all the different blockchain name systems. But it's important for you all to understand that when you say something about a blockchain name system, you're probably only talking about one of them, or maybe one or two that are sort of copying each other. You're not talking about all blockchain name systems. And I say that because there's over a dozen of them. Not all of them are popular, three or four or five of them are popular. But there are so many, and they're competing with each other.

And to some extent, they're also competing with the global DNS that we all know and love. But their popularity changes based on how many names have been registered in each one, or how the application uses those names. Some of them are more focused on browser applications. Some of them are more focused on currency applications. Some of them are more focused on NFT applications. So that will change the popularity. There's money behind these. So there are marketing campaigns. And so the marketing campaigns may change who are more or less popular.

Also buying names in the different systems, they come at very different prices. So some of them are more expensive than others. Maybe the cheaper ones become more popular. Maybe the expensive ones become more popular, depending on how you have to pay for them. Some of them you can pay cash for, just like you can in the normal

global domain name system. But others you have to pay in cryptocurrency. Sometimes it's hard to figure out how to get a cryptocurrency. All of that's going to change from year to year which ones are popular.

The next most important thing to understand is what are the names in these blockchain name systems? They've structured their names like the global DNS. And so they each have a TLD and SLDs and such. So some of them use the TLDs that are not yet in the global DNS. So they have .wallet, .crypto, things like that. Some of them use the same TLDs as each other. And as Alain said earlier, there are multiple of the blockchain name systems using .wallet. Sometimes there's no coordination among them. There's no policy. Each one has their own policy. They can pick whichever TLDs they want. Many of them have chosen not to compete with each other. But as we've seen in the normal internet world, those agreements can fall apart at any time.

But we know that some of them are using the same TLDs as each other because they don't care about the confusion aspect. They want to gain number of sales. Some of the systems use TLDs that are also in the global DNS. So for example, the Ethereum name system, you can have a .com or .org or .nl or .jp. More than 100 of the TLDs that are already in the global DNS also exist in the ENS. That might be confusing, might not. But it's important to understand that when you create your own blockchain name system or when you associate with a blockchain name system, their rules for what TLDs are there are just their rules. They can change the rules at any time. They can add new TLDs. They can drop ones that didn't sell very well. And this is a big differentiator between the different blockchain name systems.

Next slide, please. The other thing that is sort of important on the technical level, not so much on the policy level, is that the different name systems use different blockchains. So for example, as you can imagine, the Ethereum name system uses the Ethereum blockchain. Unstoppable Domains uses the Polygon blockchain. That's a less well-known blockchain, but it has different properties than Ethereum. The Namecoin and Handshake name systems use their own blockchains. On a technical level, which blockchain you use will have big effects. It will have an effect on how quickly queries get answered.

As David said this morning, in the global DNS, even if you have a name with five parts to it, you're going to get an answer back generally in just milliseconds because of the hierarchical structure that has been established. A blockchain, when you query it, if it is a busy blockchain, if it is a blockchain that is huge, you will get an answer back slower than the others. Now, the blockchain name systems are working on this. They are adding technology, but the actual choice of blockchain can have a huge effect on how quickly you get back names. It also has a very large effect on the cost of the names.

Buying something on one blockchain, buying a block or buying a piece of a block where you want your new registration or your changed registration for your name, costs very different. For example, between Ethereum and Polygon and very different, again, between it and the Bitcoin blockchain and all these other blockchains. Doing a technical analysis is extremely difficult because it changes all the time. Ethereum just went through a giant change, which completely made all understanding of the Ethereum blockchain different about a year ago. It went from, as Alain said, from proof of work to proof of stake.

That changed everything, not necessarily for the better or for the worse, just it changed everything. As you're evaluating these, you have to guess how they're going to go in the future because at least with the DNS, we know how the DNS has always been. Another thing that's different between the blockchain name systems is how they handle that additional data that I talked about, your avatar picture, links to non-internet webpages, things like that. Some of them have those as easy to get at data, some of them are hard to get at. Some of them have data that identify you, like your name and such like that. Others don't. Others are trying to be very anonymous and having the linkage just between the name and the wallet address.

