FINAL

*Session 4b:
The Industry's Key Movers and Shakers
Point the Way forward*

Fritz Nelson

Vice President and Editorial Director, InformationWeek

Panellists:	
Henry Samueli	Co-founder, Broadcom Corporation
Andy Bechtolsheim	Founder, Chief Development Officer & Chairman, Arista Network
David House	Chairman, Brocade Communications
	Vice Chairman, Computer History Museum
Bethany Mayer	Senior Vice President & General Manager Networking, HP

Good afternoon, everybody. I'm Fritz Nelson with InformationWeek. I want to start by first apologising for my voice. I have vocal cord paralysis, like Larry Page. Unfortunately I don't have his chequebook, but I was hoping it would be better by today. It's actually getting better and it will get a little better as I talk. But just know, even though it might pain you to hear me, it doesn't pain me at all and, in fact, the doctor has encouraged me to talk more. So you get to be my therapy.

So we're going to do, a kind of a unique twist on a panel. Mark has described this as the, I'm supposed to play the Jay Lenno role here. At first I thought that meant I had to write a monologue, which I did but the censors scratched it all out so you're not going to get the monologue today. But we're going to have our panellists come up one-by-one and we're going to get a little personal and have a little discussion with each one. They're going to stay up here and then we're going to talk to all of them in kind of a free-for-all fashion. So that's how we're going to work and it I'm going to bring up our first panellist, it's Henry Samueli who is one of the co-founders and the

CTO of Broadcom. I don't know, I guess, I wasn't here earlier this morning, I don't know if we've had any chip vendors yet but you get to represent that side of it now. Henry runs Research and Development for Broadcom and he's also a Professor at UCLA and we'll get into this in a minute, he also owns the Anaheim Ducks, so I don't know, probably a lot of people here are San Jose Shark fans, but I don't think there's any reason to hate the Ducks right?

Henry Samueli

No, no, it's a good rivalry.

Fritz Nelson

Okay, all right. I don't follow hockey. Why are you sitting so far away from me?

Henry Samueli

Because my name is here. Do you want me to sit close?

Fritz Nelson

Yes. You can move back down there, we know who you are. Okay, so I want to start out with, I mean Broadcom, you have a pretty good share of the Ethernet market. Describe what you would say your market share is.

Henry Samueli

Well I think it's an exciting business. We entered the market roughly in the fast Ethernet generation in the early to mid-nineties and have been proponents of Ethernet for a long, long time, fighting the standards battles etc. Big believers, because of everything that you've heard earlier in the day about how Ethernet, being an open standard, being scalable, flexible, can adapt to new markets. Like, for example, one that I'm sure Bob never thought about when he invented Ethernet, the automobile, did you think you'd have Ethernet in your car? But it's happening. So when you look at all the different areas where Ethernet is deployed it's just everywhere and that's been our mantra over the years, is just we drive Ethernet technologies, and also wireless technologies which are Ethernet-like into every market segment that we see can use that data traffic and data communication. So I'm a big believer in Ethernet and Ethernet-like technologies.

Fritz Nelson

Now Broadcom has been described as a provider of 'Merchant Silicon' and when I first heard that term it felt a little derogatory to me. How do you take it?

Henry Samueli

I've gotten used to it over the years but when you think of a merchant you think of a little hamburger cart off to the side where you go and buy and hotdog. We don't quite sell our chips that way but everybody gets use to that term 'Merchant silicon' but it

basically means open market silicon as opposed to proprietary ASICs, and clearly in the semiconductor business you have to be dealing with open standards to generate the kind of volumes you need to sustain a semiconductor company and, hence, that's why Ethernet is so popular amongst semiconductor companies because it's an open standard so you just continue to drive the cost down.

Fritz Nelson

Many, many years ago I asked John Chambers, the CEO of Cisco, who his biggest competitors were, and John always gives one of those, you know if I asked him, 'Who is your biggest competitor?' and he says 'Time' or some crap like that. So back in those days he said 'Point products' and he was doing battle with Extreme and Foundry and then later he said 'Somebody that's going to come out of China.' by which he meant Huawei and companies like that, and recently he said 'Merchant Silicon'. So are you competing with Cisco or, I guess, are your customers?

Henry Samueli

Well, of course, they're a great customer, anybody from Cisco? We love you. No, I mean you're right, merchant silicon you sell to the world, anybody who wants to buy semiconductor chips from a merchant silicon vendor can buy them and therefore they can build competitive products to any company out there, Cisco included. So in an abstract way, yes you could say that every OEM views semiconductor companies as their competitors because they're selling chips to their competitors but that's what merchant silicon companies do.

Fritz Nelson

Now on the panel previously we heard a lot about Software Defined Networks and what is your view on the role of Software Defined Networks and the role your company plays? Does it change anything for you?

Henry Samueli

No, not really, it's just another avenue for the deployment of Ethernet and Ethernet-like technologies and I think it will play a very important role in the future. It will evolve over time and what we call SDN today may be different than what SDN is in 5 or 10 years, but it's the concept of opening up the standards for software. I liken it kind of to what happened in the cell phone space with Android where historically all the operating systems and software stacks were proprietary in cell phones and then all of a sudden Google opens up and gives away for free the operating system and look what industry it created. So having open software interfaces is an interesting avenue to take in the networking world and we're fully supportive of it and our silicon, we work very close with people developing SDN as well as people developing proprietary standards as well.

Fritz Nelson

Let me ask the question in a different way and we've got a couple of your customers coming up here shortly. Some might think that for some of your customers the notion of software defined networks is going to threaten their business. Do you see it that way?

Henry Samueli

It can, I guess it depends how you look at it. If you can leverage to make, even if you're an OEM selling proprietary OSs today you can leverage SDN into creating new lines of business for your company. So I don't view it necessarily as bad for an OEM that has proprietary solutions as long as they look at it with an open mind and maybe develop products along those lines as well, much like, again as I said in the cell phone space, people who had proprietary OSs, adopted Android and they're doing quite well. So it can work both ways for you.

Fritz Nelson

Well let's switch to a little more chip-centric question. Earlier this year Intel at the Open Compute Summit was showing engineering samples of 100Gb silicon photonics. What role do you see that technology playing in our switches and when?

Henry Samueli

Sure, well silicon photonics definitely will play an important role in the future. If you look at high bandwidth links, 100Gb and above, they're all over optical fibre today anyway, the issue is where is the interface to that optical fibre? Today you have an electrical interface at the switch chip that goes through a backplane or some short copper distance and then it's converted in some optical module to send over an optical fibre. So clearly you can save a lot of power if you move that optical interface closer and close to the chip and hence that's where silicon photonics comes to play and ultimately if you can put that interface to optics right at the end of the silicon then you have the optimal solution from a power dissipation and density perspective. So clearly in the 100 Gb and beyond generations you'll see lots of applications for silicon photonics technology, so it's a good opportunity.

Fritz Nelson

When?

Henry Samueli

It's starting today, people are working on it today, you've mentioned the Intel announcement, there are many start-up companies working on it, we're partnering with many of those companies to look at various opportunities. So it's starting today but when will it be mass deployed? Certainly within the next several years.

