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Debate Session IV: The Next Generation of Open Networking and Open Cloud Computing – Is It OpenStack Everywhere?

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Thank you everyone for attending. I think I look better now than I did in that picture but I'll leave it to you guys to decide. So let's get started.

Basically, what we're seeing here is we're seeing an industry move to open. In technology, especially in telecoms, we've always been focused on building networks and interconnecting networks and getting them closer to our partners but what we've seen in the past couple of years is a lot of movement toward open source, and so we have a lot of different industry consortia out there. OpenDaylight will talk to us about the network controllers; OpenShift around platform-as-a-service, OpenStack around the infrastructure-as-a-service, OpenFlow will tell us a little bit about the protocol and the underlying communication. OpenCompute was fantastic in that it started to actually address hardware, servers and switchers and actually the build and design of a data centre.

Then if anyone was paying attention at the Mobile World Congress there was a telecom infrastructure project which is basically saying we're going to go to the [backhaul] of telco networks and the access control and the backend systems and we're going to actually try to make that open source in some capacity.

Then with this whole open thing is open APIs. Open APIs allow us to connect with partners. It enhances vendor interoperability; it reduces our need for external consultants. Last night I was on ProgrammableWeb, which is one of these sites around APIs, and there's 15,000 searchable APIs that you guys can look at now if they can help you with enhancing existing products like unified comms and doing things around monetisation and micro-services. There's a lot of stuff that's happening in the API domain.

Then of course there's the open interfaces. If we're going to move to what is it, 50 billion devices, connected devices by 2020, or a 100 billion by 2025, we can really only do that through the opening of interfaces, the reduction of proprietary protocols and making that open standard. We completed a very extensive IOT survey. We found that 36 per cent of users will want the data processed at the edge, so now your network has to process at the edge as well as the core. That's going to lead to a proliferation of open data centres, micro data centres at the edge - containerisation, another open term. Then we're finding that half of the enterprises actually want the data to be processed in motion, so that opens up all this in-memory computing and real-time needs.

Then of course there's the open investment. Everyone might know about AT&T Domain 2.0; maybe a few of you know about NTT, but basically these companies are investing lots around technology like SDN and open data centres to drive the market in a different direction and promote interoperability. They're actually competing to some extent against the traditional vendors and going at it alone, you can argue. Then of course there's open competition in that you speak to a lot of telcos and they will look at - say take an incumbent operator, they'll look at one alternative provider and one market and say that's my competition, and that's false. That's the wrong way to look at the market. In fact, they're your Netflix, they're your iClouds; they're actually telcos, like Orange Business Services by the way, who's - what, are you going to be a bank in France in 2017 - so you're moving and jumping adjacencies using technology as a means to differentiate. That's open competition and if anyone has not seen that, that's open season for them.

If you were to contextualise this all to a graph, we think that it's all going to be a platform play and it's going to be computer, network, server; all of that is going to be open. With things like telecom infrastructure project, OpenCompute project, we see this going all the way down to how you build and construct modular data centres, how you build and construct servers and how you actually - to your point earlier, how you make a switch think it's a server - maybe vice versa as well.

It creates some problems though of course, it's not all that easy because networks, networks are still dumb and slow. There's a lot of manual configuration. You program them with MPLS for a particular purpose and then within three months it's not fit for

purpose. There's all these things around heuristic routing which doesn't quite get us there. We actually need programmable routing - maybe we can talk about that - and we fixate on a single connectivity type, maybe ATM, maybe MPLS, maybe LTE, maybe something else rather than multiple networks, heterogeneous networks.

Then of course on the cloud side you have a whole range of other problems. Hybrid cloud is the norm; your average enterprise has three to five different clouds but they have different management layers, for every single type of cloud has a different management layer. Then if we get into configuration, incident capacity management, availability management, all these things I have here, you're dealing with another platform. You're dealing with another vendor, another solution, you're building another stack. So the problems with clouds and networks is they lack the automation of tasks and the orchestration or execution of these tasks across different infrastructures. That's the problem today that we face.

Today's response to it - the industry's response, not singling anybody out - is that's okay, we can integrate APIs. That works all right but APIs are all determined by individual vendors and they only you connect to a way that the vendor says it's okay to interconnect. So you have an inconsistent implementation and it's only an emerging technology, so that doesn't really get us there.

