

NETEVENTS

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Debate I: Transforming the Telco Network

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Panellists:

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Nicolas Fischbach	Director of Strategy, Architecture and Innovation, Colt
Jörg Ruhmann	Senior Technical Director, EMEA, Infinera
Nigel Oakley	Director of the Cloud Center of Excellence (EMEA), Juniper Networks
Kevin Vachon	Chief Operating Officer, MEF
Ruth Gamero	Technology & Innovation Strategy, Global CTO Unit - Telefónica I+D, Telefónica
Tom Homer	Head of EMEA and the Americas, Telstra Global

Emir Halilovic

Okay. So the mic is working and my clicker is working too, so we're ready to start the debate number one, transforming the telco network. We have a lot of ground to cover, so I guess I'll just start off with a quick introduction.

My name is Emir Halilovic and I'm a Program Director for Telco Infrastructure and Networking for IDC in EMEA. And transforming a telco network is something that I'm dealing with pretty much on a daily basis. How do the networks transform to support the changing demands that are being posed in front of telco businesses?

So what we see as the main driver of – or the main generator of – the need for telco transformation, is what we in IDC call the emergence of the third platform in ICT ecosystem. The elements of the third platform that basically impact everything that's happening in ICT are listed at the top. Mobility, which includes obviously BYOD, a

lot of, let's say, transformation of the IT in the enterprise that sees the workforce becoming much more mobile, much more flexible and agile; social business, mostly dealing with the social aspect and the business that relates to social interactions rather than pure transactional kind of business that has been going on; cloud, which is again transforming both the enterprise infrastructure as well as the telco infrastructure; and finally, big data. It's another all-pervasive trend for the industry.

Now the telcos are, in this situation, faced mostly with the question of how to catch up with the OTT players that are mostly the first to take advantage of the new third platform elements of ICT ecosystem. And the requirements of these third platform trends are actually what's driving the telco network transformation.

So again, why do telcos need to transform? I think, as Tom mentioned, happy pipers exist in the marketplace, but what we see, and this is just a schematic rather than direct, let's say, a graph driven from the data, is that the traditional telecom services market in the developed economies is going to shrink or is already shrinking. By telecom services, in this case we mean traditional connectivity services. In this situation what you can do to actually stay the course and continue your business as usual, is to try and drive the cost out of your network.

But to really take advantage of this new trend and to drive the business forward, telcos need to adapt and adopt a whole different host of services that is going to increase their revenue – or actually that is going to help them grow the business, rather than merely survive in the market. So on one side telcos need to drive the cost out of their businesses, to rationalise their infrastructure. And then they also have to develop new platforms. These new platforms are going to enable telcos to embrace all these services and solutions that are new to them, and enable them also to do something more than pure connectivity.

Then there's also another part of the question of why the telcos are transforming at the moment, and that is because the technology exists now to enable that transformation. SDN comes from mostly the OTT and the enterprise ecosystem. And then the NFV is, in our view, a response to the need of telcos to become more like OTT providers, and try to fight them with their own weapons, so to say, with commonality, with reliance on standardised hardware and also with platforms that are much more flexible and enable them to take full advantage of the fast cycles of software development and the innovation that exists in the software ecosystem.

So, with that, I think that we're ready to move on to the discussion part of the panel. And because we do have a limited amount of time, I would just like to start off with a very general question, which is going to, I think, be common for everybody on the panel, and that is what does telco transformation mean for each of your organisations, both in terms of the changes it brings to your business, or for solutions and products that your organisation's bringing to the telcos.

So today to discuss this with us, we have Chris Purdy, Chief Technology Officer of CENX; Nicolas Fischbach, Director of Strategy, Architecture and Innovation of Colt; Jörg Ruhmann, Senior Technical Director of Infinera for EMEA; Nigel Oakley, Director of the Cloud Center of Excellence in EMEA for Juniper; Kevin Vachon,

Chief Operating Officer of MEF; Ruth Gamero, Technology and Innovation Strategy Global CT Unit, I guess it means that you are in charge of telco innovation – technology innovation strategy in Global CTO unit of Telefónica; and finally, Tom Homer from Telstra, who we heard from.