Again, that will change over time as they look at each other and say, they're doing this, we should do this, or they're doing this, we should make sure not to do that. The resolution also differs widely. As Alain covered earlier, if you enter a blockchain name such as in a browser, right now, there's really nothing that a browser would do with your wallet address. It's not like when you type in a wallet address that you start interchanging things in the browser there. It's usually an application that does that, but some of the browsers require plugins to use blockchain names and one plugin per name system.

If you wanted to use in your browser both the ENS and Namecoin, you have to have two plugins, but some browsers, generally the niche ones, the ones that almost no one knows about but still are somewhat important in the marketplace like Opera, like Brave, they already come supporting a subset of the blockchain name systems. Those may be useful for showing non-internet web pages. They may have their own applications inside of them for exchanging cryptocurrencies. Both

Opera and Brave allow you in the browser to use the browser to exchange cryptocurrencies and they support some cryptocurrencies that others don't. Having a blockchain name might help in those environments, but you have to hope that there's no overlap in the names.

Next slide, please. I promise this is the last one on covering the variety of blockchain name systems. I'm hoping I'm not overwhelming you, but I do want to be honest about the fact that because this is not one system, you have to understand a whole lot of stuff. Some of the blockchain name systems allow the names themselves to be treated as an NFT, but others don't. NFT is a buzzword that's come up in the last few years. It means non-fungible token, which generally for most of us means nothing at all.

But NFTs are a popular topic within the blockchain world itself and so having a name that can be treated like an NFT, that you can trade around, that you can put in a portfolio is important to some people in the blockchain world. It's not important to other people, so that's why some of the blockchain name systems allow you to make the names themselves like NFTs, but others keep it as hands-off. The technical reasons behind that are incredibly complicated because there's no standard definition for what is an NFT and what's not. As I mentioned earlier, the cost of registering or renewing a name varies widely, and when I say widely, $5 versus $500.

In the global DNS, yes, there are some premier names and such like that, but if you're going and buying a.com or a name mostly in many of the ccTLDs, it's one cost fits all. To make it a little bit more difficult, the cost

actually can change minute to minute. Remember Alain said in the last presentation that the miners have to spend a bunch of money in order to be able to register the next block, which has lots of data, including this. If a miner gets lucky and that cost for that block is low, then they can charge less money for registering names within that block. If none of the miners are lucky and it's higher.

For example, the other day as I was doing my research, I looked to buy a blockchain name on one of the systems, and it said that it would be $320. I was like I'm not going to really buy it, that's pricey. I was explaining this to somebody else at ICANN, and we looked, and in fact, it was $240. I'm sure it went fluctuated at other times. When someone says I want to buy a name, they also have to ask on many of these systems, how much am I paying? For the low-cost names, it's usually pretty fixed, but for the high cost names, because the cost of the name depends on the cost of entering something in the blockchain, it can vary widely.

It turns out, for example, in the Ethereum name system, the price always goes up just until someone does a block, and then it goes down again, so people try to do timing. The last thing I'm going to mention here, this is a hot topic these days, is integration between the blockchain name systems and the global DNS. Again, it varies widely from blockchain name system to blockchain name system. Some of the blockchain name systems require you to have a DNSSEC signed record in the global before they will say your name is associated with this wallet address. Some of them don't.

Another way that it's integrated is that, again, we have additional DNS records. You might want to copy those into your blockchain name. Some of them allow that, some of them don't. The idea of integrating with the DNS, you'll hear more about that probably during the week at the ICANN meeting, very, very new. The definitions are not there. Understanding is low on this stuff, but it's very interesting because this is how many people think that the blockchain name systems will get more legitimacy is if there's some integration with the global DNS. Really the proof is going to be hard to find because it's going to be done in different ways.

Again, even if one blockchain name system says this is how we integrate with the global DNS, they can change their mind later. They can change the rules at any time. They are not making their rules based on the multi-stakeholder model that you all have been spending all this time on in ICANN. That will be different.

Next slide, please. This is my last slide. If you're thinking of questions, please jot them down, get them ready. David and Alain and I are happy to answer. As Alain said, we're the technologists. We're not the policy folks, but everyone always asks us, well, you're the experts on blockchain name systems or whatever. What do you expect in the future? I've only got a couple of points here.

Fair warning, I'm not really good at predicting the future, just as most of you aren't either. I'm a little bit older than most of the people in the room, so I have more of a track record of having guessed wrong. The things I would say are safe guesses is we're going to see even more new

blockchain name systems being created. It looks like there's good money there, and people are attracted to that.

