
DUBLIN – How It Works: Internet Standards Setting
Sunday, October 18, 2015 – 09:30 to 11:00 IST
ICANN54 | Dublin, Ireland

DAVID CONRAD:

Good morning, everyone. Welcome to the second of the series of “How It Works” tutorials. We first started this in Buenos Aires. These tutorials are intended to provide ICANN meeting attendees with a better understanding of the various components of the ecosystem in which we operate and the technologies that are used for the Internet system of unique identifiers.

This first tutorial will be provided by Paul Hoffman who is a new hire into ICANN. He actually works for me in the office of the CTO. I should probably say I’m David Conrad, ICANN CTO, and I have worked to create these “How It Works” tutorials for the community. Paul has graciously offered to provide this session on the Internet Engineering Task Force.

In Buenos Aires, a similar presentation was provided by Russ Housley of the IETF/IAB or his own company, Vigil Sec. Paul joined us July 1 and has volunteered to provide this tutorial. I hope you find it valuable.

With that quick introduction, I will now throw it over to Paul.

Note: The following is the output resulting from transcribing an audio file into a word/text document. Although the transcription is largely accurate, in some cases may be incomplete or inaccurate due to inaudible passages and grammatical corrections. It is posted as an aid to the original audio file, but should not be treated as an authoritative record.

PAUL HOFFMAN:

Russ is actually here this week in case you see him. If you were at the Buenos Aires meeting, these slides are very similar to what you saw before. It's not worth [necessarily seeing], but I've modified them some but it's based on the work that Russ did.

I've been active in the IETF for more than 20 years, sort of my background for giving this. We've got 90 minutes – fine on time – so if as I'm going you have a question that you think is [inaudible] right then, feel free to ask. Raise your hand. We have a roving mic. I will try to answer some then. I might answer by saying, "Don't worry. That's four slides from now," but feel free to ask.

If that's not working, like if I'm running behind (which I should be following), then I might ask you to stop asking questions until the end so that we really will have 15 minutes. If you're the kind of person who really wants to ask a fuller question at the end, definitely take notes. If you want to ask in the middle, that's fine.

Again, what this is about is the IETF, which is not part of ICANN. ICANN is not part of the IETF. This is an introduction so that you'll understand the relationship between the two groups, which is fairly tight.

This is a chart that ISOC, the Internet Society which I'll discuss later, prepared a few years ago which describes the entire Internet ecosystem. You can see that there are lots and lots of parts of the entire Internet ecosystem. The thing that's most relevant here is the fact that there are lots and lots of parts. It's not ICANN. It's not the IETF. There are all sorts of things. The URL for this is at the bottom of the slides if later you want to actually go through it. It's probably the best chart I've seen that describes everything.

What we're going to be talking about today is the orange oval. In that orange oval, we have three groups: the IETF, which is the main topic for today; the IAB, the Internet Architecture Board, and I have a couple slides on that; and the third thing (which is hard to read because of course there are a million things up there) in that orange oval is the IRTF, which is the Internet Research Task Force, which I'm not going to be describing in other slides.

IRTF is related to the IETF and the IAB – they often meet at the same time – but it really is very “research-y.” They don't make standards. They don't have a whole lot of process going on. It's really meant for academics and serious [researchers, but] since they sort of come under the same IETF umbrella – they're funded through the same way that that IETF is and there's not so many of them, it's like a little adjunct – they get put into here. If

anyone here is more of a researcher, academic, and such like that, you would be interested in the IRTF. But, like I said, I'm not going to be describing that that much today.

So really of this whole ecosystem, what we are covering today is just that one little bit over there, but there's plenty to cover. One of the things that people are most concerned with when they come in they say, "Why is all [of this] happening now? It's 2015, and there's this whole environment going on." Well, had you asked that question 20 years ago in 1995, there would be some of these pieces here but not that many. The IETF would have been the main center of where the work was being done. That was before ICANN existed. ICANN came out of procedural work that many people in the IETF did and such. But the IETF greatly exceeds all of that, so that's mostly what we'll be talking about today.

I've got a couple of ways of saying what the IETF does. Here's the first one. In this talk right now, I'm going to cover why. Why does the IETF do what it does? Really, that little short "we make the Net work," that sounds a little bit glib, but it's actually quite accurate and it has been accurate for the last 30 years. That is, when you think about where networking was – I can tell some people in the room maybe aren't even 30, but for those of us old-timers who remember the Net in the late '80s and in the early

‘90s it was very fragmented. The Internet was part of that, but it was considered a weird part of that.

As the IETF was starting up, there was generally a feeling that kinds of networks should stay separate. We don’t want to be part of that one [Over there]. The IETF flipped that on its head, and the main mission of the IETF from day one was if you wanted a network that was a network of networks that was going to be inclusive, that was going to include almost everybody who wanted to participate – unless they were, for example, [malicious] – but pretty much anyone else, how would you create that? What kind of engineering needs to go into that?

That’s why the IETF started. Humorously, it hasn’t changed that much in the why. That original feeling is still the same. Now, we don’t think of it as much because in the last 15-20 years, the Internet pretty much took over all of networking. You don’t really think of people saying, “I’m going to set up my own network that’s not connected to the Internet.” That’s just really rare.

But historically, that was in fact the way the world was, especially in the mid-‘80s. What you had were networks who differentiated themselves by saying, “We don’t [touch] those funny things over there” for any value of those funny things. CompuServe was a private network that didn’t want to interact

with some of its competitors. It wanted to be an independent silo.

But the IETF looked at this all and said, “You know, you’re all going to come around to the right idea eventually, and they did, but that whole feeling of, “Why start something like this?” came from that. The main mission really was: how do we make an environment where that’s going to be possible? Well, we need to have documentation. We need to have good end [inaudible]. We need to have some sort of policies.

But again, when this all started in the mid-‘80s, we didn’t really know what the future would look like. By the way, I’m saying “we” here. I did not get active in the IETF until the mid-‘90s, but [inaudible] started the IETF knew what they wanted. They knew some ways to start getting there, but they didn’t really know what it was going to end up [looking like].

This is the way. I’ll have a couple of other why slides sprinkled throughout. Most of this discussion today is going to be the how: how the IETF works, how you can work with the IETF. But it’s important to remember the why because, especially if you’re a person who has come into the Internet in the last 20 years, you may not remember that the world was not destined to be this way.

In fact, it was funny. As the IETF started to become popular, many of the organizers of these other networks were openly ridiculing the IETF for being a bunch of socialist hippies, of not understanding how the world would really work, that no one really wants to have that much interaction with [inaudible].

Specifically, some of the ridicule came from folks like in the [ITU] who said permissionless interaction with a network is dangerous. No one is going to want that. Of course, we don't hear that anymore, but again I wanted to emphasize the why here actually has a fair amount [inaudible].

This is one of the mottos that you will hear a fair amount: “We reject kings, presidents, and voting. We believe in rough consensus and running code.” This is highly prized in the IETF. It's not always adhered to.

A couple of things that come from this that you should note are one thing is in the IETF there's no voting. I'll talk a little bit more about that.