Fritz Nelson

You said you were partnering with companies, would we see silicon photonics coming from a company like Broadcom?

Henry Samueli

Potentially, yes. Anything can happen in the future.

Fritz Nelson

All right. I was trying to see if I could tell where Rick Merrit was, trying to make news. There he is down there, okay. So we talk about speeds, we're going to have Arista up here in just a little bit, sick amounts of bandwidth on their newest switch, lots of high port densities, will it end? Are we going to reach a point of 'We're done.'?

Henry Samueli

No, it's a great question because we're so spoiled over the last fifty years, literally our lifetime's practically, we've been spoiled by Moore's Law where chips got twice as fast or twice as dense every two years and it was just never-ending exponential growth and that translated into faster speeds on networking links, it translating into higher density on switch ports and the networking boxes, so we automatically expect it to happen every two years. But it's not, Moore's Law is coming to an end, people have been talking about it for many years now, the question is when? There's common consensus out there by the end of the next decade it will pretty much come to an end, so another 15 years or so of Moore's Law and then we've got a problem, it's going to take some radical new invention because standard CMOS silicon transistors will stop scaling, once you get to the so-called, roughly around five nanometre realm.

What that means is that everything is going to start plateauing, that the speeds of networks are going to start plateauing, now at what number? I'm pretty comfortable we'll get to terabit speeds, we're at 100 gigabit today, researching 400 gig, so I can see a path to terabit speeds. I'm not sure I see a path to petabit speeds, so we may be limited at the terabit range.

Then you're going to see densities of switch ports start levelling off, now every two years you're doubling the densities of switch ports in a silicon chip, that's going to start levelling off.

So when you start seeing the network level off in inherent capability it's going to change the dynamics of the entire industry because you no longer have these exponential increases every year. Now we still have another 15 years or so to enjoy but we need to start preparing at some point for a network that doesn't grow exponentially every two years.

Fritz Nelson

Okay, I'm going to put you on the spot here. Who is your favourite customer?

Henry Samueli

You know I'm not going to answer that one.

Fritz Nelson

I thought it would warm you up and then --

Henry Samueli

We love all of our customers.

Fritz Nelson

Okay, all right. Get a couple more drinks in you and we'll see. So just to get a little personal for a second on a couple of different fronts. I didn't know you owned, and we're practically neighbours in Southern California, I didn't know you owned the Ducks. When did you buy them?

Henry Samueli

In 2005.

Fritz Nelson

Okay and then two years later they won the championship.

Henry Samueli

Two years later we won the Stanley Cup, yes.

Fritz Nelson

Yes, and so what made, are you, you're a big hockey fan?

Henry Samueli

I've grown to become an enormous hockey fan, yes. I didn't start that way, I grew up in Los Angeles so I was a bit UCLA Bruins basketball fan, Lakers fan and all that, but now completely switched over to hockey.

Fritz Nelson

So why hockey? Why not bring a football team to Los Angeles?

Henry Samueli

People have tried and failed. Someday it might happen but we tried to get a basketball team down there in Orange County and that failed too.

Fritz Nelson

One other thing, and I don't know if you're involved in this or not, I actually was in your office so I think you might be but, back in the day there was a lot, when I went into Broadcom there were lots of sports cars, Ferraris and stuff in the parking lot.

Henry Samueli

The good old days of the internet boom.

Fritz Nelson

The good old days, he's right. Well I saw a Tesla there last week, so are you into racing?

Henry Samueli

No, no, not personally, but a lot of our employees are actually.

Fritz Nelson

All right, I'm just trying to see is there something about speed that's a common thread?

Henry Samueli

I limit the speed to the silicon chips, not to automobiles.

Fritz Nelson

All right, well Henry thank you. We're going to keep you, you can move back to your seat now --

Henry Samueli

Thanks.

Fritz Nelson

We're going to talk to our next guest and we'll come back to you. So thank you Henry, very good.

Our next guest is Bethany Mayer, she is the Senior Vice President and General Manager of the Networking Division of Hewlett Packard. Before joining HP Bethany was at Blue Coat, Mirapoint, JDSU, and I found out also you have roots back to Cisco as well, so a long industry history.

Now I want to start, I'll let you get settled here and you, are you going to be --

Bethany Mayer

I feel a bit lonely because Henry is way over there. So anyways --

Fritz Nelson

You just talk to me, ignore him for now. Now one thing I want to note about HP, specifically the Networking Division, I don't know if you know this, thirteen consecutive quarters of revenue growth. Now I've did a little homework today --

Bethany Mayer

Actually fourteen as of today.

Fritz Nelson

I was just, you're stealing my thunder and I'm stealing yours, because today HP announced their earnings and a little bit of kind of bad news, the earnings were down. Up versus expectations so I'll say that, but in almost every area down year-over-year. The Networking Division up. Wow. So congratulations.

Bethany Mayer

Thank you.

Fritz Nelson

Fourteen consecutive quarters. Now the reason I'm bringing this up is because I want to know how amid all the turmoil of Mark Hurd leaving and Board dysfunction, I don't know how else to put it, Ray Lane stepping down as the Chairman of the Board, somehow the Networking Division just keeps chugging away. How have you done it?

Bethany Mayer

So I've been with HP now for three years and when I first started Mark Hurd was in place and so I have seen a lot of changes over the three years, and I thought start-ups were sort of wild.

I've been very fortunate that, first the networking business at HP is considered very strategic. As you know we made an acquisition of 3Com, my favourite company, three years ago actually, and so the reason for that was because HP really wanted to create this converged infrastructure that we talk a lot about, of Server, Storage and Networking. So a very strategic part of that is the networking part of it.

As well I would say that my boss, David Donatelli is a pretty straightforward business guy and so he really works hard to keep us focused on our goals.

Then the last piece I would tell you is I think we make great products, very innovative products, we have embraced, as you know, OpenFlow for many years and, frankly, people buy good products so I think some of it is, frankly, we just have great products that sell.

Fritz Nelson

Well I have my own theory which is that even though we're here talking about technologies like Ethernet, so it seems like the topic of the day, I think when people

think about HP, and certainly the turmoil the company has endured, hopefully behind them now, they don't think about networking quite as much, for better or worse, but I think it's kind of allowed your and your team to just kind of do their job. Speaking of which, and you mentioned 3Com, talk about where you are now with the merging of 3Com and the ProCurve stuff. Where is that?

Bethany Mayer

Sure. So we acquired 3Com and it closed as of April 2010. We spent about two years actually doing integration between the 3Com products and the ProCurve products that HP has been building now for 25 years. Essentially the integration of that product portfolio is now behind us, I would tell you though that we've throughout that time continued to do quite a bit of innovating and bringing out new products every single year. So it's a testament to both the 3Com folks that we acquired as well as HP and, frankly, HP has just solid engineering capabilities, to really both integrate and innovate simultaneously.

Fritz Nelson

I thought for a while, because you guys bought 3PAR and then 3Com, you were going after all the threes.

Bethany Mayer

Yes we like threes, we do, we're fans of three.