Then the optimist out there will say that's okay, we'll wait for the vendors to start working together and playing nice; well, that doesn't happen either. They all say it; they tell us analysts every day how they work with each other but they don't. They like to - they do promote, whether we want it to be that way or not, some form of vendor lock-in because they don't want to lose the customer. That's one thing. Then of course if we're going to go down that path we might as well wait for open standards.

The third one of course is building your own intellectual property using open source competing against vendors, which I've heard some of the panellists tell me before that that's what they essentially do. The problem is open source also leads to fragmentation; everyone has their own different view and version of open source. It doesn't really integrate so well with each other. If one single vendor that is building its own IP to pull this all together, it makes it hard to speak to other vendors, so there's a scale problem. If you go with one carrier that has fantastic intellectual property that's not necessarily available in another carrier in another region. So unfortunately that's another challenge; I don't really have an answer for that one today.

The thing that we're seeing is this is a very elaborate SDN research that we did, and we're seeing SDN happen around campus, cloud data centre [unclear]. What we're saying here it's actually IT process automation around the hybrid cloud which is driving the software-defined conversation. A lot of carriers in the room and in general in the market, a lot of carriers will talk about how many data centres I have connected and hanging off the end of my network, they don't talk about the depth of integration, they talk about the breadth of coverage; that's a different thing. The one that actually gets it right which can actually integrate network with cloud through a template-based approach really can make a difference as a carrier, in our opinion.

In terms of IT process automation, when we survey different sizes of enterprise, every single of them, except the over-10,000, will want to talk about IT process automation as a means to get into the software-defined network conversation. We don't see SDN being limited to network or to data centre, it's actually going to tie everything together. That's what the market actually wants; that's what we understand from our surveys.

So in terms of maturity, this is where it's at now, because everyone says well, SDN, this stuff's not immature; in fact, it is. In the past couple of years, you've seen maybe interest moving from Australia, New Zealand and India, Singapore to across the region. In the past 365 days we're seeing Malaysians, Philippines and Indonesians, in addition to all the other countries I'm mentioning, ready to have an SDN conversation, ready to have a transformation conversation because this is the only way we can actually start solving these industry problems.

In terms of expectations there's a lot of them but I just wanted to share some thoughts. There's everything out there under the sun; we see a lot of interest in layer four to layer seven technologies through NFE. There's really a lot of cool, interesting conversations you can have. The trick to this is talking about security; if you can - good security conversations make the enterprise feel secure going with you in some way, shape or form, then it really unlocks a lot of opportunity.

Then the last thing before I start talking to the panellists is this is the sentiment that I hear from customers: we want to avoid vendor lock-in, everyone says that, but we do not have the skills sets for open source. We cannot call 1800opensource for help; that's the reality. Typically, they might talk to a service provider who may have those skill sets, and then there's a lot of talk around you can reduce your licensing costs and things like that with open source, but then you'll pay a premium for the developers who know open source, and then you're locked into maybe your internal developers.

That's a perspective from current analysis, but without further ado I'd like to hear - well, that's a different slide from last night - I'd like to hear from the experts themselves. So we'll talk with Jon Vestal at the end. Can you tell us about maybe the Telstra PEN network? This is one of the SDN solutions that is actually working in the market that's commercially available - and maybe what your customers think of it and how they're responding to this development you guys have done.

Jon Vestal

Yes, sure. Thanks, Dustin. We launched the PEN service going on three years now - it was November 2013 - fully SDN orchestration. I hate the word SDN; it means different things to different people. We chose an OpenFlow solution. Doing this three years ago we had no choice, we had to do open source. That was the open option back three years ago to create the solution that we put in place. We used OpenStack and [Acorifa] and [Aviforms] and we had to glue it all together.

One of the comments you said that resonated with me is there's no 1800opensource. One of the growing pains that we had in trying to introduce this was taking a group of network engineers who know IOS, GNU OS, all of these box vendor operating systems and teaching them Python. Just think about that in your own environment, sit

down with network engineers that have been there for 15, 20 years and try to get them to do something in somewhat of a structured language. It was a comedy of errors. It was a weeklong session and it was probably the worst thing we ever did. I used this excuse a lot but I had hair before we started that venture.

But it's something we had to do. We came to the realisation early on that if we didn't use open source we weren't going to be able to control our own destiny; we weren't going to be able to hit our deadlines and be, I think, first to market with the solutions that we put out there. It was critical for us to get that done and do it in-house, and we still do it in-house today.