If there's no voting, you have to at some point figure out when are we done on this decision, so the idea of rough consensus. I have a presentation on rough consensus.

The last little bit here of running code, a very “engineering-ish” thing, it's not always true. In fact, sometimes the IETF

standardizes things without running code, and sometimes they discover after they've finished standardizing it that it doesn't actually work because when someone wrote code they discovered it didn't work. But in general having running code for things that you're working on, whether it's an actual protocol or even a process, is considered very valuable in the IETF.

Dave Clark said this umpty-ump years ago, maybe 25. I don't think it was quite 30 years ago. But the idea here is, and you'll see this as we go through some of the following slides, is that the IETF really doesn't care about hearing from on high what people want. A very important person comes in and says, "Oh, no. You shouldn't do that," the fact that they're a very important person pretty much doesn't mean much to folks in the IETF.

Now, if they can show in a technical way why you don't want to do that, great. But the IETF, more than most organizations you would expect, tends to actually – I mean, David used the word "reject" here – reject the idea that if you walk in and say, "I'm very important and you should do this," usually that's more of a cause for laughter than it is for respect. If you come in saying, "Hi. I've really looked at this. Here's my analysis. This is why I think you should do this," then you get a lot more respect.

How does one become an IETF participant? This is a quote from an RFC. I'll talk a little bit more later about what RFCs are, and

the RFCs are all numbered. From RFC 4677, because it's a loosely controlled group, it's self-organized, anyone can really be a participant. That first bullet point, "Everyone is invited to participate," is absolutely true. I see a number of people here in the room. I won't ask everyone to raise their hand, but anyone in the room who can raise their hand can be a participant in the IETF.

I'm not saying you all [want to]. Many folks here are probably not primarily technical, and the IETF is a primarily technical organization. But if you're in this room right now, you might be technically-oriented and you might find a group of other technically-oriented people interesting. You can be a participant. When I say "can be," I mean literally that's all it takes is interest. You get on a mailing list, and you are a participant in the IETF. There are no fees. There's no membership requirement. That just happens.

It really is an open community. Being an open community, it's a very international community. From day one, the IETF, even though many people come from the United States, was international. That is, the leadership of the IETF in the very first year included Europeans and Asians, which was also considered a little bit radical in the mid-'80s. In the mid-'80s, a lot of these organizations that were starting up to talk about networking

were very national, or maybe it might be like “the European this.”

But the IETF started off with a bunch of academics and researchers going, “Hey, there are [people] all over the world who are studying networking so, sure, why wouldn’t we do this? And e-mail is international. Since one of the primary ways that the IETF does its work is through e-mail, sure, we’ll just start off with this,” which bothered a fair number of people, as well, because they were like, “How do I know if that person from that country is representing the government or not?”

It turns out the IETF is really against representation, so the third bullet point, it’s “interested individuals, not companies,” that could probably even say “not organizations,” “not governments,” or whatever. If you show up on a mailing list with your technical, you may be from Google, you may be from the government of Spain or whatever. People don’t actually care where you’re from that much. They really care what you’re bringing.

A good way to see this, by the way, is because some companies are very heavily represented in the IETF. For example, Cisco (the router maker) has hundreds of Cisco employees who are there. They don’t speak for Cisco. If you want to see one of the funnier things, go onto one of the routing discussions and watch Cisco

people argue with each other, not only about the [inaudible] but about what's a good idea or not. That's a good way to really get a feeling for this doesn't happen.

The same happens with countries. Sometimes people will say, "Oh, the Chinese are not going to want this," and someone from China will say, "Well, I don't know who you're talking about. I'm Chinese. I think it's just fine," or vice versa.

The representation part, sure, we all spend our time on this unless it's a hobby coming from some place. That's not how you get paid attention to in the IETF at all. Really, the goal is rough consensus, and the way we get there is by doing it mostly that you participate remotely. The IETF meets three times a year, which is where ICANN got the magic number of three times a year. But as you'll see in later slides, you don't have to go to IETF meetings at all to be very effective. Most of the work is done on the mailing lists.

There are a number of people who have made very important standards in the IETF who have not ever shown up to a meeting or showed up for a meeting, lost their travel funding or whatever, and have continued to be extremely important to the IETF and have not shown up in over a decade.

Let's talk a little bit about the rough consensus thing because this is very weird, right? Voting is easy. Everything else gets a

little bit funky. Because there is no defined membership – remember in the last slide I just said you could be a member today, and you don’t have to sign up – how would you have voting if you don’t know who are the people who can vote?

The idea of rough consensus has been part of the ethos of the IETF since the very beginning. One of the very important things is not only is there no voting, but you don’t need to be unanimous ever. There are plenty of technical topics where there’s going to be a small minority who are going to disagree with the way something is going. If there is rough consensus of the group, then it moves forward.

Sometimes the IETF will do things that look a little bit like voting. They’ll say, “Who wants this?” and hands will be raised. But that’s usually just to get a feeling for how much more do we need to discuss this. There are 20-25 people in the room right now. If I said right now, “Who understands this?” and, say, 20 of you raised your hand, that gives me a sense of, “Oh, okay, I can probably move on.” If 10 of you raise your hand, I get the sense of, “Oh, I need to keep going on this.” That’s very much what happens [inaudible].

Remember, since the IETF only meets three times a year and yet progress gets made at other times, on a mailing list when the working group chair might say, “How are we doing on this?” they

have no idea what the percentage is. They'll have a feeling for when they say – and this is how you get rough consensus – “Who is sort of against this?” No one speaks up. They say, “Okay, we can move forward.” Or a couple people speak up, or some people say, “I don't know what we're doing.” That's how you get to rough consensus.

Disputes here are really resolved by discussion. Even with a face-to-face meeting, so there is a face-to-face meeting, some decisions seem to get made. The decisions are never finalized at the meeting. They're always taken back to the mailing list later. Usually it's okay, but sometimes people who weren't at a face-to-face meeting really do get to say, “No, this didn't really go the way that I thought that it would because this didn't get described.” If the topic of rough consensus is of interest to you, there's a recent RFC on that, that is actually pretty fascinating.

The result of what the IETF does is [inaudible]. Again, I want to emphasize that the idea of open standards is a recent idea. Even by 1993, there were many organizations who were not the IETF who were very, very, very against the idea of open standards. [inaudible] came out and said, “Any standards the IETF does cannot be legitimate because anyone can get at them.” Of course, those people have all sort of fallen off, but no one who is doing an open standard because it's open can say, “Oh, well, we can enforce this.”

There isn't an enforcement group. It really is an open standard. Open means you are welcome to adopt it. If you want to do things on the open Internet, you probably need to adopt this in order to interact because other people will say, "No, we aren't going to be able to communicate with you if you don't do this." But, in fact, there's no Internet police in the sense of saying, "You must follow this specific standard." When there's consensus about this, it becomes an open standard. It can change later. There's no one who says, "You must do it until this time, until later."

The IETF's idea of the open standards was sort of weird, sort of radical, but it the way that things have worked since then. Pretty much every other standards group has had to adopt it because of the popularity of the Internet. Not everyone has. For example, some standards groups make you pay money in order to see their standards. They make you pay money in order to say that you're using their standards. IETF never has, never will.