So starting maybe from Chris, what does Telco transformation mean for your business and what solutions your company is working on to help them on the transformation journey.

Chris Purdy

I guess when it comes to telco transformation, if you look at the industry in general, only the top players offer their services customer self-serve, on demand in real time. If I want additional compute, if I want additional memory, if I want additional storage, I have a REST API that can do it and integrate into my systems. I have a web portal that can do that.

Now by contrast, when I go to my telco company and I'm looking for their traditionally services being connectivity, I have long wait times. I have 90 days when there's physical install, but I'll often get very long wait times, even for things that just require changes that are taking place. Now so every service provider is understanding that they've actually got to be much more dynamic in their service activation and their service times and their customer self serve. And then they have to go up into the additional businesses in order to compete with the over-the-top players.

Now of course, two major enabling technologies that everyone talks about is SDN and NFV and how that's going to solve it. I think there's one fundamental missing component in that, which is service orchestration. If you ask yourself why is it that it takes often minimum two weeks, sometimes even a month to increase the bandwidth of an existing service when really all it does it change a policer on a network element, it's because of the operational support systems, how they're structured and how they're built in service providers.

There's a functional silo model that's in place where you have an inventory system that crosses all the mains. You have a fault system that crosses all the mains. You have a provisioning system that crosses all the mains. And it's fundamentally unsound because it never hides complexity of the domains. This was developed at a time when there were many fewer domains and things were much simpler in telco networks than they are now. And as telco want to add more domains, like an infrastructure-as-a-service domain and application support domains, etc., it's getting much more complex. So we fundamentally believe that what telcos have to do is focus on per-domain service orchestration solutions that give customer self serve for that domain and then hid complexity to all the domains that are above and below that. And so the key is this notion of a service orchestration solution.

We are a software company and we build service orchestration solutions. We've been deployed in some of the top-tier especially mobile operators in the US. Two of the top three are using our system further for their complete Ethernet mobile backhaul infrastructure as an example. And so our fundamental belief is that in order to enable

telco transformation, telcos have to understand that one of the biggest barriers to innovation has been their traditional operational support system and their operations. And so our mission is to essentially help move that along much faster.

Emir Halilovic

Nicolas?

Nicolas Fischbach

Yes. Let me go next. I think you touched on a lot of good points already. I think what I'm going to do is share some lessons learnt on what we've done at Colt when it comes to SDN and NFV. We started pretty early, so there's lots of lessons learnt. We burnt our fingers. We failed sometimes. We did a lot of things, so let me share a little bit more what we're doing there.

To just set the scene, I don't know if you know what Colt is. Colt is a business-to-business service provider. We done the residential. We done the consumer. We done the mobile. Really focus on very specific articles like financial sector, insurances, large enterprises, SMEs and so on. We operate in 22 countries. We are found [on the ground] all over Europe. We have 20 data centres that we own and operate in Europe. And we decided to transform. We started in more or less 20 years ago with [inaudible] operations, which we integrated over the years. We've been operating as one company for quite some time now. But even with being only 20 years old, there's already a lot of legacy. So all the constraints you mentioned, we see them.

And in 2009/2010 we came up with the vision of integration IP and Ethernet services, the need to drive automation but it was very early days so there was no research in the market. Then SDN came and later on we did [convert] to CPE. Actually the presentation we did with the Juniper guys predates NFV. So we've done that before the date of the [ETC] working group. And we continue to drive that. So that's what we've done to help transform the network, deliver those new services but also manage unit costs. It's a combination that you mentioned of how do you manage cost? How do you deliver faster? Initial in-life changes and how do you actually compete, if you will, with the OTTs, even if it's hard to compete with OTTs just because the differentiation is so big.