Dustin Kehoe

Okay. Thank you, Jon. Can I just pick up on a point that was made at breakfast from Jonathon about how you're going to teach a switch to basically act like a server, or a switch is a server?

Jonathan Seckler

Like I said earlier again, this morning, switches, the central architecture of the switch has become pretty commoditised or standardised or whatever adjective of the week that you'd like to use from a hardware architectural standpoint, and the software that runs on these switches has started to become similarly standardised using a lot of common interfaces. The introduction of the open network install environment, or ONIE, a couple of years ago; the release to OCP of the switch abstraction interface - this a hardware abstraction layer for switching silicon to OS - the sonic OCP release that I talked about earlier, all of that is very much in line with the trend toward an open way of looking at networking.

I like to think of it in terms of the server world. If you think about how we as enterprises went to market or how we used technology in the 1990s for example, a lot of us - SAP ran on a mainframe, or your ERP applications ran on a mainframe. In the 1990s I was at [AVAR]; I used to sell AS400s and my customers would use the AS400 as their messaging system. This was all pre-internet. Today you would never think to run those applications on that kind of a proprietary design because the benefits of an industry-standard infrastructure are just so great. And yet when it comes to the network, we're still operating in that let's go with - let's pick a vendor that's got a proprietary point of view in the market, let's lock in on them, let's get trained on their technology and certified and then we'll stick with that and we'll be locked in as a company going forward for the foreseeable future.

Frankly, I think there's something wrong with that. I think that's why Dell has been an advocate of industry standards where you don't have a legacy business to protect, so we have the luxury of being that way, but at the end of the day it really does bring a lot of flexibility, it brings a lot of capability to the enterprise and to service providers, and I think even more importantly, it definitely takes a lot of those costs out of the maintenance and acquisition of equipment and allows you to pull it back in and use it for innovation and interesting solutions.

Dustin Kehoe

Since you have three carriers over to your left, I would imagine one of the arguments you would make to that or counterarguments might be, is it carrier grade? Does anyone want to take that - okay, [Gint].

Gint Atkinson

Let me jump on a little bit of history. Virtual switchers, virtual routers, software-defined networks, specifically radios, over-the-air provisioning of new protocol stacks; we're talking about decades, decades old. Granted on the mobile side there had to be a lot of standardisation so it went down the standardisation track, but let's get back onto routers and Cisco. I don't know about you, but if you go back decades to BSD and when it wasn't called open source and it was simply called GNU and other projects, we did build the internet on software routers that were out there. When there were problems we patched them ourselves, sent the patches back out to the community and then the patch eventually worked its way into the release. There were a lot of things missing though, but let's just stick with the router, I'm not talking about all the OSS interfaces, all the other systems, just plain vanilla routing.

A lot of companies did not want to run their routers the way the Department of Defence did, the way the Energy Department did and all of these other research institutions that were building the internet backbone. Eventually companies like Cisco stepped up and offered support and put it into a standardised package that included a box. Eventually, as you build more of your business or you just depended on the network more and more, 10, 20, 30-minute restoration times were just not acceptable and we started going into the world of having to give it mainframe-like characteristics. All of a sudden the standards that you had on DECnet and what you had on IBM, all of a sudden those standards were being pulled into the open source routers. There was no way you could get the router to execute as cleanly, reliably and to recover as fast as the proprietary network systems.

Still, LU 6.2 would be really handy. Considering what you can do with LU 6.2 in terms of transactional messaging, it's pretty darn good. We have to go to a tonne of other open source projects and products to get what LU 6.2 did in a proprietary world. Then we end up with these boxes and then we end up with shareholders who deserve returns, and where did the shareholders' investments sit in the scheme of priorities depends on which jurisdiction you're in, but overall they've got to make money for the shareholders. So you end up with all of the different go-to-market and revenue strategies that the vendors create, and in a network space with network boxes - today, let's jump forward - today you're not going to find a single bit of open solution that's going to give you sub-50-millisecond restoration on an ELAN service instance, reaching across a physical jellyfish topology with 100 endpoints. You're not going to get that; it's not fast enough.

Now, if we go back to what many of us suffered a few months ago, all the cable outages we were getting in APAC, we have a cable outage, we jumped onto the protected path in sub-50-milliseconds, lo and behold the next day that cable goes out.