Let's talk a little bit more. On the next few slides are going to come back into the how does the IETF work. The way that work starts to happen in the IETF is that someone writes an Internet draft. When I say "somebody," I mean it could be any of you in this room, as well. You do not have to be an IETF member in order to write an Internet draft. In fact, we regularly see Internet

drafts written by people who no one has really even seen say anything on a mailing list.

An Internet draft is really just a proposal. It is not something that is at all finalized. The idea of an Internet draft, and this started really early in the IETF culture, is that the first thing that someone proposes about something new is likely to be rough and possibly flat-out wrong. That's okay. We would rather have it said. We would rather have it said in public rather than private work go on and then only brought out when they [inaudible].

I want to emphasize here, if you look at an Internet draft and you say, "Oh, my God. This is terrible," that's just fine. We hope that it doesn't progress, but the fact that someone wrote an Internet draft that has a really bad idea in it is actually a positive thing. I say this as somebody who has written some Internet drafts where I put them out and people are just like, "Ew! Did you not think of this enough?" That's fine because what you want is somebody to be able to say, "That doesn't look right; this looks right." Then if I agree with them, I'll just modify it and I'll do another version. Internet drafts go through many versions.

Again, that's a little bit hard for some people because they're a little bit embarrassed about saying things that are wrong, so we don't get as many Internet drafts as we might hope for. But in fact, this process of try something, try something, just go ahead

and get it published, let everyone see it - and you folks, again, just like all documents in the IETF, Internet drafts are completely open for reading – it's a way to get things started. RFCs, the things that people have come to agreement on, come later, and I've got some slides on RFCs.

This is a little bit of digression about the format. The Internet drafts and RFC format, they're all in English. We need to have some language that everyone will understand. We've considered at times going multilingual, and it has turned out the translation of technical material generally doesn't work very well, especially if there's supposed to be universal understanding of it. So the IETF has stayed with English, not that it wants to be in English, but that still seems to work the best.

This is a sore point for me, but we're still using ASCII text for all of our drafts, which means that [people] with names that are not pretty much English names are stuck right now. That's changing. We're moving to XML, like this says. We'll have full internationalization. I would have hoped that it would have happened by now. It will happen next year, and I'm hoping that next year really is next year, that it's not the rolling "next year" that we're all used to. But for now, it's still just ugly ASCII text. It looks like [inaudible] on a line printer from the '80s, and in fact you can.

Now, the flipside of my complaint is the fact that after 44 years of RFCs, you can actually still go back and read RFC [inaudible]. Everyone can. Some standards organizations picked Microsoft Word as a format and such, and you can't actually read the old Microsoft Word doc. You can actually still read everything that the IETF has published, so that's a positive thing.

Let's talk a little bit about what happens when something becomes an RFC. These are the numbers of RFCs published each year. Just for reference, it shows when the IETF actually formed. There were RFCs written before the IETF was formed. A bunch of researchers had gotten together just informally and said, "This is how we think the networking should work," but the IETF formed pretty much in the mid-'80s. That's the first arrow. Then ICANN about a decade and a half later, second arrow.

These are the total numbers of RFCs, not RFCs about the DNS. The number of RFCs in the DNS is much smaller. It's a large number. It's over 100, but we're not getting hundreds a year published on it.

What this chart shows is that the popularity of publishing these things has gone up and down. Different periods have different [times]. Remember, the IETF covers everything, not just the DNS. The things from Layer 2 and Layer 3, routing, sometimes get more popular. Some applications like HTTP sometimes get more

popular. So you see more RFCs at different times about them. Aggregating it this way doesn't really show you much other than that we're still publishing a lot of RFCs every year. [inaudible] yet active in the IETF, you will probably only care about a narrow [inaudible] them. If you're a generalist, you have a lot to cover.

Some examples, these are our RFCs that Russ had chosen that are sort of related to what we do here also in ICANN. This is just a sampling. Like I said, there are over 100 RFCs that are really related to DNS and addressing and such.

RFC 1034 and RFC 1035 are the definition of how DNS works. You'll notice those are low numbers. They were published before 1990. Pretty much if you're a technologist in this area working the DNS, those two are the ones you care about.

A little bit later, we [inaudible] something about how the DNS itself, how the system works. How does delegation work? What are root name servers and such like that?

A little bit later than that, RFC 2826 – so some RFCs are actually written by the IAB, and I'll describe think about IAB (the Internet Architecture Board) in a little bit. They're sort of the overall architecture folks. One of the things that, as hopefully you know coming to an ICANN meeting, is that the DNS, you can only have really one DNS. Two people can't both say that they are

responsible for .com or something like that. This was a statement from the IAB calling for a unique DNS root.

It's because at the time, there were some people who were saying, "Oh, we can have roots." It makes sense from the business standpoint if you want to break the Internet up into small little chunks, but it doesn't make sense [inaudible]. So the IAB came out and said, "No, this is how we believe this should be working."

Notice in this list, you have technical specifications. You also have procedural specifications. I'll just zip through the others. WHOIS is a separate protocol from the DNS. DNSSEC came later. Now, notice that DNSSEC came way later than domain names. Those three RFCs are dense but interesting to some people.

Internationalized domain names came later. Now, we had a cut about [inaudible]. We had a first round of international domain names actually between WHOIS and the DNSSEC ones. The ones settled on later, the second round which came in about 2010, are the ones that you see here.

Again, I want to note, internationalized domain names have not always been around. [It took] quite a while for us to be able to figure out how are we going to do [inaudible]. In fact, serious work didn't even start on it until approximately the year

[inaudible], and then it took a few more years for the first cut and another almost seven years for the second cut.

An RDAP is a [inaudible]. Another procedural one is Principles for Operation of the IANA Registries. For those of you who are following the transition, that's a fairly important RFC. The last one that Russ threw on here was HTTP just as a reminder that we do a lot of stuff other than [inaudible]. HTTP, the things on the Web, people care about a lot. HTTP1 would have been RFC maybe 1000 or so. So it took that long to get HTTP2.

Let's go back. I'm going to skip over this. Mostly this is a recap of some earlier slides. Why is the IETF doing what it wants to do? Really the most important thing out of here is the IETF is about one Internet. It doesn't have to be an Internet that agrees with each other. In fact, it's very easy to disagree with each other.

But technically, if you want to have universal communication, you need to have a set of rules that people voluntarily follow. No one is forced to follow these, but if they don't follow them, they're not going to be part of the Internet. A set of rules that everyone can follow, and how do we do that? What is the way to do that? Really, the bold at the bottom, the "rough consensus and running code," really is what we're concerned with.

Earlier about the IETF has three meetings a year, this is [inaudible]. Notice two things on this. One the most we ever had

at an IETF meeting was 2,800 and ICANN meetings typically have that many or more. So IETF meetings are smaller than ICANN meetings. Another thing to notice is it has pretty much stabilized and the numbers over the last [inaudible] stabilized and the number is significantly lower than what you get at an ICANN meeting. So 1,200 is what we typically get.