So we did CPE back in the days. It's been running since November 2012. Today we deliver about 60% to 70% of IP access and IP VPN services using virtual CPE. Since a little bit more than a year now, it was August a year ago, we delivered our first SDN overlay system inside data centre, actually in Paris in Les Ulis data centre using a next-generation fabric to actually accommodate east/west traffic, service orchestration inside the data centre, how you link that with V cloud. And since a little bit over a year too now we also have SDN in the WAN for our [carrier] platform using the [site route plan] controller.

So we have a lot of experience. It cost us also a lot of sweat, not just financially. And the experience is that you have to be prepared to rip and replace. Technology is moving so fast that you have actually to convince your finance people that

depreciation needs to be looked at completely differently, that you might actually rip and replace.

Another lesson learnt is that there's only so much innovation and so much change a company, even of our size, we're like 5,500 people, can absorb each year. So trying to drive more from an architecture point of view and step change in technology doesn't work because the rest of the company cannot absorb it fast enough. And in the end, even though it's very early technology, technology is easy compared to changing people, operating processes and the OSS stack.

So we on-boarded a lot of the people very early in the process, working on upscaling them because their work is going to change going forward. We discussed that over breakfast at two in the morning, like how do people who used to touch a CLI are not going to touch a CLI any more. But you need all the skills because people are saying that SDN is going to make this stack easier because of abstraction. But you look at the layers, the complexity you're introducing by adding more layers, with the new control plane and a hybrid model, part of the OSS stack, service estimation, service orchestration, the APIs, the self-service model in view of the customer, people have to understand end to end. So you probably need to transform some CCIEs or Juniper-equivalent of CCIEs, whatever they are, into people that understand the OSS stack and the end experience. So that's pretty interesting.

And the other one is transforming the operating model. How do you change, train and adapt in some countries 1,500 people that deal with the operations, delivery assurance and so on and so on. So that was very, very interesting.

The latest thing we're working on is the next stage of our virtual CPE and V model, so we don't want to say too much about it because the [RFI] is actually due to communicate end of this week to the vendors. But the lessons learnt with virtual CPE were very useful. It helped us understand how our next-gen OSS stack needs to look like and also which domains actually compose SDN NFV, because to me those links – those two are very much interlinked. Open [floor] is kind of dead to me so you can quote me, and [Dan Peat] loves me for that. But I think the OSS concept is much wider than that in the NFV space. I think we try to understand. We're not a mobile operator so all the staff, all the people that are focusing more on the mobile are more NFV. Not too interested. We're interested by other things. But you realise that NFV is not just one thing; it's actually a set of domains from the virtual network functions themselves, service chaining, the OSS stack back to the orchestration point and how do you actually deal with that.

So in transforming also something that was more expensive, which is, to take an example, on-premise CPE by something which is in software, but then you look, you're also changing from a single point which is very well known into a layer of domains that need to communicate with each other. So it's this shift of complexity, shift of cost also that you need to understand because I would say SDN NFV is cheaper. I tend not to agree. We had very early experience where actually SDN-based solutions were actually more, from a TCO point of view, much more expensive

than putting a box on customer premises with all the in-life management and so on and so on, so quite interesting.

Emir Halilovic

Thank you. And for a vendor like Infinera, mostly in optics, what does it mean to have a transformation?

Jörg Ruhmann

So, yes, the transformation for us is a little different because if you look, the network function utilisation is pretty much touching on the layers, like three to seven, which we are, as transport company, are touching more the layers zero to three. And if you recall the applications, the data centres, there's still the need to transport the traffic between the data centres and from the end customer to the data centres.

So right now there's some challenges coming up with this one. One of them is from scalability because if you look at the forecast on the data centres and if you look on the architecture on the data centres, so you have one of them which are in the city, for example, you have several data centres in a city which need to be interconnected. And then you have some of them that are going over long distance because they're going to areas, Scandinavia countries or in Canada, we have good infrastructure in terms of power supply, in terms of cost point of view. So there are definite challenges and you still have to address those.