Now we have to do exactly what the airlines do; reroute customers onto unplanned routes, stitched-together routes, restoration-as-a-service, perfect application. If you've got a minute or two to add value, this is where SDN is going to fit in. Maybe we can get it down to 10 seconds but under 100 milliseconds when you're talking network protection, service-level protection; we're just not there yet.

Dustin Kehoe

Okay, and we'll put the network aside really quick and move to data centre.

From the floor

[Unclear].

Actually, I'd like to put a little bit of perspective on this.

Dustin Kehoe

[Unclear].

From the floor

We're asking if it's telco grade; that's actually asking me if it's cloud grade, because it's not the telcos who are leading the cloud initiative out there, it's the public cloud providers that are really bringing things forward, the open standards are bringing things forward. Telcos are about keeping you connected, whereas cloud is about keeping you engaged. Every time you go to Google and you hit search, that's SDN; when you go to Facebook and you hit like that's SDN; when you're doing peer-to-peer, a lot is SDN. With all these requirements with the memory being out, everything going in memory, instead go out to the edge, it's very important that you're balancing off networks and not actually routing networks.

I liked Sean Mitchell's (TechDay) question earlier when we asked about well, how's the switching comparing to 2012, why aren't we using these big providers like Cisco and so on. I can say we do not have Cisco anywhere in our network right now: it's open standard. [Unclear] Quagga, we're doing amazing things. Most SDN providers are using a Quagga-based technology that's gets rid of Spanning Tree. To what Gint was saying, that's exactly how you get sub-51 millisecond latency or failover times. We got it down to seven milliseconds for failing over on a full virtual machine from one data centre to the next data centre - within a certain range, 16 kilometres to be exact. You cannot do that if you're trunking systems, if you're using a Spanning Tree type environment.

When you say, quote [unclear] cloud grade, security has a different mentality to it as well, how we [unclear] security in a telco-grade system versus a cloud-grade system. What [Dave] was saying and what Sean was saying earlier about why did we choose Dell, it's a high brand, high price and so on, their image. Actually, there were about three companies in hardware and software alike that didn’t pass our PAT, and these are major brands that are out there.

When we came across our SDN and we [started to mark] Dell on the OpenCompute platform as they have, we were extremely impressed. Running a multi-tenant system that keeps our customers engaged at the private cloud, the hybrid cloud and the public cloud integration is extremely important and our price is very sensitive. We can't just go out and say okay, we're going to spend a million on Cisco licensing or VMware licensing, we need to be a lot more savvy than that. That's where Dell with [big switch] and everybody came in and using an OpenStack environment is really the key solution of how we're approaching it.

Dustin Kehoe

Okay. Derek, you work in the data centre domain but you work for a company that arguably has the largest MPLS network in the world in terms of coverage, number of POPs and we can get into that sort of detail later. You work in a network company but in a data centre domain; do you see potential to link these two together, taking all the different arguments into consideration?

Derrick Loi

Thanks. Absolutely. I think if you look at it today in terms of a lot of the enterprises, one key concern as they evolve or embark on digital transformation, is how do they keep all the employees, all the suppliers and all their customers connected. Now, that is definitely the key role of network, to keep customers, suppliers and employees connected. But like what [Steve] has said here, we also realize that as customers embark on digital transformation, it is now about how do we help our customers keep their customers engaged. This is where it's very natural on top of the network to the extent that intelligence, that control, that managed services from the network layer to the data centre layer and to provide an end-to-end scope services for them. Now, the other key observation as well as practice we have put into place is that - other than the need to orchestrate the ability to set up individual network, virtual circuits on demand for customers, depending upon the destination or the public cloud that they want to connect to. It is also important to make the network application-ready and intelligent enough to automate the network connection, bandwidth, COS based on the workloads that's being used. This again ties strongly back to how do we integrate, be it the APIs, the various standards of SDN, into the way we actually orchestrate infrastructure and applications within data centres. So that is exactly where Orange has gone. We have today our hybrid cloud or multi-cloud orchestration engine. Within this engine and the associated portal, not only are you able to virtualize the various compute, storage components, the various OS and platforms, we have also integrated close to about 80 over open source apps so that you can have an application app store on day one, we have the templates that allow the customers to integrate their own applications. This means that we have now enabled our customer to orchestrate the ability to set up, provision the various applications and the underlying infrastructure-as-a-service, that will be provisioned to power these applications on an automated basis. Now, on top of that, what we have also done is to virtualize and automate the provisioning of the various network services components via OpenFlow and the various SDN standards, so that depending upon the policies that are set, the customer is now able to provision

the right virtual circuit to the right MPLS network or the right public cloud access gateway, so that the workload is also flowing through the right network connection to the right destination. That is something that we have done as well, to truly link SDDC with SDN.