Like ICANN, or actually ICANN did it like the IETF, they meet in different continents each time, try to get around. IETF for their face-to-face meetings is not as aggressive as ICANN at meeting in far-flung [inaudible] because it seems like people are more funded to come to ICANN meetings than they are to IETF meetings. So IETF pretty much normally meets in North America, Europe, Asia once each year that way.

We've never had a meeting south of the equator. We're going to have one here in Buenos Aires. North America used to be U.S. because that was easy for everyone to get to until the U.S. State Department made it hard for a lot of people to get to. So now North America, most often not the U.S. The U.S. State Department just started making things really hard for a lot of people to get visas easily and the Canadians didn't, so we meet in Vancouver a lot. Again, when we say 1,200 people show up, that's probably less than a third of the active IETF participants. Really, [inaudible] don't come to meetings who are still doing very good work.

Regardless of meetings, when does the IETF pick up stuff? Because it's the Internet. It could be anything. Well, the IETF really tries to look at solving problems. Its engineers are the kind of people who like to solve problems. There are always problems. The question is: when does a problem need to be solved by a policy [instead of] an engineering solution? That's sort of a tough call. The longer that the Internet has existed, the more things [inaudible] policy.

IETF tends to take on things where we can scope it fairly well. The IETF tends not to take on things saying, "Let's fix voice communication." That's [inaudible]. Somebody says, "We want to do voice communication in this style," that's the kind of thing that the IETF would take on more.

There has to be an agreement of when we finish. Unlike [CERTs], the IETF likes to close off working groups when the work is done, especially if the work is being done by people who really are going to try come to the meetings. They don't want to come to meetings for the rest of their lives. They would like to have a feeling that the work is going to get done, finished. Part of the scope is knowing when you can be done.

Now, I grant you the IETF fails miserably at that sometimes and there are working groups that have lasted for 10 or 15 years. But when those working groups get closed, usually there's a lot of

cheering and things like that. We're getting better these days at actually coming up with work items that [inaudible] closed as part of the scope. Maybe it needs to get reopened again three years later when people are using a protocol, but generally things are supposed to get closed.

Sometimes work comes to the IETF from other standards organizations. Nobody 20 years ago would have thought that the IETF would be the [inaudible]. There are many other standards organizations that are much better funded, that have closed membership and such like that who think, "Well, we've got all this money. We've got more [inaudible]. We meet in nicer locations. This is where the work will be done." But it turns out that open sort of won.

Some of those organizations are going out of business, and on their way out of business they hand all their work to the IETF. The IETF sometimes says, "No, that's not interesting to us. The reason you're going out of business is you didn't really [inaudible]." Sometimes that kind of work from other standards organizations [inaudible], and it's actually very useful.

For example, the W3C, the [inaudible] Web standards. They're still around and such like that. Sometimes the IETF and the W3C will work together. Sometimes the IETF will take on work. It will start in the IETF. The W3C says, "You know what? We think we

would be better at that.” If the IETF agrees, it’s like, “Great. We don’t need to have that.” The IETF is not out [inaudible]. We’re looking for problems that need to be solved. Conversely, some work will start in the IEEE or in [inaudible]. They’ll say, “We started this, but it’s now feeling very ‘Internet-y.’ You take it over.” Sometimes the answer is yes; sometimes the answer is no and then the [inaudible].

Sometimes interest groups come to the IETF and say, “We would like you to start doing this. These are [usually] policy groups. We’ll get privacy groups at least once a year. “The Internet doesn’t have the right amount of privacy. You should fix this.” Usually, the response is, “Well, we’ve [inaudible]. Let us encrypt this because you want to look in, you are giving a back door to every [inaudible] also wants to look in.”

That’s a novel thought though. There was a big push early on that all telephony equipment should have back doors for the government, and they didn’t really get the fact that any back door is [inaudible]. They said, “We’ll make sure we’re the only ones using it.” The IETF early on – actually sometimes the IETF has a sense of humor – so RFC 1984 was an example of the IETF saying, “No. Back doors are helpful to a much wider variety of [inaudible].” It took 20 years, but we’re finally getting there on that.

Let me do a little bit of structural overview. It looks like I'm actually on time, so it looks like we are going to have [inaudible]. The first line here should make people laugh, that there are no members at IETF. There is no actual structure. The IETF is not a corporations. One of the reasons ICANN is a corporation is they looked at that and they were like, "No, that's never going to work." But the IETF still is not a corporation.

We have meetings. There are working groups. I'll talk a little bit about the working groups. Working groups are formed in areas. I'll talk a little bit about areas. The next couple slides will cover this. [inaudible] and IESG. I'll talk about the IESG [inaudible].

That first line, "there are no members," is actually very relevant. When I say, "Oh, there's a working group on this topic," a working group means a mailing list. [inaudible] and has a little bit of adult supervision, but anyone can be part of that. If you are part of a working group, you are part of the IETF.

Now, many people are part of many, many working groups at the same time. But there are people who care about one topic. They don't really have time to [inaudible] of this, but part of their job has them interested in one topic. They are as much an IETF member as someone like me who follows 15 or 20 [working groups]. They are as much of an IETF member as me who has been a leader in a bunch of working groups. The fact that I am

leading a working group doesn't make me a special member because there are no members.

Here is a picture of what I just said on the other slide. You'll notice that a lot of these bubbles are not connected to [inaudible]. It's not a hierarchical organization at all. The place where there is a little bit of hierarchy is the IESG, which I'll cover.

Remember I said that there are seven areas. [inaudible] up on the slide, and each area has working groups. Notice that IANA, the RFC Editor, all of that – there are not direct ties [inaudible], so it really is pretty loose. There are very good agreements, and you'll see at the end of my talk I will talk about agreements between the IETF and ICANN. There are good agreements, but given that the IETF [inaudible], there's no contract between the IETF and ICANN. There are very strong agreements. The IETF is covered by ISOC, and I'll cover that in another slide. But it's not like the IETF corporation is going to make an [agreement]. There is no such thing.

UNIDENTIFIED MALE:

I will take this opportunity to say that we will have a survey for people at the end of the tutorial to provide comments on how Paul did.

PAUL HOFFMAN: Or am doing.

UNIDENTIFIED MALE: Or am doing, yes. Also, any thoughts you all might have on additional tutorials, I'd like to see. So please do respond to that survey. Thank you.

UNIDENTIFIED MALE: I'll be putting the URL up on the screen at the end of Paul's presentation.

PAUL HOFFMAN: This was actually a good place for me to take a little bit of a drink of water because ISOC is a real corporation. They're a nonprofit. They've been around since 1995. They are the corporate home for the IETF, but that again is somewhat loose. The IETF is not a subsidiary of ISOC. ISOC funds the IETF and helps other people fund the IETF because the IETF gets [contributions]. They come through ISOC.

ISOC actually even though the Internet [inaudible] well before 1994, ISOC pretty much came into existence when it turned out that the U.S. government was going to stop funding secretariat that made the IETF work. Someone said, "Oh, we should have a nonprofit," and such like that, so ISOC got formed. It's a

wonderful group. There's only one slide on ISOC here, but if you are interested in the social side of the Internet, promoting the Internet really for users, the whole "bottom-up" thing, definitely look into ISOC, great group of people. You can [inaudible] ISOC.org.