Even though we've got a couple that are popular now and a bunch that aren't popular, we'll see even more. We will see more change between what's popular and what's not. We'll also certainly see technical changes, features being added to the existing systems, either new types of additional names, better ability to quickly get the wallet addresses, things like that. Definitely more technical changes. You always see technical changes being added to any system, and the blockchain name systems are no different. We will also see, certainly in the next year or two, maybe longer, more marketing of the current systems. As there is more competition now, some of them are marketing against each other.

Some are working with each other. For example, there are groups of the blockchain name systems that are working together with certain integrators. We'll hear more about integration with the global DNS. Hopefully we get good definitions of that. Hopefully people stick with those. These are the kinds of things I expect. You'll notice I didn't say anything terribly interesting on this slide because we just don't know. When people say, well, what's going to happen next in the global DNS, we're much more able to make good predictions. We know what's happened in the last few years. There's a single global DNS. We know what's happening inside of ICANN on major topics.

You folks in the GAC come out with a communique after every meeting talking about what's important to you. There's centralization there. In the blockchain name systems, there's no centralization and therefore

trying to predict the future is that much harder. With that, I think it's time for questions. You can go to the last slide, but it's one of those generic ICANN last slides. If you have questions, I'll stay on the line here, but Alain and David can also answer questions depending on which topic you're asking about. Thank you.

ALISA HEAVER: Thank you, Paul. This is Alisa Heaver for the record. Very interesting presentation as was the presentation of Alain. I have a question myself, but I also want to defer to the rest of the room because I almost cannot imagine that there aren't any questions, but I'll kick off. I was wondering to make it a little bit more practical. Do you have an example of how a non-internet web page in the blockchain would look like? Is it like a regular web page as we know it on the ICANN DNS?

PAUL HOFFMAN: Yes and no. So thank you. That's a very good question. I sort of breezed over it here because it's not something that -- it's very, very, very niche, but there is a system called the IPFS, which is I don't even remember what the acronym is. I don't remember what the first two letters of the acronym is. The second two letters, the third and fourth are for file system. It is a non-internet file system. It's a file system that is stored on a zillion people's laptops and desktops and such like that. So I can say here is a web page and many, many people are going to host this web page and I have no control over that.

But that web page gets an address and if I put that address and associate it with my blockchain name system name and someone goes

to that in one of the browsers, it will say, oh, if I'm in a browser and this person has entered a blockchain name, they must want to see whether there is one of these IPFS web pages somewhere and it goes out and looks for it. Again, I don't want to sound condescending here, but it will find it on any old random server. That's literally how it is designed, is that there's massive decentralization and then it will show that to you. Those web pages are fairly static. You can't run anything useful on them because if you link to another page, that page is somewhere else in the IPFS.

You don't know whether that's going to be available. It's something that the folks in the blockchain world are very interested in, but thank you, someone in the chat said it's the interplanetary file system. We're still on one planet for now, at least I am. So it is a niche application. It might become more popular in the future. I don't think so because we've got all the web pages we have now. Every restaurant on the corner has their own website, but for the people interested in it, that's something that they can include a link to it in some of the blockchain name systems. Again, one of the differences is that not all the blockchain name systems let you have IPFS links. Hopefully that answered your question.

ALISA HEAVER: Yes, thank you. I also see hands up and four questions in French, actually, in the chat. I'm looking at Tracy. Do you want to do the moderation, or…?

TRACY HACKSHAW: Yes, so I think there's at least one question in the room as well, but let's start with the questions in the chat. That might be a good way to deal with it. Gulten, maybe you could give us some help with that, if possible.

GULTEN TEPE OKSUZOGLU: Thank you, Tracy. Of course. We have a queue lining up. First on the line is Wang Lang from Chinese delegation, will be followed by Rosalind KennyBirch from UK, and then Manal Ismail Egypt, and finally T. Santhosh from GAC India. Wang Lang? Thank you.

TRACY HACKSHAW: There's one in the room as well who's not using Zoom, but we will get to that question after.

GULTEN TEPE OKSUZOGLU: Wang Lang, go ahead. Thank you.

