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Anna Villani: Hello everyone and welcome to Optical Trends Now. A webinar series featuring perspectives from key participants in the optical communication industry. This webinar includes participation from Cignal AI as well as ADVA optical networking. Today, the speakers are going to discuss the current optical trends among cloud customers large and small. And what impact hard work and [inaudible 00:00:38] having on industry participants.

They're also going to talk about 5G wireless and a little bit about the component supply chain. We've got some interesting people so there should be no shortage of things to talk about. I'd like to introduce today's participants. Our first speaker is Stephan Rettenberger. He is the senior vice president of marketing and investor relations at ADVA.

Stephan Rettenberger: Hello Anna and hello ladies and gentlemen. Thank you for joining.

Anna Villani: Joining Stephan is Uli Dopfer. He is the chief financial advisor at ADVA.

Uli Dopfer: Hello everybody and welcome from my side.

Anna Villani: Finally, our third speaker is Andrew Schmitt. He is the lead analyst for optical equipment here at Cignal Ai.

Andrew Schmitt: Thanks Anna and thank you everyone for joining.

Anna Villani: My name is Anna Villani and I am a software engineer here at Cignal. I design, organize and operate the front and back of research infrastructure here, including the technology behind this webinar.

Before we begin, I'd like to explain the webinar interface to you. If you're here listening you've already joined the webinar and it's browser based so there is no downloading required. Presenters may be sharing their screen at some point during this session to present slides, but that actually won't be the case today as it will just be an audio discussion.

All participants are in listen only mode and the session is being recorded so that all registered participants will receive a full written transcript of the event within a few days. We want to make this an interactive event and participants are welcome to ask questions at any time.

To the right of your screen there should be a question mark near the top in a gray side bar. Simply click that button and type your question. Your questions will only be seen by the presenters. We will address as many questions as we have time for at the end of the session but also may cover some of them as the event takes place.

Welcome to all of you and thank you for joining. I'm now going to pass the controls to Andrew Schmitt.

Andrew Schmitt: Great. Thank you Anna. Thank you Stephan, Uli for joining today and for having a conversation. I'd like to just start off and talk a little bit about ADVA. I consider ADVA to be the original DCI company, before DCI was cool, this was something that you guys have been doing for a long time. Particularly with some of the small and medium types of enterprises. Before the rise of major purchasers like Google and Amazon and Microsoft.

Can you talk a little bit about some of the things you've learned from being in this business for so long and I guess, as we've started to see some of these big cloud computing consumers of optical hardware emerge, how is it changing your business? How is it changing the market from your perspective?

Stephan Rettenberger: Good question to start it off. I think it was actually you in one of your reports who called us the original DCI company, I do like that label. ADVA started in 1994 when Al Gore said, "We're gonna build the internet." And I guess that was probably also the birth of a lot of the optic industries as we have seen them evolve. Most of the industry participants at the time, jumped into the long haul space. I guess, there the WDM technology made the biggest difference in terms of lowering the cost per gigabit mile, but our company co-founder and still CEO, Bryan Protiva said there must be an application elsewhere, where the technology could be used. And with exactly what you said it was interconnecting data centers.

At the time, it was mainly the Fortune 500 guys and within that group, predominantly financial services that have the need for disaster recovery solutions. So, primary and the backup data center to graphically disperse by a couple of miles and you would back up the data that you generate in the primary to backups in case there was a failure you could retrieve it without having lost any data.

That market, quite interesting actually, has evolved since. I would say there is no larger scale enterprise that doesn't have some sort of, not only a disaster recovery, but a business continuity implementation. So, that's not just backing up data. That's running two synchronous data centers that are only a few miles, but in some cases tens of miles maybe more than a hundred, miles apart. So, both data centers are running synchronously and if you lose a sit you would not lose any data and you would even have any application down time. So, all your online backing, all your online trading, online reservations, whatever else is happening is still up and running.

I guess the difference between that business and what has emerged and has created some hype around DCIs that very often these business continuity solutions involved industry guys like IBM, the form of Brocade, EMC, etc. These networks you also have exotic protocols. At the time it was ESCON, then FICON,

fiber channel. Fiber channel currently at 16 and 32 gig is still an important protocol in that application which is not really that much supported by classical metro type gear.

The hyper scale. I think that was the second part of your question. How have they changed the market? I guess they appreciate just like they fortune 500. Solutions that are very cost, space, and power efficient, that are easy to you, scale nicely. Again, they don't require some of the features but they value simplicity. The fact that ADVA had been doing this for more than twenty years, I think it also gave us a headstart with hyper scale.

The big difference is that, of course, the purchasing volume of any of the big cloud guys is significantly larger than anything in the fortune 500 community would typically happen. They typically just care about big fat ethernet pipes. So, 10 gig E, 40 gig E, 100 gig E, soon probably some 400 gigabits science coming along.

So, volume, pure data throughput, and the necessity for Ethernet only is the big differences. What is interesting to see is that some of the value at these places just like encryption, etc. Which we thought was initially mainly a private enterprise specific requirement but are now also seeing greater level of interest in the hyper scale space.

Andrew Schmitt:

We keep track of how much the hyper scale operators spend on optical equipment and, in North America, its approaching 20 percent of the entire market. They're now a very significant source of spend in the optical market. Much larger than all the enterprises put together and they're about on par with what the cable MSO spent in a given year. So, they're a significant source of spending but they're not bigger than, lets say, all of the incumbent operators.

When you look back to your smaller traditional DCI customers, I would imagine some of them are moving more and more of their computing loads over to Amazon AWS, Microsoft Azure. Is that changing the kind of transport equipment that they're purchasing from you? Are they changing the kinds of networks that they're building as they move more of their workloads into the cloud?