The important thing here is that the IETF does need to be funded to have three meetings a year. Only part of the IETF's funding comes from [inaudible] fees. The rest of the money comes from ISOC. So ISOC is really the center of that. ISOC has a fulltime staff person who is in charge [of] making sure all of that works for the IETF, but that's voluntary on ISOC's [part]. ISOC's mission, which is bigger than the IETF's mission, is to help the Internet thrive in many ways, probably the technical [inaudible]. Love ISOC, give them good props.

By the way, you can join ISOC also without paying any money. Funny how that idea started to spread around.

Going back to some of the upper-level stuff of the IETF, remember in the picture there was the IESG, which had all the working groups underneath it. Over [inaudible] the side is the Internet Architecture Board. I know some people here think that IAB stands for Internet Advertising. This IAB preceded that IAB.

The IAB is not like a parent. It is more like [sideboard] where since the IETF is doing engineering on specific topics, you want a

group of people looking at the [inaudible] of the engineering that's going on, both technical engineering and some of the policy engineering, and that's the IAB. They give advice. They don't get to overrule.

Because the IETF, who doesn't exist, needs to have liaisons with a bunch of people who do exist and those people freak out when you say that, "Oh, no, the IETF doesn't exist formally," the IAB does all of the liaison stuff. Every time that the IETF needs to send a liaison message, for example, to ICANN, it goes through the IAB.

You'll see a number of IAB members here at the meeting, due to all the CCWG and IANA transition stuff, the IAB folks who are doing more of the work on that. They do the IANA registry. Part of the reason that IANA exists is as a registry for the IETF. The IAB is the one who oversees [inaudible]. The IAB also oversees the RFC Editor because you want to have a good editor in place. You want to have good processes in place for your publishing, so the IAB does all of that. Sometimes when appeals happen, the IAB is one of the places in the appeal [inaudible].

Of this slide, I would say the most important thing for people in this room is the middle point about the IAB selects the IANA registry operator. So far, that has been ICANN. I have a little bit

of example there. But that is a choice that's made by "the IETF in general," but the IAB in specific.

Now, let's hop back to the IETF. Here are the different areas. The next slide will explain some of this more, but some people ask, "What does the IETF do technically?" There are seven areas:

Applications and Real Time. Applications such as HTTP. Applications such as FTP. Some of the applications that you know are all done in that area. Real Time has taken over so much that they put their name as part of this. Things like SIP, now many of you are noticing that you can do video conferencing right [in a] Web browser these days. That's all from the ART [inaudible].

Internet area is for things that are on Layer 3. Things such as: how do devices talk to each other without talking through applications?

Operations and Management – operations is very important on the Internet. [inaudible] people who are running it. The IETF doesn't make standards for the operators, but they let the operators [inaudible] to say things like, "This is a large concern," or "This protocol that the IETF produced is really hard for us to run as operators. We want more operational advice." Right now, the DNS work being done in the IETF is mostly being done actually in the operations. Not like we need new DNS work as

much as we need more [inaudible] operations. The main group that's doing DNS work in the IETF right now is the DNS Op Working Group, so the operations area.

Routing – how do the packets move around? Hugely complex, horrible stuff, but without it the Internet would be one-tenth the speed that it is now. So routing is still very important.

Security area – something that I've been active in for the last 20 years. Once you are having some communication [inaudible] kind of security do you have? Can you make it better? Can you make it pretty much so that you are absolutely sure you know who you're talking [to]? Can you make it so that you're sure that no one else can see your communication? Security area has been very important in the IETF from the very early [days].

Transport – basically they're sort of a catchall for many things, but congestion at a single point is a transport issue. For example, many of us are staying in hotels and we notice that the Wi-Fi in our hotel is terrible. It's usually not terrible because of the size of the pipe. It's usually terrible because you have 40 different people at the same time coming through the pipe and fighting with each other for space because everyone is trying to watch a video at the same time or whatever. So it's not just a size issue, but it's also a [inaudible]. That's what happens in transport. By the way, I'm grossly simplifying a lot of this.

The General area is rarely used in the IETF. It's usually for policy, but policy does come up in the IETF and you'll see why when we start talking about the IANA transition.

Each area has area directors. These days, there are usually two or three area directors, depending on the area. What an area director in the IETF does is have overall planning power but not necessarily veto. For example, if there is a topic that might be in multiple areas, the area directors will agree.

It is the area directors' responsibility to set up the working groups and also to pick the working leadership. It is a very important part of the area directors' work to shut down [working groups]. Lots of working groups are like, "Oh, no, no. We're not done yet. We're not done yet," and yet we all know that if you leave a bunch of people working well past their "best buy" date, they will keep doing work and it will be more and more fragile work. So it's the area directors' responsibility to say, "No, you guys are done."

One of the things that area directors do is actually read all of the document [inaudible] for all of the IETF not just their area. It's a very important responsibility because during review – and we'll talk a little bit about review in a slide or two – during review of documents [inaudible] will ask really hard questions that no one asked in the working group because we all understood the topic.

Some area director will say, “Did you think about this?” and a working group will say, “No. That’s a very good one. Hold that thought. We’ll be back.” They go off, do more work, and then they come back. It’s very valuable.

One thing that the IETF is well-known for is the products of the IETF [inaudible] better review than in many other standards organizations where the review is done just by [inaudible]. That’s where the area directors come in.

All the area directors [together], that’s the Internet Engineering Steering Group. The IESG is the gang of the area directors. They do some process management and such like that. They do approve the working group charter as a whole. An area director can’t just create a working group on their own. They have to also take it to the IESG, although it’s usually accepted.

The fourth bullet is really important, which I was just talking about. They review all of the [inaudible], and they approve the RFCs. Again, some people are skeptical about the need for this.

By the way, area directors in the IESG are not paid. They’re paid by [inaudible]. IETF does not pay its leadership, including the IETF chair. Whoever is the IETF chair, which is pretty much a fulltime job, had better have funding from somebody else because they aren’t going to last very long without eating.

But if you are an area director, you get zero dollars from the IETF. You get no travel funding from the IETF. This has become a little bit contentious because that means some people [who] are qualified to do this aren't able to do this because they can't afford it.

Being an area director is about a 60 or 70% time job. Not that many companies are willing to take some of their best engineers and say, "Sure, we will lose 60% of your time for the next two or four or six years to help the Internet," but some companies do.

This is really important. If you're an area director, this is not like a stepping stone to some long-term job. In fact, sometimes area directors end up area directors because their company says, "No, we're having financial troubles. You don't get to do all of that all the time."

This really separates the IETF from a lot of standards organizations. Most standards organizations pay their leadership. The IETF doesn't, which makes sense because if the IETF doesn't exist, what are they going to pay with? But the IESG is a very important group, and it's volunteers. Just like, remember I said earlier, any of you can be participants in the IETF. You're not going to get paid to do that. You're not going to get any travel stipends or [inaudible]. This is all volunteer.