Fritz Nelson

Now HP has been a big proponent of Software Defined Networks from the very beginning. Can you talk about why that is and what is HP's stance on SDN?

Bethany Mayer

Sure. Well HP as a company is a very standards based and standards oriented company in all that we do, really if you look across the business units we're very standards oriented. OpenFlow was as a result of a few folks, PhD students actually at Stanford several years ago, who worked on something they called Ethane and essentially this was [Rob McKeown] particularly that worked on this. Our HP Labs has been very involved with Stanford for many years and so they began to work with him on this and eventually moved itself into HP Networking, or at the time ProCurve Labs themselves, to them deploy a commercially available OpenFlow switch and we did that in 2008. So we were the first company that developed and deployed commercially available OpenFlow and we've been continuing to progress with that over the course of the last several years so that now forty of our switching platforms are OpenFlow enabled and we have 20-million OpenFlow enabled ports out in the market today.

Fritz Nelson

Doesn't OpenFlow, the sort of notion that we're going to make the hardware part a bit of a commodity, doesn't that threaten HPs networking business?

Bethany Mayer

So one of the panellists just a little bit ago mentioned that it depends on how you look at it. From our perspective we've actually embraced SDN. Frankly, we have a lot of capabilities in our software and in the functionality of the software we bring to the market, even currently in the management platform that we've developed over the last several years. But we've now built our own SDN controller and we've also created APIs that are open for folks to build applications on and then we're building applications on them.

From our perspective our focus is around simplification of the network and it's also based on convergence of technologies and an intelligent way to give our customers value, and what SDN brings is the ability to be able to extract a lot of the difficulties that have been frustrating to the network administrators and IT in terms of just having to go box-by-box-by-box using Perl scripts in the CLI to make changes. So this allows customers to have a much more flexible way of changing their network and they need it for what's coming, which is a lot of big data and cloud etc. We feel very strongly that customers pay for value, period, so whether it's in our ASICs that we develop and we utilise for a special purpose, where it's our SDN controller or whether it's application, there's value there and customers will pay for that and we're very comfortable with that as a company.

Fritz Nelson

So you recently announced your FlexFabric, which I challenge you to say three times fast.

Bethany Mayer

Yes, my marketing guy is maybe here, FlexFabric, FlexFabric, FlexFabric. That's the fastest I can go.

Fritz Nelson

But in the announcement it was called the first chassis-based switch to support OpenFlow 1.3.

Bethany Mayer

Yes, for sure.

Fritz Nelson

There's not a lot of OpenFlow implementation happening, at least on the enterprise side, and I don't know on the carrier side that much, but why is it so important to be the first?

Bethany Mayer

Well we really feel that there is going to be a huge sea change as a result of software defined networks as a result of software control in the network itself. So a number of things, one was we actually do have customers who utilise OpenFlow today and have been utilising our OpenFlow interfaces for many years, primarily in the research community. Then what we decided was as the emergence of OpenFlow as our true standard and our ability to create a controller we then are able to provide something that's very enterprise ready and hardened for our commercial customers. So that's why we went to building the controller ourselves because we believe that customers really are looking for a big change in their network. It's a very difficult thing to maintain your network, it's an even more difficult thing to change it in any way, to reconfigure it, and the amount of errors that go on as a result of changing your network today is quite high. So by putting in place more software oriented ways to control your network we believe that that's very valuable to our customers and compelling and that the industry will embrace it. I have to tell you, every single customer that we talk to is very interested and what's to do something utilising Software Defined Networking.

Fritz Nelson

And what are your thoughts regarding what Henry and I talked about with silicon photonics, does HP see a future there? And I'll ask you to respond to the plateauing of speed on the network.

Bethany Mayer

Sure. So yes, HP has been very involved with photonics research. HP is an iconic company and I'm actually very thankful to be there because this is a company that does research, real research versus generally just acquiring a bunch of different things and integrating them. The research that we did was primarily around photonics in HP network and HP's research team as well as in the networking business, and we believe very strongly that photonics is going to be very important as we near the 100 Gigabit mark in terms of speed in the network, and it will really, I think change, and this is the CTO of our company, Martin Fink has talked about this, really changed how the datacentre is structured, how it will look, even to the point where chipsets, CPU processing versus memory is. There are so many things you can do as results of utilising photonics. Anyways, we've been very involved with it and we are right on top of this trend as well.

Fritz Nelson

Now Henry owns a hockey team --

Bethany Mayer

Yes he does.

Fritz Nelson

The guy who is coming up next I think is like a yacht racer or something, what do you do for fun? Top that.

Bethany Mayer

Oh I work a lot. So I work a lot, I watch hockey, I love hockey actually, my husband is Canadian so I know more than you might think about hockey. My husband and I, we have granddaughter so we're kind of involved with our family and we spend a lot of time with our kids.

Fritz Nelson

Who needs a hockey team? Okay great, thank you so much Bethany.

Bethany Mayer

You're welcome.

Fritz Nelson

Our next guest is Andy Bechtolsheim who is the Founder and Chief Development Officer for Arista. Now before Andy was with Arista he was the Founder and Chief System Architect at SUN and before that with Granite as well. Hello, good to see you again. We didn't have a chance to de-brief so I'm going to take a little leeway here with you and put you on the spot as well and this is regarding your previous role as the Chief Architect at SUN. What do you think of what Oracle is doing with Exadata?

Andy Bechtolsheim

Oh recently? I haven't a clue, but I was going to comment that SUN started because of this vision that the network is your computer and every product sold from day one had an Ethernet interface, so we were one of the earliest adopters of Ethernet and, in fact, my involvement in Ethernet dates back to my student days. So I came to the States in 1976 and I was at Carnegie Mellon University back east and my advisor was Sam Fuller who later was at Digital Equipment. But he did visit Xerox PARC and he came back one day and he said 'I have seen the future, it's called Ethernet'. I said 'What's Ethernet?' and he goes 'It's this yellow cable that just connects all these computers here.' Well I was very impressed.

Fritz Nelson

Well I will tell you that Oracle and its competitor SAP are building these basically in-memory database products and selling these purpose-built application boxes so-to-speak, Exadata, SAP's HANA and they're kind of taking those SUN server systems and making them more task-specific, application-specific. It seemed to me that in some ways there was a vision there at SUN for that too.

Andy Bechtolsheim

Well I guess I can comment just a little bit, which is, it is true that delivering a high quality hardware/software solution of a cluster-based scalable enterprise Exadata or whatever it is, is a hard problem, so there's a benefit to both the vendor and the customer to have these sort of vertical appliances, if you will, that are fully qualified, fully tested and they come out. Now it is a thing that's sold for the value of the software more than the hardware I would guess but the point is it is unique in the sense that other people, not unique, other people are now following this, I hear IBM is now positioning their PureFlex system to be this more integrated software approach and it actually does make sense because in the end you buy hardware to run software.

Fritz Nelson

So you are paying attention to it then.

Andy Bechtolsheim

Well it's good for applications where people buy into a very reliable, robust software stack and they want to have the utmost in quality and reliability, so that's the position of this. The alternative view is what's happening in the cloud where people buy motherboards made in China and then develop their own software stacks based on open standards to compete with this. So there is an emerging trend in the cloud that is actually the same idea but based on open standards.