WANG LANG: Thanks. This is Wang Lang from GAC China, and thank you, Paul. Thank you for your specific explanation. My question is about the future of the blockchain name systems. Is there any one of the blockchain systems which takes the dominant position, and what's your take of the future of it? Will it coexist with our global DNS, or will it replace our global DNS in the future? Thank you.

PAUL HOFFMAN: Thank you. Very good questions. Currently, there is no one that is dominant. There are ones that are dominant in different local communities within the blockchain world, but there is none that are dominant across. That could change in the future. We don't know, and again, I'm not the person you want to ask about predicting the future. I have a track record of being wrong, but so do most of us techies. They will always coexist with the DNS. The DNS has proven itself, its value, so well, especially the part that there's a single global DNS. That's why you're all at an ICANN meeting right now. So any of the blockchain name systems that work well or not will always be coexisting with the global DNS.

And then your last question is, can the blockchain name systems become more dominant? They can. I don't currently see how because right now what people really like about the global DNS is you enter a name and you get to a website, a mail server, whatever, that you get an IP address. The fact that the blockchain name systems are really meaning to get you to a wallet address, very, very important in the blockchain world, so far not important in other places. But there are big dreamers in the blockchain world, people who write long papers about a grand future where the blockchains really are predominant. And if those come true, a name system that is tied to the blockchains might really take off.

One thing to note, however, though, is that's all based on the idea of a name to a wallet address. We can do name to wallet address in the current DNS today. And in fact, we are doing it. It's just not used very much. So even in a world as some of the blockchain dreamers talk about, about where everything is done between blockchain addresses

and wallets and such, that can be coordinated with the global DNS. We don't need blockchain name systems for it. We have them. They are popular within the blockchain world. But there's no technical need for them. A wallet address appears in the global DNS the same way that it appears in the blockchain names. Thank you.

TRACY HACKSHAW: So next in the queue.

ROSALIND KENNYBIRCH: Great. And thanks so much for a really helpful morning of presentations. This is Rosalind KennyBirch, UK. I just wanted to ask, when there are overlapping TLDs between different blockchains and the DNS, how exactly does the decision get made for which result to show the user? Thank you.

TRACY HACKSHAW: Alain, do you want to take that?

ALAIN DURAND: Yes, I would take this one. And the short answer is we don't know. Because there is no consensus here on which one to take. If it's just overlapping, and it's a contract, it's a problem.

TRACY HACKSHAW: So there's still questions in the queue. Next in the queue, Gulten, just remind me.

GULTEN TEPE OKSUZOGLU: We have Manal Ismail, former GAC chair from Egypt delegation on the line.

TRACY HACKSHAW: Thanks.

MANAL ISMAIL: Thank you. And I was stupid enough not to write my questions. So the two I remember now because I was compiling so many as Alisa mentioned. Alain, so what influences the decision whether to update the last current block or create a new one? And the second question also you mentioned that there are regular checks, whether every four hours or six hours or so, and this consumes a lot of energy. So is this done routinely, irrespective of whether there is change or not, or just whenever a change is sensed? Thank you.

ALAIN DURAND: Thank you, Manal, for these questions. So that's a fundamental property of a blockchain. You can never update anything. Never. You can always add something, at the end of it. But you cannot update it.

MANAL ISMAIL: But you mentioned that updating it changes the signature. Is this regarding a new block?

ALAIN DURAND: So when you want to add something, you and other people will create a new block with your data, their data, and all of this, and this will be added at the end of the chain, and there will be a new signature generated that links it back to the rest. That's how it works. So this process of creating a new block happens usually on a regular period. It depends on the blockchain. Some it happens when it's ready, but in many of them it happens like every six hours, every four hours. And there's always, at least on popular blockchains, there's always things to add.

So if there's nothing to add, it essentially means that the blockchain is not very popular, it's not really used, and then it's dying. But on the ones that are successful, there's always something to add. And this process goes through the steps, 12 steps that I described, where all the miners are doing this competition to find this number that will help them to link the block back. And that is process that happens every time we add a block, so every few hours, that takes this enormous amount of energy.

PAUL HOFFMAN: If I can help you also, Manal, you were asking about updates. So as Alain said, you can't change anything that's currently in the blockchain, but you can add a later record that says, I'm updating that block from two weeks ago. And so someone reading the blockchain sequentially, if they're looking at the end, they have the current data, but they can also start at the beginning and look at the history of something.