At the same time, as you can always see on the slides, everybody's talking about high level of automation and flexibility, and this has to come through the transport layer as well. So we're seeing several directions, several trends. So one trend is that we need somehow application-optimised transport devices which are coming out a little of the classical telco approach, because the telco approach is very rich on norms and recommendations, while the data centre space, especially from the new internet content providers, has a little bit more freedom. They don't have the legacy here at several locations. They're more free to innovate and they're not less tight as well. They're asking us to go for different passes and routes, to which we have adapted. And they're redefining, and we did, and we're just coming out with – we just launched a kind of data centre connectivity purpose-optimised solution.

And to what has been a discussion on this with the internet content providers, we have our customers, mainly in the US. And it's a very disruptive approach of how traditional carrier and telcos or carriers would use transport in the space. So first of all I think it has to be very simple, easy to manage. In order to manage the scale you need something which we call like high-scalable optics, which is coming. Everybody knows this one from the [silicon board]. It's the integration.

So what the guys are doing on silicon we did on photonics. So the integrating, which is just bringing it to really more digital layer and is open to what is characteristic to SDN, automation. So right now we're putting everything before – if you look on transport, for example, setting very steady. So transponder has a certain capacity but you cannot vary it. It was very steady and you used a lot of layer two and layer three

devices to route it through the network. Right now what we're doing is that we say, well, we have scalable optics. You can even activate software by software transport capacity because you have a massive scalable optical device in your transmission platform and then you just can remotely activate the software and [read] the traffic and you can really virtually create bandwidth, which has not been done before.

So there's a kind of level of flexibility in there. And what we're seeing as requirement generally is that we need a convergence between the different layers. So if you say so all the intelligence can become virtualised and call it in data centres from layer three to seven, you talk about the virtual CPEs, we're seeing the same in the transport. So we're collapsing zero, so transport with routing, [OTN] switching, and a certain amount, the right amount, not the full-blown scale of packet functionality as a convergent transport platform. And just coming out as well there's a kind of packet switch module for [inaudible].

So right now we're seeing different areas of where we have to fit in. But the common denominator is really that we have to make it controllable by something like APIs and SDN. So we're going a little way from the standard network management approach, but we have to be very automation – we have to be open to automation and to give additional horse power to what is coming up as calculation and power in the data centres.

Emir Halilovic

Nigel for Juniper is one of the heavyweights in telco or, let's say, carrier IP networking and pioneers in SDN. How does telco transformation affect your business and basically how do you empower it?

Nigel Oakley

So I've been working in the SDN arena for about two years now and had the opportunity to work with the majority of some of the tier-one telcos across EMEA and a lot of the tier-two telcos as well. The message that I hear all the time from those companies is the challenge of service agility and service velocity, the ability to be able to deliver new services more quickly and to be more experimental with new service. And a lot of that comes from the OTTs' rep. So a lot of the large tier ones are challenged in terms of being able to get new services out quickly.

In fact I was talking at breakfast this morning, working with one major European telco. It takes them roughly two years from the idea through to getting the service actually launched into all their points of presence around their network. And they've almost got to the point where they give up on the service before they actually get the service deployed because they know it's going to take them too long to deploy the service in the first place. So that's stifling innovation inside that telco and ultimately is the major threat and challenge for them.

This is where SDN comes in. For me, SDN is automation in the end. It's about automating the complexity of the underlying network, exposing APIs which allow you ultimately to get to the vision where the marketing team can think of a new

service, push a button and launch it in an experimental or launch it on a scale deployment in a much, much, much quicker way.

The challenge that a lot of these operators are facing today is that they have large multi-vendor networks. Those large multi-vendor networks take a very, very long time to transform. I'd like to think a lot of them are complete Juniper end to end, but I would probably not be realistic at that particular point. So we have to be able to produce solutions which will scale over lots of different vendor solutions and ultimately encompass the OSS stack as well.

So for Juniper today, we've launched a range of capabilities to be able to deliver SDN in typically an overlay networking environment. And I think what's really interesting at the moment, you can see the industry splitting. You can see industry splitting into trying to preserve the environment we already have and investing in changing the equipment they have in the network from an underlay perspective or companies such as Juniper which are investing in overlay technologies, software overlays that will scale over the whole of the core and the EDGE network and also make the delivery of the services in that environment.