Let's talk a little bit about working groups because if you join, which would be lovely if you did, I'm going to take a little bit of [wing] here. You're here at ICANN. You hear about bottom-up. There are some questions about how bottom-up [inaudible]. The IETF is extremely bottom-up. That is, as I said, you can join. Your work can be done in a working group. That's it. That's how bottom-up it is.

The work in the IETF is done in working groups by volunteers. The community forms itself. If you have a great technical idea, you find the right working [group and try] to convince them that it's a good idea. Or not necessarily that your idea is a good idea [inaudible] topic is a good idea to work on. So there's a huge difference. Of course, being an engineer, you might think, "Oh, yes, I know the right answer for this problem." You may not know the right answer for the problem, but you might have identified a really interesting problem.

Part of the work in the IETF where people need to be open and why we have working groups and not just this document gets published [inaudible] is you want open discussion of ideas. [inaudible] very bottom-up.

Working groups have charters. You may come up with an idea for which there is no existing working group, and your idea

might be important enough to warrant [a] charter for that specific idea. Or you may [inaudible] have a group of things.

Each working group has a chair who sets agenda and such like that. But basically, I'll pick an example that isn't that relevant, IPSec is one of the ways that VPNs work and something that I've been [working on] the last 15 years. You might be an IPSec developer. The IPSec Working Group has been around forever.

You come in and you actually have a problem that we haven't dealt with before. We look at it and we're like, "Oh, right." That's how you participate. The working group goes, "Yeah, yeah. Okay, you're right. We need to deal with [this]." Now, you may have a proposed solution, and it might be a good solution or it might be a bad solution. But you brought [a] problem in, we're going to work on it, we're going to have a solution. That's where working groups come in.

Some work is done outside of working groups. You might have a problem and a solution. There is no working group currently, and that can still flow through the IETF process. That's more rare. But working groups gain and lose active [members] all the time.

For example, in the DNS world, a new engineer gets hired by a DNS-related company. They come in, they start doing stuff, and they have an idea. They're there. Or somebody is working on it a

while and is like, “Oh, God. The IETF is the hardest place to work in. I’m tired of this,” and they go away. No one ever notices other than the fact that they aren’t posting. There’s no “I’m now part of this working group.”

Once the working group does something, it goes through this process. You can maybe see the very light green line. Notice that in the top bubble it says “standards track document.” That’s what I was mentioning just in the last slide of not everything has to have an individual document that you take to an area director and [say], “I would like you to sponsor this.” But that still starts up here, find a sponsoring AD. Or if it’s a working group, it’s going to be the AD that [inaudible].

It goes through “last call,” and it goes through IETF Community Review. Note, every piece of work that is standardized in the IETF, every topic, goes through that large bubble down there.

You may be a DNS expert, but you have an opportunity to comment on every single piece of work coming through. You may have a side hobby where you care about routing. Or you used to run routers, now you’re doing DNS and such like that. You might actually review all of those documents and you might say, “Hey, nothing to say during the working group. I didn’t even know that that working existed. But I’m reading this document and it says this here. That’s obviously wrong.” Everyone goes,

“Oh, right. Okay. We’ll get back to you.” This is where [inaudible].

You’ll see that this line goes that way. It doesn’t always go that way. It could be that it goes up and down and up and down on the left-hand side a little bit. This is really one of the strengths of having a bottom-up open group is that people can appear there. Now, normally it does follow the line. [After] comments and suggestions, they’re usually more minor, it goes to the IESG. The IESG says, “Yes, this is good enough,” although they usually kick things back. It goes to the RFC Editor and gets published as an RFC.

I would say 95% of things in the IETF Community Review get no comment. No one pays attention, or if they do, it’s all editorial and they don’t bother. But of that 5% that get comments, a fair number get [inaudible] back. Some of them get axed. Someone says, “You said the problem was this. I agree with the problem. You said your solution was this. Here’s why your solution doesn’t work. And I’m sorry, I don’t have a better solution.” It goes back to the working group and they’re like, “Right, we don’t have a better solution.” So what you get is a problem statement with no solution. That’s still valuable. That’s very valuable to folks on the Internet, but you’re in trouble.

Let me go through the standards process a little bit here. Actually, we've sort of covered this. I'm going to skip over [this slide]. The formal review we just covered a little bit more here. Again, the most important thing here is the IETF-wide Last Call is everybody, anybody. You don't even have to be active in a working group. You can do nothing other than follow the mailing list that says when an IETF-wide Last Call is, throw in your comments.

[inaudible] time. I'm going to skip a little bit of Russ' slides. A little bit on the bottom-up stuff. You know that there's a nominations committee here in ICANN [inaudible] the Board. That's model after the IETF's.

Basically, to get on the IETF Nomination Committee, you have to have shown up at a couple face-to-face meetings, meaning you've probably [inaudible] and you're chosen by random selection, literally. Maybe there are ten slots on the NomCom and there are usually 100 or 150 people who say they would be willing to [inaudible]. They run a random number generator to pick [inaudible]. The idea there is that you don't only want [inaudible] choosing. You actually want people who know the social aspect of the IETF also choosing. But pretty much the NomCom works like the NomCom [inaudible].

Let's get a little bit into – and I want to catch this before we take questions – the next couple slides are really about things that the IETF does that overlap with [inaudible] ICANN. The IETF has the IANA protocol parameter registries. These are registries that were originally set up by the IETF before there was even a thing called IANA. [inaudible] the thing called ICANN.

Where say there's a protocol that there's a bunch of extensions and each have to all agree on the number. Somebody has to say, "Number 14 means this, and number [inaudible]." Usually fairly boring stuff. This has always been done by someone called IANA, the Internet Assigned Numbers Authority. It's really not an authority because they don't make up the numbers. They just assign them.

The middle bullet says [for 15] years this function has been done through a formalized agreement (and RFC number) between ICANN [inaudible]. What this slide doesn't say is for 20 years before that 15 years it was done by this [inaudible], but he did it wearing an IANA hat when he did it. The guy's name is Jon Postel. So for 15 years this has actually been a formal function, an agreement, a Memorandum of Understanding, between the IETF and ICANN.

In the last [inaudible] with that MoU, things have happened where people have said, "We want to make sure that this set of

registries is updated at a certain speed.” [inaudible] happens at a certain amount of time. Some registries need to be [inaudible] more often. That MoU has evolved over time, but in fact for the last 15 years this has worked just fine.

Here are some examples of protocol parameters. Probably half of the standards that the IETF produces need to have something done by IANA. Sometimes it’s a registry that’s only going to have two items. It’s expandable but no one ever bothers to, but we still need to have that.

There’s an example here on the right of HTTP error codes. Sometimes when you go on the Web, you’ll [inaudible] 404 or something like that. Those are all numbers that you want to be stable. So 404-Not Found, a browser always wants to know when it gets something that says 404 back, that’s what it means or 403-Forbidden. So there are references for all the RFCs on all of that.