So for example, within the name system, you might say, I have registered this name in this block. And then later on, there will be

another block that says, Paul has transferred the registration of that name to somebody else. So the name still exists, but now the ownership has transferred. And generally, there are two types of blockchains, as Alain said, ones that are based on time and ones that are based on availability of data.

Even on very unpopular blockchains, people want to say stuff, people want to use the blockchains. They are using them for applications that we are not familiar with. And there's often lots of data in there. And the cost varies, again, between blockchains. So an expensive blockchain might be an important one, but you may not want your data there because your data is not worth that much. You might put it on a cheap blockchain and hope people are looking at it. Hopefully that helps.

TRACY HACKSHAW: Thank you very much. There's a question in the room. Let's take that question now. Sir, can you identify yourself and go ahead? Thank you very much.

NASSOUR ALI: Thank you very much. This is Ali from Chad. Thank you very much, Mr. Alain, for this presentation. It was an excellent presentation that we listened to with great interest. I would like to say that it is extremely important for all of us to make sure that we are able to surf on the internet in good conditions. But we can't exclude or underestimate that there are domain names that are registered with bad intentions. Opening a bad store, a fake market, and that can create a lot of trouble for people. So my question would be, what are the measures to prevent

these actions? What are the controls that exist to manage this contraband market? And also, what are the weaknesses of the DNS protocol? Thank you so much.

ALAIN DURAND: I will try to answer you in French. Thank you very much. So there are two facets to your questions. What happens in the DNS and what happens in the blockchain environment? In the DNS environment, when you have malicious domain names that are registered, you have procedures that are discussed in order to manage these types of things, the takedowns. There are agreements, procedures that we can follow, and many people are actually specialized in that and treat those specific issues. When you transfer that in the blockchain environment, things are much more complex for two reasons.

First of all, the technical reason. I explained earlier that you can't change anything in the block. You can only add things later. So the fact that the malicious domain names has been registered can never be erased. You might be able to create a registration to say, this name is not valid any longer. We took it down, but the actual registration of the name has been done. And again, nothing can be changed in the blockchain. You can only add something that updates the information that exists. So it's much more complex.

Second aspect, I explained in my presentation that the domain names or the names rather in the blockchain naming systems are not linked to the ICANN policies. They have their own internal policies. And so it depends on the blockchain. Certain blockchains have solutions to deal with these issues. Others may not. And that's where the multiplicity of

blockchain systems comes into question. Now, as far as your second question on the weaknesses of the DNS protocol, that is a very wide question. I don't have time to answer now, but I can address that later.

TRACY HACKSHAW: Thank you very much and we can go back to the Zoom queue. So I apologize for those who didn't realize we are using the Zoom queue for those in the room as well. But if you have questions in the room, please raise your physical hands if you wish. Gulten.

GULTEN TEPE OKSUZOGLU: We have T. Santhosh from GAC India.

T. SANTHOSH: Thank you, Gulten. Thank you, Paul and Alain for a good presentation on what is the blockchain and the DNS-based blockchain. And during the presentation, it was mentioned that this encouraged widespread deployment of the servers. And also it is more distributive and brings in more flat architecture. So now I would like to know that what will be the future of the open resolvers which we are using in the current DNS system. Thank you.

PAUL HOFFMAN: David, do you want to take that since you often give talks on that?

TRACY HACKSHAW: David, there's a mic in front here if you wish. To grab it, good. Perhaps you come to the front, it'll be easier for the cameras to grab you. Thanks.

DAVID HUBERMAN: Thank you. So your question is about the future of open resolvers in the DNS. So, I'm thinking. It's a good question.

ALAIN DURAND: Maybe David, I can help you a little bit and then you can follow up on it. As Paul said, we are technologists and we have a really, really bad track record of predicting the future. What we can do is to track the past and track the present and make some educated guess. But those are only guesses, right? So the real important things that we can give to the community is some measurements of those things. Measurements in the past, measurements today, and then you can think about what it will be. So we are tracking actually the usage of open resolvers.