So for me today it's the major reflection point I see within the whole networking industry, and it's very exciting to be part of it. And I think looking very carefully at the underlying technology, the investment in standards, what standards are going to be used so that you can provide a multi-vendor network and multi-vendor capability is really crucial in this transformation towards SDN.

Emir Halilovic

And Kevin, from your standpoint and the standpoint of MEF, what is telco transformation bringing to the association's, let's say, day-to-day operation or more strategic planning in the future?

Kevin Vachon

Well these are very changing times. They're very interesting and exciting times. I could probably answer the question, I don't know, three or four different ways. The comment about standard was probably a pretty good segue. I'll pick two themes.

Firstly what we've done as a group that's built all of the standards for Ethernet services, we've enabled the telcos to establish a new services fabric on a global basis that replaces all of the old telecom capabilities, the TDM network, which really do not have the flexibility and capabilities to go anywhere near where this industry needs to go to support the third platform, to support all the different new business models. So that has been hugely successful. That has standardised. Ethernet services are building out rapidly around the world and have for some time and will continue to do so. So we've given them a service fabric which can be used as a platform.

You will hear a much more elaborate, I guess, view as to how we will enable transformation today at five o'clock. Interestingly enough, you called the IT platform the third platform. We're using a third network theme as our concept as to how we'll enable that transformation.

The second way I guess I would answer the question, again coming back, looking at it from a services perspective and a standard perspective is I think right now we've got probably the perfect storm happening for Ethernet. One is the demand is growing, driven by the desire to get rid of the old TDM services, the need for more bandwidth, the need for secure, reliable connectivity for cloud, the need for more agility, flexibility and so on and so forth. And so you've got demand.

With that comes the justification for expenditures on the management front, whether you're talking about management of SDN environments or any other one. In the traditional OSS world, unless you have a certain critical mass of service volumes, things happen manually and you can't afford to invest in very sophisticated systems. The volumes are now there. So regardless of whether there were any new technologies being implemented, like SDN and NFV, the investments of the OSS and the management layer would have been happening in a big way for Ethernet services.

Then you add to that, so the software companies, the CENXes of the world and others are pushing more product into the market. You add to that the enhancements that are capable of carrier Ethernet as a result of SDN. More manageability, more flexibility. You look at NFE and what that's going to do, the ability to drive cost down to be able to make services more flexible. So there's a lot of very positive things happening.

Now what we are doing now versus what we did even ten years ago in some ways are similar. Ten years ago, when we started building all of these service specifications, we did them in a technology-agnostic way, in an abstract way. We allowed the service providers to pick their own migration speed and strategies. Some might have wanted to run Ethernet over legacy technologies for some time. Some still do. Others were building greenfield packet high-speed optical environments so they could offer more interesting services.

You'll hear a lot in our new story about service orchestration. And service orchestration to us of course means being able to support existing environments, virtual environments, SDN underneath us and so on and so forth. So what we've always been doing, we've taken an agnostic approach to how these things happen and we let the operators go at their own pace.

Emir Halilovic

Thank you. And now, Ruth, we haven't talked too much about NFV. And if I understand correctly, that's where your responsibilities lie within Telefónica predominantly. So can you tell us a little bit about what Telefónica is doing there?

Ruth Gamero

Thank you. Hello, everyone. I want to say thank you for inviting Telefónica to participate in this session debate about this topic that is telco network transformation. As my colleague from Colt has said before, there's a lot of things to do with transforming the network. But as I belong to the research and development area of Telefónica, I'm going to speak about one of the most innovative projects that we have been doing recently, that is network virtualisation.

Network virtualisation can set up separating and so forth from our network equipment to run the server in a common server, commercial operated servers. And we have been working on that during several years. We have example too as proof of concept. Five years ago we began building a low-cost approved traffic proof and then we built inspection and then we had a proof of concept or a virtual customer equipment and now we have a trial in Brazil of this proof of use – this use case of network function virtualisation.