Fritz Nelson

Well there's a reason I'm bringing this up because in some ways companies like HP and Cisco on the networking side are trying to build that stack, especially around SDN. Now, if I may, and I have to look at my notes here because these numbers are mind-boggling --

Andy Bechtolsheim

Can I pitch in here? So SDN is a completely different vector here. In other words, the vertical stacks that [seem to have succeeded] in the market have APIs and software on top of the API and the same cannot be said about networking, at least today, it's just not the same and there's no application software that runs on top of the SDN world today.

Fritz Nelson

There was a guy here from Infoblox, Stu, was saying that they have something. So we're getting there.

Andy Bechtolsheim

There are early examples, for example, it was publically announced that we recently partnered with SAP HANA to provide the network switch for their HANA Cloud Appliance I guess it's called,. And the reason was that they could integrate their

system management with our network (inaudible) within a matter of a week or two of effort which they couldn't do with any other vendor apparently, but it is true that these things are getting integrated because what the customer wanted was one system to administer.

Fritz Nelson

Right and so this latest product that you guys had won a Best of Interop Award, the 7500EE, 30 terabit per second backplane, mixtures of 10, 40 and 100 Gigabit ports, lots and lots of ports depending on which of those you pick right? And very little latency, huge buffers, big time scalability, low cost per port, you guys have built really a pretty incredible sounding box, but is it just about --

Andy Bechtolsheim

Yes, the monster switch.

Fritz Nelson

The monster switch, I like that. Is it really just about the speed?

Andy Bechtolsheim

No, let me go back to the beginning of Arista which is, when we started we thought the problem was actually software not the hardware. We saw the emergence of merchant silicon and in fact the 7500 uses silicon from the gentleman on my right here, and so the silicon is getting more and more expensive to do, it's really not economical for anybody except the one company that has the dominating market share to build their own chips. And furthermore, the merchant chips, at least the ones we're getting, are actually better than the kind of chips other people are designing internally. As a result there's really no reason for anybody to make their own chips these days but the problem is the software. So we have this saying internally that 'Hardware is easy, software is hard', which is really true. In networking you have a software stack that's, let's just say 5 (inaudible) of code and the problem is if one line is broken the whole thing crashes and you cannot sell the box who cares about reliability which is your entire customer base.

So we managed to break this software up into these tiny little modules that separate Linux processes, it's more reliable, has an internal memory database, it actually works as advertised, meaning it's exceedingly robust and at least our customers tell us it's more robust than the competition. What this means is that people only buy into big switches if they don't go down and the barrier to entry is actually not the hardware but actually the software.

Fritz Nelson

So just to prove to you that I read some of your literature I wrote down some terms. Universal network architecture, build it once, get the network out of the way. What does all that mean?

Andy Bechtolsheim

Okay, what we call the universal network, it's really the conclusion that when people have cheap enough bandwidth so they can build a completely non-blocking network with, not just 1,000 or 10,000, but 100,000 servers in a cloud, where you no longer have to silo those things into zones or containers or pods or whatever they called them, the customer is actually much better off because you no longer have to worry about data placement and compute placement.

The problem before was they had these sort of smaller zones and then when you run out of the capacity in that zone what do you do? Because you're connected to the other part of the next zone but it's a low band of connection. So a universal network is one where you no longer have to worry about the network, the whole argument here is that the network really should be invisible to the applications, if you don't see it that's what you want, you get the same latency, the same bandwidth, the same throughput wherever you are, you can communicate from Server A to Server Z, it doesn't matter if they're the same rack, the next rack or they're building across the campus there. That is what people are designing and the advantage of that is you no longer have to worry about designing your network around your application it works for any applications it doesn't matter whether it's a (inaudible), a search engine, a game engine or storage cluster or whatever it is, it all works with the same network which is an incredible simplification for customers.

Fritz Nelson

Okay, I do want to come back to SDN, I'm going to read two quotes from Jayshree your CEO. 'SDN is not about replacing existing network architectures and topologies.' and she also said 'Arista does not believe in a rigid separation of control plane from data plane.' So what is Arista's approach and stance towards SDN?

Andy Bechtolsheim

So there is a lot of interest in SDN for all kinds of use cases, including just OpEx cost reduction, making things more manageable, reducing the number of network engineers running around and so on. Now our view has been that is an incremental deployment kind of scenario, not a Greenfield scenario, in other words people are not waiting for SDN (inaudible) to show up to design their network around SDN, they want SDN on top of an existing physical network and it has to work with existing infrastructure which is the physical switches and so on. So arguably we actually have the most programmable network stack out there and we today support any type of OpenDaylight, Big Switch, OpenFlow controller in the sense that it was really easy for us to add these kinds of support things for different customers. But what we're finding is that it's really driven by use cases where people can see a clear benefit of what they want to do with this and we can enable this at both the physical switch level and then tying this back into a virtual switch management system.

Fritz Nelson

Now I've asked Henry and Bethany about silicon photonics and you were there when Intel announced that and were showing --

Andy Bechtolsheim

Yes, I'm a fan.

Fritz Nelson

Do you have some with you?

Andy Bechtolsheim

Well I usually carry some in my pocket but not today.

Fritz Nelson

Not today.

Andy Bechtolsheim

No, the point is that if you look at the cost structure of high speed networking, meaning 10-Gigabit and above, it's actually sadly dominated by the optics not by the silicon. This is kind of a shocker but the optics cost much more per port than the silicon and that inhibits the market and particularly when you get to the 100 Gb level. I was just sitting next to (inaudible) and she has this beautiful Ethernet forecast report and even the report, you know, the analyst basically says they cannot forecast the high Gb market because the optics are so expensive that nobody can afford it. So the difference between optics that would be priced correctly to the market where they have to be versus the situation today is, is the difference of 100-1 in volume for a 100 Gigabit. And basically 100 Gigabit won't take off at the current price points because it's just stratospherically priced. So our customers tell us that they won't take 100 Gb until it costs less than 10 times 10 Gb, it's that simple.

Fritz Nelson

And are your, I'm under the understanding that your technology is being deployed in a lot of the financial services sector where speed, especially for things like algorithmic trading is essential, is that true?.

Andy Bechtolsheim

Well at the beginning of the company the majority of business was high-frequency trading, otherwise known as legalised front-running.

Fritz Nelson

We'll just call it capitalism.

Andy Bechtolsheim

And 'til today we believe that the majority of stock trades actually go over Arista switches, but that was years ago. Today the majority of our business is actually cloud networking, meaning large, ultra, large scale datacentres that do the cloud stuff and we've been very fortunate to have a product line that fits the requirements of those customers and has scale to 100,000 servers and beyond.

Fritz Nelson

And because I asked Henry and Bethany, so what do you do in your free time? What's your hobby?

Andy Bechtolsheim

In my free time? I worry about networking.

Fritz Nelson

Well, your hobby. None of these people have free time.

Andy Bechtolsheim

No, I work 80 hours a week so I don't have a lot of free time.

Fritz Nelson

So you're just, you're a workaholic.