There are probably, I don’t know if it’s – this slide says thousands of registries. Yeah, probably over 1,000 and less than 2,000. Pretty much part of the agreement with IANA is that they’ll just say yes when IETF says we want a new registry for something that almost no one cares about but the people who care about it, care about it a lot. IANA says, “Great. Here’s a new registry for you, and we will [inaudible].”

Going back a slide here for those of you who are [inaudible]. An example of a registry that's important in the DNS space is in DNSSEC. As you might know [inaudible] DNSSEC, you can use different signing algorithms. You want to make sure you know which algorithm was used on each thing, so each message has an algorithm number. Those numbers go into a registry like this. That would be closer to what we're [inaudible]. But lots and lots of protocols have protocol parameters that need registries.

The way that this happens really is that IETF makes the policy that says, "I want a registry of this sort." The IAB provides a little bit of oversight so that the IETF doesn't go crazy, and IANA implements it. There has never been a problem with IANA implementing. Pretty much IANA is very good at just saying yes.

The bottom thing is 35+ years of experience with this structure. Again, ICANN has only existed for 15 of those 35. Before that, there was an IANA. Again, it was mostly a guy. At some point like maybe in [1990 he] got like a part-time staff person to help him out with that. But IANA itself really has existed for 35+ years. ICANN has been running [inaudible] function for the 15 years that ICANN has existed.

Getting back to what's happening this week, there is the stewardship transition. I'm not going to cover this in detail here, believe me. But the big picture here is the U.S. NTIA had a say in

this when it happened 15 years ago. We thought that was a good idea. Now we don't and, fortunately, the U.S. NTIA also doesn't. So the question is: how do we [transition] that?

This is one of the things that happens in the IETF. We make a policy, we make a protocol. It's running on the Internet for a while and they're like, "No. We need to make a change." Sometimes change is easy on a protocol, sometimes very easy. Sometimes it's very difficult. As I [inaudible] in the slide [inaudible], HTTP2 took more than 15 years after [inaudible] even though during that 15 years people were saying, "This is sort of broken," "It would be nicer if we did this." The same thing is true here. It became clear at some point that the NTIA [being] part of all this was not being all that helpful. NTIA ended up agreeing, and yet here we are many years later dealing with the stewardship transition.

Let me give you a quick overview of how the IETF [inaudible] to have this happen. By the way, there are some dates here. The last dates here are possibly going to change this week. But basically, first thing, there was the Memorandum of Understanding. There was a working group in the IETF called IANA Plan for how do we plan for this. IANA Plan met. They got community consensus in the IETF on the plan for how to make the independent function.

After the community agreed, the IESG looked at it. They made some improvements, again, with the community. Then the ICG got formed, which also has input from the Numbers folks who are not IETF related. Then this is all going to go to the NTIA. Along the bottom, you'll see that there is the Service Level Agreement that was agreed to early on. There's going to be a new one. But basically, this is how it happened.

The important part of this slide really is the fact that the IETF community got to review the output of that working group. The IESG got to review the output of the community discussion. That all came to a head and came out with where we are today.

This is mostly a historical slide because the IANA Plan Working Group really isn't doing anything anymore. Again, it's going to be a working group that can close by itself. It doesn't need to last forever. Most of the work of the working group was finished earlier. There's going to be some niggling going on when some of that plan changes. That will go through the working group again and go for IETF consensus.

Here is the proposal for the parameter registry, how it will shift over. The last line here is the last draft that was being worked on for how to make that happen. Again, I'm zipping through this because if you're not interested in this, which is just fine, you don't need the details. If you are interested, you're going to get a

whole lot more detail from other folks this [inaudible]. The most important part of this is, again, IANA started as an IETF function early on. The importance grew over time, but IANA became important before ICANN even came on the scene. Since ICANN has been on the scene, it has been doing all the IANA stuff. This is where we are at now.

Giving a little bit of time here, there's a little movie here. I'm going to show you the movie. It's about two minutes long. It's put together by ISOC, by the way. Then we'll be ready for questions.

Magic of YouTube. Well, through the magic of YouTube. There we go. Let me start that over again. You won't mind an extra 20 seconds.

"...and infrastructure to keep it growing and running smoothly. That's why we need the Internet Engineering Task Force, a global organization of volunteers collaborating to design standards that provide the infrastructure for innovation on the Internet. The IETF is open – open participation, open processes, and open standards.

"Today, because of the IETF, we can do so many things that [inaudible] for granted: e-mailing colleagues, instant messaging friends, and making phone calls to family – all over the Internet. Even [inaudible] Internet addresses can [use] different

languages, and we can be more confident in the information we access [inaudible] Internet.

“Tomorrow, because of the IETF, [inaudible] more people will have an address on the Internet, joining the two billion of us already [connected. That] means more people communicating and collaborating on new ideas.

“New ideas like an Internet of Things connecting devices in your home and beyond [inaudible] smart grid that links everything from your thermostat to medical devices. Imagine all of the things the Internet will connect: your car, your appliances, and your mobile devices.

“The IETF is open [to] you and your ideas. Support the Internet. Support the Internet engineering Task Force.”

That was the last slide. I’m happy to answer questions. We still have about ten minutes left. [inaudible] any questions later. I also included Russ Housley who had given the presentation before. I verified with him. He’s still happy to answer questions. That was a lot of information.

UNIDENTIFIED MALE: I’m going to go here, and then I’ll come here.

PAUL HOFFMAN: Oh, the desk mics work. Great.

UNIDENTIFIED MALE: Thank you for the excellent presentation and that [inaudible] insight into how IETF and other standards organizations work together. My question is, I want to have more clarity on how does other standards like IEEE, W3C, ISO, and International Electrotechnical Commission (IEC) decide works amongst themselves from what standards to work on. How do you sort it out amongst yourselves?

PAUL HOFFMAN: Very good. I can't answer the question of how do they pick what they want to do. But the question of how do the organizations agree on what to do, it's actually quite difficult because different organizations have different membership structures. Some of them have financial incentives for trying to bring work to them.

Some of them have an inability to take work from the IETF because the [inaudible] done open. So there are many organizations that can only take work they can copyright themselves. So the IETF with the RFCs, anyone can have access. So there are some organizations that literally cannot take IETF work as a beginning. So it's actually quite complicated.

The W3C is an example of one where it's actually quite easy. The W3C and the IETF work together very well. The IEEE and IETF work [together] very well. The IEEE is electronic-specific engineers. These are people who work on things like making Ethernet work, so there are a lot of standards in Ethernet such as Ethernet security, things that happen in the wires, how do you make the wires talk to each other. IEEE and IETF have an extremely good relationship. I can't even remember [inaudible]. I mean, there's been a little bit of contention, and it gets solved within a few months.

Some of the others you mentioned like the IEC and ISO, all of these organizations have liaisons. Some of the liaison relationships are active. Some of them [inaudible] much. ISO is one because ISO has so many different activities. Some of the activities are very well coordinated with the IETF. Some of them not so much. Usually, the coordination happens almost by accident.

ISO has done some work and someone says, "Hey, this could have been done in the IETF," and then there's some coordination. Or the IETF starts doing something and an IETF participant says, "Hey, I'm on the ISO work group that's doing this, and we're already doing this." So it just sort of catches up.