And more than two years ago we presented our NFV vision with other telco operators and we contribute to the creation of the industry specification group of NFV inside [ETSI]. And that now, in our [equipment] we have people that belong to the managing board of these. We are the technical – we launched the technical [commentary] and we are involved in the performance and in the proof-of-concept group. And we are seeing that there is a lot of activity with vendors and with other telco providers, building this use case using NFV.

And one of the things that we are doing now is we have launched recently this year our NFV reference lab because although we know that NFV is the technology is almost there, we know that there are things to do. We have to overcome some gaps and we are working on that with the industry on that. We have identified three main challenges to make this happen.

One of them is the carrier-grade performance, so we working in several parts with the baseline technology, with hardware, with the operating system and with [an advisor] because we find that network virtualisation is not the same as cloud technology because there are some specific characteristics that make it special, for instance, data traffic. The workload is very huge. And they needed having a global vision of the network, as my colleague – my first colleague of the session debate has explained before. So this is a thing that we have to solve and we are working with the industry in open projects with open source because we think that this technology has to be open. We cannot build silo, so we think that is a good approach and we are working with other colleagues, for instance, within that and with [Redheart], with [Lennox], with the advice of [IKBM] and with [Openstat] to build the baseline technology.

And we think that the added value, the value must be added in the virtualisation of the network function and built on the function, and the orchestrator, so we are open to collaborate with the industry and in our NFV reference lab. And of course there's a lot of things that a telco has to do with the network. But as I belong to this team, to the team of research, this is one of the more challenging projects in which we are involved.

Emir Halilovic

But obviously one of the most essential ones, I would say. Tom, finally, we have heard quite a bit about what Telstra is doing. But can you tell us a little bit more about what do you think is the main challenge in telco transformation? Does it lie with technology or is it further up in the organisation? What do you think?

Tom Homer

So I guess first of all we like the idea of telco transformation. We like the idea of being able to launch products more quickly. We like the idea of flexibility. We like the idea of consolidation. And I think the challenge that we face is we don't see that many use cases for customers, for enterprise customers. And I guess like every other telco, the challenge is the return on investment case when we have such significant investments, as I think somebody else said, in multi-vendor networks. The transformation takes a long time.

This reminds me a little bit of where we were in cloud five years ago and maybe even back 20 years to Cisco and what they were doing with MPLS and tagging. It's great. It absolutely makes sense. It's definitely the way we all will head, I think. But the challenge is making it pay now. And I think one of the original questions that was posed in the debate was who wants to be a leader in this space and is there a business case for being a leader? I think that's a pretty challenging thing to do, say does anybody want to be the first mover here? Does anybody want to genuinely do this transformation? Or actually are many of us going to wait, see some lessons learnt and then move at their own pace because we've got such a big sunk investment in those, in all of the platforms that we've got.

So I think we like it. We see the value in being able to do all the things that telco transformation provides. But we're not convinced yet on the business case.

Emir Halilovic

And there you are, let's say, willing to let somebody else be a pioneer, so say?

Tom Homer

Well I think interestingly what we're doing with Cisco on the Intercloud platform is we're letting – we're sharing the innovation with them. And I think Telstra's actually got a track record of doing that with a number of our vendors. And so I think if somebody was willing to come up with something creative and interesting, vendors, then we'd be interested in hearing about it.

Emir Halilovic

Absolutely. Well that would round off our introductory and possibly the last question from me because we only have a few minutes left and I would like to open the floor for some questions from the audience, if there are any. I'm sure there are at least a couple.

From the floor

A question about the transforming of telco networks. Is it realistic to differentiate between type of telcos, for instance, very competitive MNOs only offering consumer services would have a different approach compared to high [DO] OpCos who are [current] player.