Andy Bechtolsheim

Well I don't work for a living, I work because I enjoy it. But the point is, there's a lot of innovation and opportunity here and Moore's Law, at least for the near term has no signs of slowing down. So I actually would phrase it, and long term the prediction's a little more difficult, but short-term we actually are finally back on the Moore's Law curve where the last, let's just say 10, 12 years were really quite slow, where the market leader didn't have a lot of incentive to essentially improve their product very quickly. Whereas now with the advent of merchant silicon every other year there's a chip coming out that's twice as good as the previous chip, so this is unheard of in recent history of networking. And it really allows networking to keep up and to catch up with the demands on the server computing side because obviously, you know, faster Intel servers need faster networks to deliver faster results.

So all of these things go hand-in-hand but there was as risk at one point that the network just wouldn't keep up. If you think about it, it took 10 years from let's just say 2000 to 2012 from Ethernet to go from one gig to 10 gig in any kind of volume. Now it's going to take just another three years until 40 gig, maybe actually the highest volume thing in a data centre, and then a couple of years later it's going to be 100 gig. So we're seeing a very nice much shortened upward cycle that really helps customers to deliver much more bandwidth to the applications than the last 12 years. I wanted to thank you to the gentleman on my right here especially.

Fritz Nelson

He did say you were his favourite customer.

Bethany Mayer

Wait a minute. That can't be right. We're his customer too.

Andy Bechtolsheim

The thing about silicon is it really is getting more expensive every turn. A 28 nanometer should cost twice as much to do than a 14 nanometer and so on. And the only worry I would have in this whole business is that if it gets so expensive to make a new chip that people couldn't afford it anymore. That would be a problem. But so far there's no sense of that. So so far there's enough market size and the market's growing and people get a return on their investment they can keep justifying making those investments. And that's true for the chip vendors as well, also at the system level.

Fritz Nelson

So I'm going to move you down to your chair at the end. Thank you very much. Great job. Now I'm going to bring up Dave House. Now when Dave came to us as a last-minute addition to this panel I was like Dave House, I have not heard that name for a while. And then come to find out that Dave is the Chairman of Brocade, so I guess maybe I'm out of the loop or something like that but a few other people didn't know that either. But if you do remember Dave, he was the CEO of Bay Networks which was the company that formed when Synoptics and Wellfleet merged. And then that got bought by Nortel and then I think he took a little vacation and then they imploded. Or at least that's my version of the story.

Dave House

I spent a year and then I left and then they imploded.

Fritz Nelson

Exactly. You should have stayed. So thank you for joining us and…

Dave House

Doesn't Jay Leno usually sit down? You need a desk.

Fritz Nelson

I know. Mark, why don't have like a chair, a comfortable chair. I'm getting tired of standing up here. So I guess one of the things that I was trying to remember -- when we were talking before somebody mentioned Proteon and Bay comes up. What were you guys relative to Cisco in terms of size? I remember it being a pretty fierce head-to-head battle back in those days?

Dave House

We're back to history again. We started with history this morning; now we're back to history again. So Cisco was certainly larger, significantly larger than Bay. Bay became I think the big competitor clearly to Cisco in those days and that's probably why we were popular to Nortel.

Fritz Nelson

Right. So fast-forwarding to now, you're with Brocade. Tell us about your journey there and what they're up to.

Dave House

Well Brocade's an interesting company in an interesting situation. They're a data centre company. They have storage area networks using fibre channel and that's 70% of the business and they've got about 70% of that marketplace. But there's a huge transition taking place now with the cloud, with big data. Big data was always there, it just happened to be in the big banks and the big manufacturing companies and it was inside a big data centre which of course had redundancy in back-up and other physical locations and data lifecycle management and all that sort of thing. But it existed in a different kind of format.

Today we're finding big data everywhere and the data centre everywhere and the same kind of problems that existed in the classic data centre. That is the data centre was created when people observed that mainframes were going to go away and mainframes attached to a bunch of spindles on one side and several mainframes on another and we needed to attach servers to spindles. And guess what, that's east-west traffic, and that's where fabric was invented and low latency time, high availability, easy configurability, self-configuring, just plug in a box and it self-configures. Those are the things that were needed at that time in the 90s when fibre channel and Brocade was created.

Today we're taking that to the Ethernet world, because the future is about Ethernet and that is the dominant technology and that's what's increasingly in the data centre, but doing it using the things that we learned in the fibre channel space. And so very low latency, totally east-west traffic, noting hierarchical, easy to manage, easy to configure. Self-configuring, add more capacity, you just add more boxes and they self-configure. Self-reroute relative to failure; ability to handle redundancy; ability to handle redundancy between physical locations, your ability to keep your big data in multiple locations; and of course it's all about east-west traffic, low latency times.

Fritz Nelson

And Brocade acquired Foundry on the networking side. How did that go? I haven't heard much about Foundry which could actually mean it went really well, it was digested and we just don't know it?

Dave House

Well Foundry was a great acquisition because it was producing very high performance products and a limited set of customers but some very important customers in the federal government space, in all the three letter acronym [inaudible] agencies and carriers in terms of content delivery networks and very fast bandwidth dedicated kind of networks.

But because it had performance it provided a great level of expertise in the Ethernet space that we could take with our fibre channel space to create Ethernet fibre. So the focus today is on Ethernet fibre, the ability to handle these big data centres, the big amounts of east-west traffic.

Fritz Nelson

Now I asked Bethany and Andy about the threat of SDN to their business. How does Brocade look at it?

Dave House

It's an opportunity for us. We're still a small player in much of that space. We actually look at it as not being that much different than what we've ever done in our business. It is something that needs to be -- it's not a simple transition to get there. For one thing, as Andy pointed out, there's a thing called an installed base out there and we need to be able to evolve upon that. I spent 23 of my years at Intel and I learned very much how evolving the microprocessor forward in a compatible fashion, in a smooth fashion that was easy for the customer, is critical and it's got to be done in that way.

Fritz Nelson

Now at lunch we were talking about your own personal endeavours in the wine business. So what got you started there?

Dave House

Well at Intel, because I was the one guy that came out of the customer base -- I used to design mini computers before Intel -- I was the guy that salesman that wanted to talk to customers. So I always was at dinner and I was always handed the wine list and had to choose the wine and I used to give it to the salesman and after a while I started choosing it myself because I knew what I liked. So I got interested in wine; I built a house, I had a lot of land, I thought it would be nice to put a vineyard in. So I planted a vineyard in '98 and that was fun and we made our first wine in 2001 and now House Family Wineries are making some of the best Cabernet and Chardonnay in the Santa Cruz Mountains AVA.

Fritz Nelson

We're all wondering where our bottles are.

Dave House

Put House Family Winery into your search engine. You can buy it there.

Fritz Nelson

Okay. Search engine you say. Okay. Alright, well you can stay here. I'm going to move here. We're just going to keep a gap between those guys.

Dave House

You can sit down now.