Dustin Kehoe

Cloud-ready networks. You heard from the experts; are there any questions from the floor?

From the floor

I think everyone had too much fun last night, I think that's what happened.

Dustin Kehoe

All right. So then I'll throw one out there just to the panel. Do you agree that - I talked about standards, SDN standards; I'm curious what those SDN standards are because everyone says they're not standardised yet but let's get back to APIs, building your own intellectual property, vendor interoperability. Is that a fair assessment of where we're at? We're probably not there for vendor interoperability, we're probably more looking at APIs and open source and building your own IP. Is that kind of the approach that you are guys are seeing?

From the floor

As far as - there's been a lot of [statements] from the cloud coming out of the emerging technology realm about five years ago. CIOs today are actually saying not if we should cloud but how we're going to use cloud to best benefit our business. In doing so, they're coming across other problems. They're coming across okay, now we have 10 virtual machines on [ADB US], 10 on Azura, 100 on our private cloud and we need to do [DR] out into another piece of the cloud.

People always ask, what's after the cloud, what's after all the hype? This is where hyper conversions is really coming in, the hybrid cloud model, of being able to say okay, it's one cloud platform, one portal to control them all. Most of the companies are writing the APIs today to be able to integrate. Even ADB US and Azura are integrating with each other. If you look at what Rackspace is doing, they have their third-party cloud platform too integrated with these providers.

It brings a consolidation of the market, which is good, so we're starting to see that now and there's a lot of good things happening there to say okay, I want my primary systems on my private cloud, I want my DR on ADB US, I want my storage on Azura because it's cheaper and my computer on ADB US. And you're getting to the point where we can do that.

Dustin Kehoe

Okay. Would you guys agree with that?

Jon Vestal

Yeah. I think the enterprise right now has got way too many decisions to make: where do they put their apps, how do they use it, do they do it onsite, do they do it offsite, do they use a SaaS writer? What we keep coming back to is the only way that those all work together is with the network in the middle. As carriers, I think there was a time in the last couple of years when we forgot that. We were still selling services in very rigid, fixed environments and weren't meeting the customers' needs, to mirror the way they were consuming the network resources and what they can do with the network resources in parallel to how they were consuming those cloud services. I think we're starting to see a shift to where we're seeing the carriers now start to offer services and product, and not only allowed the clouds to connect to each other but also provide new models to consume those service that are more in line with a consumption-based solution.

Jonathan Seckler

I want to talk - you mentioned earlier, you asked the question about is - the difference between open this and open that, open source, open vendors, open standards et cetera. I think that the model that we all have to look to is outside of the networking industry per se. Just because something is open or open source or what have you doesn't mean that it's generic. If you look at the way the server model was built, there was a similar trend toward open source technologies and Linux 15 years ago was open source, we had the Cathedral in the market and all that, all kinds of great debates about software. But the reality is that is if you're an enterprise and you're in the business of providing a service, whether you're a service provider or an enterprise, you're going to look to a partner to package up the open source or the open standards in a way that makes it easier for you to manage and makes it easier for you to deliver your service.

The Facebook and Google model of building your own and rewriting your software to suit yourself is very alluring maybe, but it's not realistic for the vast majority of us sitting in this room. The reality is we want the benefits of that and we'll get the benefits of that, but we want it and we'll get it through the standardisation, through the packaging of those solutions, from someone in the industry. Whether it's a vendor like Dell or a software provider like Red Hat or something that whether you're going to make those choices. I think that's the thing we need to remember; it's not about the world's going to go to white boxes and generic hardware from Taiwan and we're going to recompile our software every day because that's the way it works. It's that we're going to take advantage of the capabilities of people who do do that to turn our businesses into a richer service, a richer experience and at a lower cost.

Steven Davis

That reminds me, by the way, back in 1995 Larry Ellison put out a million-dollar challenge to the open source and open database networks to say what open platform

out there can actually meet what Oracle can do on a replication and all the functionality. It took [unclear] seven years before it actually could, but then of course the challenge was over, but Oracle maintained that lead as Oracle for a good seven years before the open source market came up and caught up to where Oracle was.