We are tracking it per ISP basis, per country basis, per region basis, and worldwide. I can talk about Europe, because you are here in Europe. I published a paper not that long ago that talks about what is the usage of open resolvers in Europe and specifically for consumers. Because we realize that the market for consumers and the market for businesses is actually very, very different. For consumers, when I did the measurement not that long ago, we realized that 96%, 96% of consumers of large ISPs in Europe were using the ISP provided resolver, 96%. There was a few that were using some other surprising things, but very little, and 4% that were using open resolvers, 4%.

Out of those 4%, one was a dominant player that had about half of that market share, that means 2%. There were two of them that were about 1%, and everything else was in the noise. These numbers have been changing slightly and we are tracking them, but so far, the larger picture is exactly the same. We did change in a few years, we don't know yet, we are tracking it, and so far, those are the numbers. 96% are using the ISP provided resolver. The numbers are slightly different in other regions of the world.

In Europe, in highly developed economies, this is what's happening. If you go to economies in transition, however, and you're trying to stand up an access provider, an ISP, to connect people who have never been connected before, your efforts are on building that last mile connectivity. Your efforts are on strengthening the connectivity so that it's always working. What your efforts don't focus on is on the DNS resolver, and you know why?

Because you point your users to an open resolver. You point your users at CloudFlare or 1.1.1.1 or Google 8.8.8.8. Open resolvers, while they provide some interesting questions about data privacy and data protection across multiple jurisdictions, are actually super useful in economies in transition to getting everybody connected to a very resilient and a very fast DNS resolver. I hope that answers your question.

TRACY HACKSHAW: Thank you. Gulten, I understand that there are also written questions in the chat. Some of them are in French. I'm not sure if you could get some assistance from staff with that. But in addition to those in the

queue, maybe you could get that read. And there's also one physically in the room raised his hand.

GULTEN TEPE OKSUZOGLU: Thank you, Tracy. Tomboye Ibrahim from Chad delegation raised four questions in the chat pod that reads as, is there a mechanism that can be used to verify that a miner follows the 51% rule? Can two or more miners reach the target at the same time? Who is managing name allocation in blockchain systems? And finally, can there be collision between their TLDs and those of the global DNS? Thank you, Tombaya.

PAUL HOFFMAN: I can grab those, Alain. I know you certainly know the answer. I want to answer the first two really quickly because the third and fourth are the interesting ones. The 51% rule differs from blockchain to blockchain as Alain said. So you have to look at the establishment of the blockchain and then also as the rules change over time. Miners colliding with each other on timing and such, again, that's up to the blockchain. And some of them change their rules over time. The more interesting questions were, how do names get established in the blockchain name systems?

And the answer to that is, it really depends on the blockchain name system and also its maturity. What we've seen historically is that some of the blockchain name systems change the rules on that two or three years in after they're more well established. And the collisions with TLDs, that's up to them. They're not part of the ICANN process. Anyone in the ICANN process, of course, we know that there is no collision among TLDs. It's a unique name system. Like every TLD is unique. The

rules for getting a new TLD are well established and such. In the blockchain name systems, those rules are recent. They change over time.

Competition between the name systems will affect that. Coordination between the name systems will affect that. There have been groups of name systems that have tried to do some coordinating. They've made big announcements about that. We certainly look forward. We, as ICANN staff, follow that, not because there's any interaction with ICANN. They're not part of the community, but we should be knowing that kind of thing. So we do follow it. We just don't see results that we can report at this point.

TRACY HACKSHAW: Alain, you want to say anything further?

ALAIN DURAND: I think that Paul just answered all the elements with the data we know.

TRACY HACKSHAW: Good to have you covered all the Zoom. So let's just take a colleague who's in the room first, and we can come back.

CARSTEN SCHIEFNER: Thank you. My name is Carsten Schiefner. And again, thank you for this 360 degrees view on the issue of alternative routes, as well as blockchain naming systems. I just wonder, and you guys mentioned that a couple of times already, so here's one more, about a prediction.

Looking at, and we've just had the issue of collisions, looking at that particular issue, is there any kind of knowledge in the room already in terms of to what extent one blockchain name systems has fought another system due to collisions in the naming system?

Because that possibly could serve some kind of a prediction, or as a prediction for the new gTLD round, because we've seen that, if my recollection serves me right, we've seen that in the past already, that alternative routes have fought ICANN in one of the last rounds for gTLDs, because they have applied or deployed one certain top-level domain already in the alternative routes. So that would be my question, thank you.