Fritz Nelson

Is that going to create a problem with the mikes? Can I sit? I'll stand, it's fine. I think I'd rather stand. I get a little antsy if I sit. So we're going to just open this up as a panel. We're going to talk a little bit more about SDN and we're going to talk about the future of networks, what's going to drive some of these fast speeds even more, even less latency, even higher speeds and kind of the future and some of the things that Bob talked about this morning. But along the way of course, cue up your questions as well and we'll leave some time for that at the end.

So coming back to SDN, and anybody can jump in and answer this question, some of the founding members of ONF were Google, Verizon, Facebook, Deutsche Telekom, Yahoo, Microsoft and these are some of the people that have been the proponents of software defined networks. The publication that I work for, InformationWeek, did a survey of its readers asking about SDN deployment and it was I think somewhere around 4%. So my point is, this is kind of in our world a first world problem isn't it? When will we see SDN being…

Dave House

This is classic of any technology. I remember when Bob Metcalfe used to walk around and sing next year is the year of the LAN and then the next year he'd say next year is the year of the LAN and then it was next year. And then it was last year was the year of the LAN because it just happened. And any of these technologies come up in an s-shaped curve and we the technologists always think they're going to be here before they're here and then all of a sudden they're there before the incumbents -- it's there before the incumbents knew that it was really important.

Bethany Mayer

I thought that 2001 was going to be the year of video but that didn't really work out. It took a little while longer for that.

Dave House

But it got here.

Bethany Mayer

It did get here and what I would say -- so HP was a founding member of ONF, just to be clear on that one, and we think it's very…

Fritz Nelson

But you're not a first tier member apparently.

Bethany Mayer

We're not a first tier member? Okay, fair enough. Even so we think it's very important and we do think that it will be -- it is a big shift and I think that the industry unfortunately had kind of collated around a particular way of networking that I don't think was all that advantageous to the customer. And primarily it was difficult and only certified people could do it and when anybody needed to change anything it was very nerve-wracking because they didn't know if the whole thing was going to come down or not.

So I think the ability to allow it to be easier to change, to be quicker to change, more flexible, is very important, however we get there. And this is a way to get there. That's how we think of it.

Fritz Nelson

It sounds great but so few are doing it so what are -- other than everything takes time what are the challenges that have to be overcome? When I talk to IT managers, network managers, there's a fear that it's complicated and change is not good.

Andy Bechtolsheim

So even the 4% sounds a little high to me by the way. It's very, very early stages in SDN. And people can't even agree what it actually means, what are the real use cases. It started off as open flow and then it really dawned on people that open flow was just a device driver. That's just the interface between the controller and the switch, it doesn't do anything else. I think there's an emerging consensus now that more centralist management would be a very good thing, being able to administer policies across a whole set of switches whereas centralised control planes is a real challenge because if that thing goes down your entire network fails. So the original notion that networks survive because each switch is actually an independent entity independent of the others had some real value that actually gets lost if the whole thing becomes one centralised controller.

So to deliver centralised control, no-fault 100% reliable robust plan hasn't been done. You would have to scale to immense flows and lots of events and there isn't a product you can buy today that actually does this. So SDN deployment has been largely in research labs, universities, people at special use cases like tap aggregation is an interesting one, like people who want to tap a whole bunch of flows and they don't want to spend more money on -- what are they called these boxes -- the sniffer kind of boxes.

So that's interesting use cases but people are not displacing the networks they have been designed at any rate that I can see.

Fritz Nelson

Right. Now Bethany, you brought up video and I think one thing that happened there over time was we started to see -- I'm maybe overstating it -- but killer apps. Video conferencing, video chat. So from your point of view, what's going to be the killer app? Because I think to some degree a network administrator is going to need to see that compelling value proposition and a killer app?

Bethany Mayer

Well I think there are a couple of big things. One is cloud. Cloud is -- we have a lot of customers who either want to build their own private cloud or they want to use a public cloud or they want to do both, they want to have hybrid clouds. And to do that they're satisfying dev opps folks and they're satisfying their user base because of SAS-based applications and I think that right now what has happened is that their biggest -- the long pole in the tent has been the ability to modify the network to make that possible. So they all need to have some level of more agility in their network to be able to [solve] that.

But I think the other thing too is that we'll see a lot more movement of big data going across from server to server and across the enterprise and I think that will have an impact on how fast you can modify that network and what you do with the network. So those are some applications that are served present, that people have to worry about, that make the network a stumbling block instead of a help to the business.

Some applications that we've seen that are interesting to people and that we've actually developed some capabilities around have been security primarily. Being able to dissolve some of the security requirements into the switching fabric itself which has never been done before. And we tried to do it with, as an example, network access control. What we ended up with was a bunch of boxes sitting next to switches and that really wasn't helpful.

So there are some applications where if you could dissolve that capability, either its load-balancing is a good example or security into the switching fabric, things can be -- that's a very helpful thing for the customer.

Fritz Nelson

Now I want to ask you -- and I realise that there's a danger when I bring up an example like Google that we're talking about an outlier here. But Google is making their own switches using merchant silicon and putting a lot of weight behind the open source routing project. Does that help or hinder other efforts like open flow?

Andy Bechtolsheim

If I could comment. So Google is essentially a special case where they very early identified the need for very scalable networking. I think it was back in 2005. There

was actually an RFQ out from Google that was just one line which was they wanted a switch with 10,000 ports (inaudible). And the product didn't exist and barely exists today. But their conclusion was they're better off just going off and building their own switches and they have a fairly good-sized team, I believe it's around 300 people, that both design the software stack they run as well as operate the network.

Now Google of course has a scale in terms of their infrastructure that's unmatched by any other entity and nobody else has quite followed them in their footsteps. And people may have Google envy but what they're finding is it's actually very expensive to build your own networking stuff from scratch because if it breaks your network is down and then your website is down. So people do need a network in the cloud that never breaks and that's a fairly high barrier to entry whether you do it internally or come in as a vendor.

So what we see happening is there's now competition in the market that the prices that the large cloud people pay for networking are actually quite reasonable and we don't see anybody else thinking they need to build their own stuff to get it much cheaper. It's a reasonably attractive business proposition to just go with off-the-shelf equipment.

Bethany Mayer

The market is segmenting is what's happening, for now, and then it might be that folks are going to go more and more to the cloud and just utilise the network in the cloud. But for right now there's a segmentation between the cloud environment where we're just hyper scale and then the rest of the enterprise world. But I do think that the cloud is changing things because folks are going to shift more and more to service providers and to the cloud and then the question is okay then what happens then.

Fritz Nelson

I have one more question on this. Earlier today there was a gentleman from Cisco appear and he talked about what Cisco is doing with open daylight. Now I thought I saw other panel members roll their eyes or maybe it was just me. But the proclamation was it's an open standard developed and encouraged by Cisco and we would like others to be a part of it. Reactions to whether that helps or hinders software defined networking? They have a thick skin so you could say…

Unidentified participant

It is an open standard so that is true and I think there's actually a growing momentum behind this because there really wasn't a need in the market to have different kinds of APIs or other unique differences between vendors. I think the real question is and remains is Cisco wanting to make this the -- is this the standard or is there something else coming that is the enhanced proprietary version of that standard. So Cisco is famous for taking open standards and making it so complicated that only they can deliver it and I think that's what people are worrying about or wondering about. But open standards are good. Ethernet is an open standard. We all like it that way.