Now, if we look at what OpenStack has done over the years - this is the last five years alone - four years ago, even three years ago, my first choice would not necessarily have been OpenStack. You've got CloudStack out there, you've got VMware out there, you've got VMware controlling the market. Well, as of today it only took OpenStack two years to take 54 per cent of the market, over everybody. Now, that's reliability…

Dustin Kehoe

Are you counting Amazon in that figure?

Steven Davis

Amazon is on their own solution [unclear].

Dustin Kehoe

All right. Yeah, okay.

Steven Davis

That also has a lot to do with scalability. When you're talking about the size of Amazon and Google, sometimes it's actually more beneficial to run your own software in that case because you have such a mega-scale. It's like at what point do you start building your own data centres. If you have 500 racks, yeah, it may be in your best interests to start building your own data centres rather than leasing from somebody else.

Dustin Kehoe

Leasing from somebody, yeah, control. If I'm hearing it correctly, I see a couple of different things. Maybe from a telco point of view, maybe you don't want to do all these things internally inside your network, especially because you have so many banks on the Colt network, that's what I remember your company for but then there's another part to it where when you're speaking to the enterprise. The enterprise doesn't want vendor lock-in, the enterprise does by and large want open source, and it would be the likes of Telstra, Orange and Colt Technology that stands between the open source community and the enterprise saying don't worry, we can integrate, we can go with a hybrid model. If you want to go with a named vendor that's fine, but we can give you these extra extensions that maybe support your business needs. We can support it, we can guarantee it; it's not 1800opensource, it's your global account manager. Is that what I'm hearing?

Gint Atkinson

I just want to say it doesn’t work. At the level of down in the network, the things that a network needs to do before you build services on top of it - let's specifically say the control plane - you can't be a cloud service provider's provider of terabytes' worth of capacity and service instances.

Dustin Kehoe

You're talking about your network; your network is a completely different profile and an enterprise.

Gint Atkinson

Right, our network that's going to serve, but on top of it we want everything else exactly as you laid out. The difficulty is just getting down to the point where you can build a network service platform where the network itself runs at the quality of service that's needed to deliver that massive variety of services. On top of that, SDN plays really well for building new services like asymmetrical restoration and protection services and dynamic service chaining and composition and mixing and layer two, three and even zero to spin up a complex network service. That's where SDN and [unclear].

Dustin Kehoe

Let's play to our strengths. Let's use SDN for what it's good at, is what I'm hearing.

Gint Atkinson

Right.

Dustin Kehoe

We have a few minutes left. A question from the floor, with the mike? Right.

David Heath, IT Wire

Yeah, hi. David Heath, IT Wire. First, just a random thought. We're talking about the combination of switchers and servers; does that make it a swerver or a snitch? I don't know.

But my real question. Do we see a convergence of the cloud and the infrastructure that supports it, so will SDN merge the switches and the servers and we'll end up with just one single infrastructure?

Steven Davis

I would like to think so, and where we're going is probably the right direction. Again, it's by keeping everybody engaged. If I've come from Singapore and I fly to London, when I land in London and I turn my phone on, Facebook already knows I'm there. All my content on Facebook is already transferred to the closest point of presence,

which means we're not using an expensive global telco backbone. They do it one time and just follow you, so wherever you go, whether it's a CRM, your billing or whatnot actually follows you where you're at. This goes into a larger-scale discussion actually on analytics and tracking and the global point of presence.

All this is coming into play and it's tracking everybody out there, which is necessarily a good thing because it adds to the additional levels of security and the days of hacking are over. Now it's about bots just doing disruption more than anything else, because if you're a hacker and you hack something you're going to get caught now. Everything is tracking you, the telco, all the way through is tracking. So the convergence of where we're going, everything being converged, everything being a solid network, everything being therefore personalisation for you, if you want to create Hadoop and put it in for yourself, it's about that hyper-convergence of everything around you. IOT, cloud, your friend in another country, your friend next to you, they're all the same distance away.

Dustin Kehoe

Any more questions? Are there any final thoughts from the panel before we close off? Okay, so we all agree with each other, perfect. All right. Well, thank you very much. A big hand for the panellists.

[Applause]

Manek Dubash

Thank you, Dustin. Great, spot on.

[End]