PAUL HOFFMAN: Not a technical question, I assure you. So I have been working with folks inside of ICANN, the folks in GDS who are working on the next round, some of the legal folks and such. We've been thinking about this. We have not made any statements yet. It's not clear if we will, because why would we make statements about communities that are outside of ICANN? Watch this space, don't watch the technical space. You're not going to hear the announcements from us. It is something that people on ICANN staff have been looking at. We've also been looking at how the alternative namespaces are dealing with each other about collisions. But nothing yet, and again, if it comes, it will be a policy decision.

You folks in the room are a major part of -- the policy gears that grind at ICANN are there. However, ICANN's going to respond to this, it will be a policy, and it should come from a policy decision, not just best guesses.

TRACY HACKSHAW: Thank you.

CARSTEN SCHIEFNER: Thank you.

TRACY HACKSHAW: There's another question in the room, so I know that, but let's return to the Zoom chat and question hands. Gulten?

GULTEN TEPE OKSUZOGLU: Thank you, Tracy. We have a question raised by Josele GAC, more or less the representative. Is there a need for an internet of things naming system, and is blockchain technology under consideration? Thank you.

PAUL HOFFMAN: Very good question. Alain, do you want to take that, since you've worked on IOT stuff?

ALAIN DURAND: I'll start. The short answer is, when people wanted to do a name to a wallet mapping, they could have used the DNS they decide not to. IOT devices, they could use the DNS and it works today. We actually made some demonstration back many, many years ago in an ICANN meeting in Abu Dhabi, I think it was in 2017 or 18, where we used the DNS for IOT devices to go and find how to update themselves. So not just use the

DNS to do some browsing or grabbing information, but to go and update themselves. So the DNS actually works very well for IOT devices. Can they invent something? Yes. Could something else work? Yes.

The question here is not to prevent innovation. Innovation happens all the time. You don't have to use the DNS, you can use something else. The question really is, if you do it in a corner of your garage or your lab, it's easy. When we talked about scaling, as David mentioned at the very beginning of this day, things are really different. And how do you scale something new to handle as many requests as the DNS does today? And how do you do this in a way that doesn't compete with the DNS, but integrate with it, is really the challenge for all those different new things. Hope that answered the question.

TRACY HACKSHAW: Thank you. I'm seeing there are three questions that we can deal with in the Zoom room, but let's go to our colleague quickly here in the physical room. Can you just identify yourself, sir?

RUSSELL WORUBA: Thank you, Paul, Alain. Russell Woruba, I'm from Papua New Guinea. This is my first GAC meeting, so very excited. It's a question of architecture we're trying to resolve between how blockchain can fit into something that is already existing. That's my observation. I'm just thinking, and the comments that are raised up to this point, is there need for us to have sort of like a technical working group of some sort between this, between the global DNS and the actual blockchain hierarchy? We are going to be writing blockchain policies in our own

countries on how it can be used, and of course, the DNS, the glue of the internet, will be affected in some sort. Just a question observation.

TRACY HACKSHAW: And cognizant of time, I'm going to try what I did in the last session and see if I could pull two more questions and see if we could maybe deal with it. So we have Ana Neves from Portugal, and Jorge Cancio from Switzerland. Ana?

ANA NEVES: Thank you very much. I think I can speak in Portuguese, is that right? So I will take advantage of that to speak, to introduce Portuguese in this GAC meeting. If you don't mind.

GULTEN TEPE OKSUZOGLU: Ana, I'm very sorry to interrupt. Could you please speak closer to the microphone? Thank you.

ANA NEVES: Yes, sure. I think it's better now. So, I'm allowed to speak in Portuguese.

TRACY HACKSHAW: You can obviously, but we're waiting for Alain to grab his headset, his device, so you can hear the question.

ANA NEVES: So never mind, I'm going to speak in English. So my point is very technical. So we know that the domain name system evolved, and it's nowadays a system that we rely, and as Alan and others already said, so it's a system that we can have some trust and it works very well, et cetera. And then there was a criticism to the blockchain or to these decentralized ledger technologies that we don't know how to erase or to replace an information that is not correct.

So my point from the technical point of view is that if you don't perceive that these decentralized ledger technologies, if they cannot evolve at the sophistication level, that will overcome those issues that you presented. And this is linked with costs. If using this kind of decentralized ledger technologies, if it will be less expensive or more expensive, what do you think? Thank you so much.