Bethany Mayer

From our perspective, so the open daylight forum which we actually are a member of, it's an open source controller is what they've been building primarily and they're looking at other things but basically that's the focus of it, that's what's been focused on. Personally our belief is that the northbound APIs and the southbound APIs need to be standard based. So you need to have a standards base programmatic interface to the devices in the switching infrastructure to be able to change them, to do things with them. And you need to have APIs that allow people to write applications to that network to then make those changes.

So open source controller is great. I don't know if anybody in the enterprise would really put it in their network, given of course the resiliency concerns that they have even with a controller, much less anything else. So it's interesting but again I think back to Andy's point, what's going to happen next with that and why -- what will change with regard to that open source so to speak.

Fritz Nelson

Okay. Henry, I want to get you back in the mix here. You mentioned in your earlier remarks about cars with sensors. So we're talking about these unbelievably fast speeds, these bigger networks, more capacity. Is it the sensors, is the Internet of everything that's driving this? Is that what's going to consume all this bandwidth in the future?

Henry Samueli

That's certainly going to contribute to the amount of bandwidth in the future because if you get literally trillions of sensors which could happen over the next couple of decades where everything in the world is going to be sensed and communicated into a network, you'll have a wireless interface on one side and an Ethernet interface on the other side. So that data will just overwhelm networks so we need to scale up obviously. So that is one component.

But then normal use that we're doing today as you drive more and more video into the network, more high definition content, if YouTube goes to ultra HD, then the bandwidth is just going to get gobbled up. So there are many drivers of bandwidth in the network but certainly sensors will be one of them over the next couple of decades.

Dave House

Can I just comment on what Andrew said earlier about Moore's Law and sort of the doomsday prediction of 15 years from now. In the 70s at Intel I started preaching about Moore's Law and about how the semiconductor -- that Moore's Law was going to solve all the problems and the next generation was going to be great. And Gordon stopped me and he says Dave, this is all true but I think about 10 years out I don't think we're going to be able to continue this.

And 10 years later when I was still talking about Moore's Law and microprocessors Gordon said Dave, I only see about 10 years here. And it became a regular thing at

Intel's strategic planning meetings that Gordon would give his prediction and Gordon would say well I see about -- but beyond 10 years I just don't see how we're going to get that. And it may be that -- by the way all along there were naysayers saying we're against this barrier, we're against that barrier. And as time went there was enough money spent and enough smart scientists that we got by that barrier.

And it could be that we're going to run into a firm barrier but I wouldn't count on it. I think the demand is going to be there and the consequences, the financial consequences, of us not breaking through would be so severe that there's going to be a real motivation. And so I think we can -- what we can say is we've got 10 to 15 years' visibility and beyond that we don't know how we're going to solve those problems yet.

Andy Bechtolsheim

I think the killer app with the [inaudible] is just cost performance. Specifically the cheaper network bandwidth gets the more people buy. And the reason is it's just a good investment. It's much easier to essentially overprovision networks to have spare capacity than trying to worry about what happens when you run out of capacity because then nobody can figure out what to do. So people are buying and putting in much more bandwidth than even we had assumed people would do a few years ago.

Dave House

And then they're using it all up.

Fritz Nelson

So Dave, I know you have some strong opinions about the future and what it holds in regards to healthcare and education. What are we going to see in this instrumented world?

Dave House

Well three things. Two very positive and one very scary. We're going to see incredible transformation in healthcare. If you think that the sensors inside your smartphone are amazing think of what happens when you start applying those sensors throughout your body. If we can put a chip in every dog why can't we measure the triglyceride and the blood pressure, why can't we monitor the activities of every individual, why can't we use that to better treat people, to lower the cost of healthcare, to improve the quality of healthcare.

Education. Education is just about ready to go through a major transformation. Bob talked this morning about [inaudible] and the big role that they will play but the combination of what's happening at Kahn Academy with supplying video, training then test comprehension and then send you a different video depending on your comprehension so that the smart kids go like this and the average kids go like this and people who didn't handle the prerequisites go back and relearn the prerequisite before they go through. So directing people through CK12 with textbooks that are non-linear in their motion. So rock star professors, the best explainers, teach everyone and the

teachers wind up being the mentors or maybe it's social networking and it's the other students that help explain. The transformation the network is going to make in education is going to be phenomenal and common core, a new standard that's coming in 2014 which changes the way students are taught is just enabling this technology transformation, very active in a number of areas.

Those are two pieces of very good news. Now the bad news. Security is going to get worse. It's terrible now. The government has declared that cyber security is our biggest threat. We've got North Korea with ICBMs and we've got Iran developing an atomic bomb but that's not our biggest problem. Our biggest problem is cyber security. People are worried about with all this information out there about me I'm concerned about my privacy. Well give it up, it's over, everybody's going to know everything. Now there's going to be government policy, political policy relative to who has access to that.

Right now Amazon and Google know everything about everything you do and the ads that pop up are all related to stuff that you have been looking at or you thought about. They already know about you. Guess what? Larry Page doesn't give a damn about you or any of that information. It's just a computer out there that knows about you. It's not people out there that are snooping into you; this is just a bunch of data and big data and databases that's marketing to a market of one. That same technology is going to allow us to educate to a student of one and that information that's going to be out there and everything is going to be known about you and the guy who can hack into it is going to know everything about you. It's the hacker you need to worry about, not Google itself.

The scary part about that is everything we're doing is layering on layers of abstraction. We've been spending the last 40 years abstracting up from the piece of wire to higher and higher levels and virtualisation and software defined networks are just another layer of abstraction that we're putting into the environment. And every one of these layers is a tunnel that people can go through to access things that they shouldn't have access to.

Fritz Nelson

There's somebody in the middle between Larry Page who doesn't care about it and the hacker who does. So a couple of weeks ago I was talking to an architect at All State and I said you know with these phones you could tell whether potentially I caused an accident or I didn't cause an accident based on the sensors and accelerometers and whether I was being a safe driver. That could be good for me because it could help me -- if I'm a safe driver I could be telling All State every time I drive and move. Or the opposite if I'm not or I did. So that's kind of creepy.

Dave House

Yes and the more we know about people's health, the more the insurance company, which is basically an economic engine which would like to be able to provide the lowest cost insurance for the people who cost the least and charge a lot to people who cost the most, will have more -- if they have access to that information and they're

allowed to price, then insurance is basically as we know it today winds up going away, people who need it won't be covered. The social implications of this are phenomenal and the policy issues on the political side, the government side, just outweigh basically everything else we're talking about. That is going to be the big issue that society is going to have to deal with in the next 10 years.

Fritz Nelson

And by the way, after I told him that he said how did you know we were working on that.

Bethany Mayer

I guess my comment would be with regard to what this is going to do, I think connectedness is going to have a very dramatic impact on increasing the quality of living, quality of life for countries around the world. I think as you get more connectedness you get more education and as you gain education in a population you increase their ability to develop their country etc. So I think that connectedness over the next several years and especially with Ethernet continuing to be more ubiquitous in more countries, it's going to have a dramatic impact on the quality of life across the world. So I think that is another big aspect of why networking is so important and what it means.