So the high-level answer is through liaison relationships. The liaisons don't always work that well, so we do sometimes get overlap of work. [Hopefully], that answers. That's the best we can do. How other organizations choose their work, that's all over the map.

I saw some other.

UNIDENTIFIED MALE: Thanks for your presentation. It was mentioned in the movie that IETF has done some work regarding the Internet of Things and also [inaudible]. What is the contribution of IETF regarding the Internet of Things, [inaudible] networks, or [inaudible] devices? Because I think you mentioned regarding IETF areas such as applications, Internet security. I think it's a cross-cutting concern that cross-cuts all these areas [inaudible].

PAUL HOFFMAN: Absolutely. The IETF is not at all a central point of work on the Internet of Things. The Internet of Things is one of these things where lots of companies started their own work and then some of it got standardized and some of it [didn't].

But coming – hello? Someone is checking. Maybe don't do that. One of the – oh.

UNIDENTIFIED MALE: That sounds like Russ.

PAUL HOFFMAN: Yes, that was Russ. There we go.

UNIDENTIFIED MALE: Ladies and gentlemen, Russ Housley.

PAUL HOFFMAN: Right. So Russ who was not giving this presentation, that was the person who we heard. That was weird, but now you know why he's not in the room.

But going back to your question on the Internet of Things, one of the things that sometimes the IETF does is lay down groundwork for things. So the Internet of Things, basically, everyone who is doing Internet of Things is doing things with IPv6. IPv6 wouldn't have existed if the IETF hadn't spent a "ker-billion" of very difficult hours making IPv6 work. But the IETF is actually in a very minor organizational [inaudible] for Internet of Things. Some of the security stuff is happening at IETF. Some of it's happening in IEEE. Some of it's happening in IoT-specific areas.

How that affects ICANN will be sort of interesting because we are not expecting Internet of Things objects. We're not expecting

your refrigerator to necessarily have a domain name, but we don't know that it won't. So it could be something that actually [comes] back and affects ICANN.

We do know that your refrigerator is going to have an IPv6 address, if you let it. I'm not sure I'm going to let [inaudible]. In fact, I'm sort of leaning quite against it. But those addresses are originally assigned out of pools that ICANN controls. ICANN gives address to the RIRs, the RIRs do. Some of that comes back here, but it doesn't necessarily go through the IETF. There are four or five working groups in the IETF that are dealing with IoT. Most of them are, in fact, about security not about isn't it wonderful.

By the way, this actually goes back to your question of how does the IETF work with other groups. We're having a really hard time working with the new IoT SDOs because they're very new. They're very private. Some of them, in fact, pride themselves that you can't do their standard without being a paid member, and you can't then expose what it's doing. The IETF doesn't work really well with groups like that, so we're having an issue on that.

Other questions? [inaudible].

UNIDENTIFIED MALE: On the two points that you mentioned, one was on the IAB. I understood that IAB members are appointed by the NomCom and are overseen by the ISOC Board of Trustees.

PAUL HOFFMAN: Yeah, ignore the “overseen.” They’re really not. It’s from the NomCom.

UNIDENTIFIED MALE: But it is not open for the individuals like IETF that anyone can join IAB directly?

PAUL HOFFMAN: Correct. No, the IAB is a group that is selected by NomCom. There are [inaudible], 13? One of those two numbers of people there, but it’s not like open group. Now, having said that, the IAB in fact has projects that they work on. Some of their projects are in fact open, that is, sort of like a working group. So if a project is open, you could just go and work on it. But in general, the IAB because it is architectural advice doesn’t have the same structure. Anyone can become an IAB member, however. NomCom looks [inaudible], and you don’t have to be an IETF old-timer to be an IAB member.

UNIDENTIFIED MALE: Related question, second point, on the IESG where the area directors that you mentioned have to allocate 60-70% of their work time and are not paid by IETF and they have to rely on the funding from the sponsor organizations, does that not limit the availability of good resources to be part of this?

PAUL HOFFMAN: Absolutely.

UNIDENTIFIED MALE: And secondly, does it not lead to capture by the [inaudible] that can well pay these individuals? Should it not be an open process?

PAUL HOFFMAN: It absolutely leads to only people who can afford to be on can be on. That is absolutely [inaudible], and that has been problem forever. Even when it was only 30-40% of your time, that's still more than most of us can just say. And even those of us who have a full-time job – this is my boss sitting here – if I said to him, “Hey, they want me on the IESG and it's only going to take 30% of my time,” he's [going to say], “That's 30% of your time. No way.” That's a perfectly reasonable response, so that causes a problem.

Fortunately, IETF is fairly bottom-up so that even with a somewhat limited group of people who can be in the management, it doesn't prevent work happening. Because the IESG might pick which working groups exist and charters and such, but they generally say yes if there is a real problem that has a real solution. So they are not necessarily that much of a gating, even though as you point out it's going to be a limited number.

One of the things that has been important on the IESG is that they rarely have more than three people from any given company on the IESG, even if there are qualified people. Cisco has been a big supporter of the IETF, and they could fill the IESG. They don't. In fact, it's usually fairly important if there are a couple [inaudible] are financially valuable to Cisco, they have some of their competitors on the [inaudible]. Money intrudes on everything. Heck, we're here this week. But that's how the IETF [inaudible] deal with it is still keeping bottom-up.

UNIDENTIFIED MALE: Is IETF trying to change that?

PAUL HOFFMAN: Some people would say yes. I would say no. We've sort of given up on trying to change that. You and I can talk more about that

later because, of course, we would love to but [inaudible]. And then we're almost out of time if you want [inaudible].

UNIDENTIFIED MALE: Just one comment related to that. One of the IESG members is actually an ICANN employee, the guy who is responsible for the operation of the L-root server, Terry Manderson, is an IESG member and a good percentage of his time is dedicated to supporting the IETF in that way.

PAUL HOFFMAN: Yes. So the ICANN, in fact, stepped – and I'm sure I would have loved to hear the discussions between Terry and his boss when he was nominated because it's like, "Oh, my God, we're losing this." But the value to the Internet is huge.

If you think about, let's say that the IETF had a whole bunch of money just to pay these people. Well, then you get captured regular people. They're not the most [inaudible]. You have to balance both of those.

We're out of time. In the [inaudible]. Thank you for coming.

UNIDENTIFIED MALE: A little bit of housekeeping. If you wouldn't mind before you leave, just head over to this URL. We're looking for feedback. We

want to continue doing these tutorials. We want to make it relevant to you. Please let us know how we're doing with it and what we could be doing better or come up with some new ideas. If you leave the room and you don't go, you'll never go to this URL, so please just take two minutes and go there and give us some feedback.

We're going to start again at 11:15 with [inaudible] and Internet Networking. We're here all day, so if you guys have the day, please spend it with us.

PAUL HOFFMAN: Actually, we're here all week so if you had questions or whatever and you see me in the hallway on this, feel free to grab me. Thank you.

UNIDENTIFIED MALE: Thank you much.

[END OF TRANSCRIPTION]