TRACY HACKSHAW: And if you don't mind me, just try and get Jorge's question and I think it's. Jorge?

JORGE CANCIO: Hello, hello everyone. Jorge Cancio, Swiss Government for the record. This is a more technical policy question. I don't think you can differentiate those aspects so easily, but anyways, perhaps a reflection for ourselves. Anyone using naming system, be it one based on blockchain or one based on the DNS, is doing a cost benefit analysis in choosing what system they are using or they are implementing or whatever. And in the cost side, you have of course, whether it is

interoperable, whether it scales, whether it is user friendly, what the user interface is.

On the benefit side, it's of course the ease or the innovation it allows, et cetera, et cetera. So the reflection is, what can we do from the icon side, from the policy side or from how the DNS works to shift or to influence this cost benefit analysis in the direction of using more the DNS or to put the question in a different way, what are the effects of ICANN policy or how the ICANN DNS works that go into increasing the costs of using the DNS and therefore, triggering the user or the implementator to use alternative naming systems. So perhaps there are factors we can influence from the ICANN framework side. In this cost benefit analysis, the people out there are considering when they choose between one system or the others.

TRACY HACKSHAW: Thanks, and the queue is closed. We are just about out of time, so Alain?

ALAIN DURAND: I will try to answer very briefly because we're running out of time. So first question, do we need another working group specifically dedicated to blockchain. I will say my usual line, this is not a technical question, so I cannot answer it. Two questions about, can blockchain technology evolve to allow updating data previously? I'm really bad at predicting the future, right? I said that earlier. However, that's a fundamental piece of the blockchain design that you cannot update anything. You can always add something to the blockchain that will update previous record, but it's a write-only system. It's not an update system.

So this is a fundamental property that is promoted actually by the blockchain people as a virtue. It may be seen as not a virtue by other people, but that's what it is. So no, it cannot really evolve that way. Or if it evolves, it will not be a blockchain anymore. It will become something else, which possibly could happen, right? Now, in terms of cost, and I want to lump your question into the question from the gentleman over there, you're absolutely correct that you need to look at the global cost. Because often people will say, oh, it costs X amount to register a name here and Y amount to register a name over there. But the registration is the easy part. What matters is, can people reach you?

Because if you create a system where you have a really tall barrier of entry for users to actually be able to access the system and make use of it, then you are not going to reach your customers. So if you think of it as a business model, you have a solution when billions of people can use and connect to you, and you have a situation where maybe a few thousand or tens of thousands can use. Which one are you going to use? This is not just cost here. This is really about opportunities. Things may change, of course, and things will change. And again, this is not about preventing innovation. This is about scaling this thing. Will this scale at some point of that resolution become something that is possible at this larger scale? And I will hand this over to David to complete this.

DAVID HUBERMAN: So you're now starting to ask the real questions. You're now starting to ask the difficult questions, some of which we're not giving you answers to. But I have good news for you. At 10:30 local time, 10:30 a.m. on Wednesday, the founder of one of these blockchain naming systems,

the founder of Unstoppable Domains, is going to be here in a session to answer these questions. So at 10:30, come to the emerging identifier technology session, and you can ask the founder these very good and very difficult questions.

TRACY HACKSHAW: Thank you very much. Maybe I could ask Alisa to help close the session. That was a record number of questions. I think that's fantastic. Thanks very much. Thanks to the team. Alisa?

ALISA HEAVER: I would just really want to thank the Octo team for setting the stage actually for this afternoon as well, and explaining us everything about how the DNS works, how blockchain DNS works. And I can say, well, looking back at Washington ICANN77, where almost half of the GAC indicated never to have heard of alternative naming spaces. I'm thrilled that, well, we start to understand now what this is about, and I just want to give another round of applause for you, because it's super interesting. Thank you.

TRACY HACKSHAW: So thank you very much. We now take a break for lunch. We're going to ask you to try and come back to the room at about just a little after one, if possible, so we can start on time. You know how the GAC is already. So let's try and start on time. So just come back just a little bit after one, if you don't mind. Thank you so much. Thanks for your questions and interaction this afternoon. Thank you.

[END OF TRANSCRIPTION]