Fritz Nelson

Questions from the audience?

Alan Weissberger

Alan Weissberger, IEEE Communications Society, Santa Clara, California, USA. That's what I was asked to do. A question primarily for HP but I'd like other panellists to jump in as well. We see a tremendous amount of confusion in what you're referring to software defined networks or software controlled networks which let me simply define is separating the logical network from the physical network. We see the pure SDN with the rigid separation of control and data plane and use of open flow as advocated by the Open Network Foundation in Stanford University. We see an overlay model where essentially you have two control planes. We see company-specific versions of network virtualisation like VMware and then finally we see people claiming the support of something that doesn't exist, the [inaudible] network function virtualisation specification or standard. And in fact there will be no standard from that activity, rather there'll be inputting contributions to [ITU] study group 13.

So the question I have is with all this confusion isn't this whole market in danger of market segmentation and churning? Thank you.

Bethany Mayer

So I'll start and I'm sure my other folks want to talk about this. So yes, there's confusion, I would agree. I think that people are just learning about this and understanding what it might mean for their company and their organisation. I think

that different companies within the industry have different definitions of SDN. I agree with that as well. But with all things that are big changes, that are sea changes, they're going to shake out. And I think the value of being able to have some more of a centralised control mechanism for the network appears to me, as I talk to customers, to be of a compelling nature for them. They really want this and they're really tired of hiring lots and lots and lots of people with very specific credentials and paying them a lot of money to hopefully hold up what they consider to be kind of a mess.

So you're right. There's going to be confusion. I'm not sure if it'll cause segmentation. I'm hoping frankly that with the use of standards that won't come to pass and so that's why HP embraces those standards so heartily. But this is valuable to all the customers I speak to. They are very interested and want it to happen. So the question is we as vendors have to do our best to support them getting it in a way that is standards based and open and flexible for them.

Andy Bechtolsheim

I would add that centralised management and orchestration I think is the number one and number two and number three use case [inaudible]. Funnily enough this has nothing to do with open flow which faces some technical challenges in terms of size of cam tables on current silicon chips which actually make it really hard to implement. So the centralised management aspect is an OpEx reduction which people desperately want. We haven't seen too many people who wanted to try out something completely unproven in network and see if that sticks.

Antony Savvas

Antony Savvas, computerworlduk.com. For good historical reasons obviously the US has dominated the way we actually develop networking over the next 40 years but obviously there are more network engineers coming out of China, India, Korea and Africa every year than anywhere else. Surely the next 40 years of networking standards are going to be decided by those continents rather than over here?

Andy Bechtolsheim

Are you talking about the standards or the vendors?

Antony Savvas, TechWorld

I'm talking about the general markets because I would have thought that in those continents, we heard from Tata that most of their customers at the moment are outside the area they come from but those areas are looking at wireless to connect their people, particularly the poor ones. So with the engineers they have locally surely they're going to be looking at ways of delivering solutions from their side of things rather than looking towards the US and Western Europe? You only have to look at the way the likes of Samsung have knocked out Motorola, Nokia and Ericsson in the mobile space. I'm just wondering whether you're afraid the same thing's going to happen with the fixed line side over here?

Andy Bechtolsheim

That's a very complicated question but let me try. So obviously the networking market divides into many, many segments. You have Ethernet on one side, you have LTE wireless on the other side that is dominated by very different vendors by the way. Cisco was not successful as an LTE company but it happens to dominate Ethernet. And vendors have an installed base, they have momentum, they build on that, they focus on it, invest in it. There's high barriers to entry, either from a software or a technology perspective to be successful in any one of these segments.

In the case of my company Arista, we focus just on the data centre. Now we looked at wine closets, other things, and said that's not for us because there's no growth there. HP is doing a great job. You have to look at this very narrowly to define how you even can get into the market. And it was this focus that allowed us as a new start-up to become the number two vendor of 10 gig and above in a data centre. But it takes an unbelievable amount of focus and attention to every single market segment to do the best product to win against the more established vendors. So it's open to other competitors but it's not easy to get into this.

Dave House

There's been innovation around the world. I don't see a lot of the innovation coming out of China right now, I see a lot of development and product and delivery of products and cost leadership but if you look at the world Europe has been the leader historically in cyber technologies. So innovation isn't just coming from the United States. I think one thing the network has done is created the death of distance. So where you are really isn't that important anymore. Innovation can come out of any place and it's the culture -- how do you create a culture that creates innovation. We had a panel on that earlier today. But it's not geographical, it's cultural.

Henry Samueli

And the other point to make is that if you look at the standards bodies which define all the future networking standards, there is more and more participation from international companies. Maybe 20 years ago it was dominated by Europe and the US but look at any IEEE standard, you have companies from everywhere around the world contributing to these standards and taking their participation in these standards very seriously. So I think that will help to create standards that are amenable and adaptable for requirements that are unique to countries around the world, that standards are meant to be flexible and they will add options that will accommodate unique needs in different countries.

So I don't think there's going to be an issue there. I think you will see international participation to drive these standards in the future.

Fritz Nelson

I think we have time for one more quick one. Rick had one up the front.

Rick Merritt, EE Times

Thanks and great panel. Rick Merritt with EE Times. So I guess I wonder in the next big season of Ethernet who's going to win? The sharks with their [ASICS] or the ducks with their merchant chips?

Andy Bechtolsheim

Merchant chips triple odds.

Bethany Mayer

We take part in both, thank you very much.

David House

Yeah they both have their roles.

Henry Samueli

I vote for merchant chips.

Bethany Mayer

And we have a great partnership with Broadcom.

Fritz Nelson

Great, any last - I think we have one minute left. Great, well - oh we have one down here. We can do it real quick.

From the floor

Who is going to build a vertical appliance which are able to manage all the applications on the networks? Is it going to be HP or Cisco or is it going to be the switch manufacturer like Arista? So vertical appliance, is it a real market and is it going to be quite embedded with the network?

Andy Bechtolsheim

You mean like the whole data centres and appliance, like server storage networking integrated?

Fritz Nelson

The monster box

Bethany Mayer

So we're not creating the monster box. We've developed a philosophy around what we call converged infrastructure and it's more than a philosophy, we do a lot of R&D work in this area. And the idea is to intelligently integrate technology in a way that

allows a customer to then spend less time on the infrastructure and just kind of maintaining it versus doing other things like maybe innovating for their own company.

So we do a lot of integration. If you look at our switching technology, we have switching technology integrated into our servers, we have switching technology integrated into our storage devices. I'm very comfortable with that; that's part of what the customers want. With regard to HP thought, we can also and do all the time exist in a completely heterogeneous environment. So they can choose any one of our products and use it with others because of our standards.

Andy Bechtolsheim

I would say there's an argument that the virtualisation vendor let's just call it has some defining role in managing everything underneath that layer. Now it hasn't been quite delivered to the market this way but it's logical to assume that things are in fact moving up and do abstract the underlying pieces more and more.

Fritz Nelson

I thank the panel for a great job.

[End]