Nicolas Fischbach

I think it is true. That's why when you see stories that NFV or SDN applies blindly to the same way to all the sales providers is clearly not true. The demand we have as a more fixed network operator, with the assets we have, the [issue] we have compared to Telefónica with also the mobile arm and also the approach completely different. And if you look, Deutsche Telekom completely did a greenfield. They went the [tail stream] route. Outside of the home base in Germany, I think they did it in Croatia for many, many reasons. There's a lot of that.

We did internally, to your point, about this benefit, you don't actually want to be the first one and pay the price of being the first one. Don't always do the benefit [inaudible] that you expect, but at least you've sparked the transformation. That worked for us. Others can do that because there's so much other constraints around it. So I think you're going to get a very different story depending on the service provider, the market he operates in, his history, even the unions.

The thing is, and that's not to pick on [inaudible] for Deutsche – of Deutsche Telekom, I think what [Axel] is trying to do is fantastic, but when I told him, when I saw it, like if you realise 10% or 20% of what is in the [tail stream] vision, it's a win for you because when you try to bring this back to Germany, all the union's going to be no, no, no, that's not part of the contract. That's the change. So all those things are quite interesting. So to me, every vision, even if you look at the market side, is the same. Once you have to implement it inside telco or service provider or somebody with only fixed, somebody with data centre, somebody with code offerings or not will be very, very different.

And that's actually a challenge for the vendors in the room because they want to have a very compelling story, but what we want to consume from them is sometimes very specific to our business and the transformation we need to go through. After [signing] guys in the room, they probably hate us for that. But honestly, that's what we see.

Emir Halilovic

Thank you. Just one short question from Camille before we finish.

Camille Mendler – Ovum

Just a quick one, and that is with that issue that you talked about – sorry, Camille Mendler, Ovum, why don't they just – telcos continue to outsource the management of the network to the vendors who can then sort out both the equipment and the labour issues?

Nicolas Fischbach

So I think that that's – we don't see that happen so much in our space. That's more the MNOs. The mobile operators actually do this, build, operate transfer-type model, they build, operate and have a transfer. I think in our space we don't do that so much. I've never seen it in my career where there was that. So it's interesting if any of the vendors, to the point of many people here, we're completely multi-vendor. We're not

seeing a single vendor any more. So does one vendor really want to take the pain? There's actually a Chinese one that wants to go through the pain to acquire business. They're going to name them and then try to transform the network to make more the assets. Their operator, it's manage, not manage servicing going to happen. I don't see it any more. It used to be a trend a couple of years ago. I haven't seen it at least in our space.

Tom Homer

But I think, again, it's based on use case. I think you can make it work in certain scenarios. And if the business case works, we'll do it. We're certainly not constrained in any particular direction in terms of the type of solution that we go for, whether that's a vendor-driven operate-type solution or whether we operate ourselves. It's just down to business case. If the vendor's got a good enough deal that will make it work and if it's transformational enough, if it gets us where we want to go, then great.

Nigel Oakley

Certainly from the vendor dimension, again worked with a lot of operators, you see them approaching this from a whole variety of different angles. So how can I make SDN work in my network? Can I apply SDN across the whole of my network? The advice I give every single time is the same, which is start with the use case because the use case defines the boundaries. And it binds the technology that you're likely to deploy into that particular area. And they are completely different. If you're looking at data centre automation versus network function virtualisation delivery, you're probably looking at different technologies, looking at different challenges, you're looking at different vendors in the network that exist today.

And that's why I've seen, certainly with the customers that I'm working, they've moved back to defining rigorous use cases which define exactly what it is they're trying to achieve, what the likely business benefits are going to be, what the boundaries of that are and then apply the technology solution to it. And in those particular cases they are advancing very quickly, in my view, in being able to utilise some of the benefits of SDN technology in the network.

Emir Halilovic

Well that would be, I think, a perfect conclusion. We've come from talking about technology and talking about how technology is actually there to where the business model is going to go in the future and how the organisation has to change to enable the telco transformation.

So, with that, let me just thank the panel with a short round of applause and call up the next panel, headed by Camille.

[End]