Uli Dopfer:

These tradition enterprise customers. For us, it's mainly financial services, strongly dominated by financial services, global financial services. But, it's also increases amount of other fortune 500 industries like traditional industries like, car industries, but also health care, media. So, I guess what we have seen, the revenue streams or the demand is still very solid despite the move to the cloud. I guess there is a trend that companies try to be in control of parts of their own network. Knowing what encryption is in the network and managing encryption keys is important. Security is a big, big topic for many of them and that's why they continue to build their own networks and increase bandwidth, and purchase their own equipment around these networks.

Stephan Rettenberger: I think I may add to that. That's actually the mixture there. The private cloud where you have the mission critical stuff, in your own network, very security, sensitive and you will be in control of your own destiny. Whereas certain things you move into the cloud is typically an addition. So, the public cloud is typically an add-on to the private one you run and expand as you grow.

Andrew Schmitt: I see. So, they're not necessarily reducing their private cloud construction. Its just the growth is moving over into the public cloud and they still maintain those internal networks. Lets say Fidelity. Fidelity's based here in Boston, it's a big financial services firm. I imagine they must have significant data center investments. When they want to build a optical network for disaster recovery. Or, lets say Goldman Sachs is doing that in New York, how do they do that? Do they work with some of your resellers? Do they have their own internal people? When you're selling to some of these smaller companies, what role do your resellers and that part of your business, what role does it play in helping them build these things.

Stephan Rettenberger: There's typically two routes to market. We refer to them as the make or the buy solution. The make solution is really only possible in markets where dark fiber is available. In those cases, the financial service institution may choose to go out, lease dark fiber, and then approach us or one of our evaluated resellers to secure and purchase the optical equipment, and then build and operate that network themselves.

Especially in markets where dark fiber is not available or the financial services institution does not want to dedicate IP resources into operating a network that may go into a buy solution and just let a provider like a Verizon Business, like a T systems in Germany, and let them build the network for them. They then just lease the network from the operated, still a private enterprise network. There is only one customer traffic running over that network but its being built and operated by a communications service provider that specializes in building networks.

We have examples were actually some of our customers tried to do both. So, have 50 percent of their installations managed and built themselves and the other 50 percent outsourced to a service provider. So, its multiple ways to reach the same goal of having a highly available, secure, ideally encrypted private network. Do it yourself, get the system vendor involved or a service provider involved.

Andrew Schmitt: Alright. Why don't we move on because we have a lot of interesting topics to hit here. I want to ask about MRV. You guys have completed the acquisition. There was some discussion about what that was helping bring to ADVA in terms of scale. Can you give us an update on what's happening now? How is your business changing and what impact is it having on ADVA?

Uli Dopfer: We completed the integration of the MRV. The MRV is now fully part of ADVA. Our main goal is to achieve some savings and not to lose any of the customers. I guess we totally achieved. We see first cross selling successes. One of the most important things is the good gross margin that MRV revenues are contributing to our P&L. It also helps us to be much stronger in Asia-Pac, if you look into our regional revenue distributions. This is all good, and thanks to MRV, we are an even stronger player in the Ethernet space, so I guess all good for now, and we should see more cross-selling successes in the future. It was a very successful acquisition thus far.

Andrew Schmitt: Anything to add, Stephan?

Stephan Rettenberger: No. I guess there's also a part of an industry consolidation that is necessary. MRV is an optical plus Ethernet player, similar to us. They had slightly stronger revenues from the Ethernet side, a little bit less from the optical, in terms of their percentage and the split. This is why I think now we're definitely in the top market share bucket here for Carrier Ethernet solutions. Like Uli said, they had some very profitable business that we were able to save and leverage inside a big organization like ADVA. Different regional exposure, with more strength in Asia-Pac, so the thing has been highly accretive very quickly, and we're quite happy that we made that move at the middle of last year.

Andrew Schmitt: Okay, all right, so accretive being the key word there. Let's move on. I want to talk about wireless 5G and front haul / back haul. This is an area that we're going to be driving more resources to in the next year in terms of trying to size the opportunity.

The only thing that we can say definitively right now is that it's going to be really big. It's a huge opportunity for optical transport and providing all of the bandwidth to these 5G radio towers. It's an order of magnitude increase in terms of bits going to and from the radios.

I've been in this business my whole career. This is one of those rare rip up and replace moments where the operators have to go in and just completely redo and rethink what they're doing in terms of transport to the 5G remote radio heads.

What's ADVA doing to capitalize on this opportunity?

Stephan Rettenberger: It is definitely a big industry event, if I can call it that way, that will have big, positive impact on the optical networking industry. I think already, with the move from 3G to 4G, we have seen a significant expansion in the fiber to the tower build outs.

I had seen some data at the time from AT&T where they were saying from 20% of the mobile towers being connected by fiber going to 80%. I think, 5G now is not only more fiber to more radio heads, we're really talking about going from

4G to 5G predominately an intensification of radio heads. Again, many of them being connected by fiber, which means there will be a lot more fiber optic transport equipment in the front haul and in the back haul.

Our CTO likes to describe a 5G infrastructure as an optical network with radio heads at the end. That's probably a bit of a one-sided illustration, but I think, from an optical networking industry perspective, it's not a bad picture to paint.

It's clearly not only the optical capacity and the need for additional fiber build outs, it is also changing the way the operators need to create and deliver services.

I think that's another technology pocket where ADVA is active. It's the whole virtualization environment. Services in the 5G environment will have to be created a little bit ... well not only a little bit, probably a lot faster, and ideally, universally and globally.

I think a transport-centric approach with a server capacity or capability at the end, where you can then via mouse click, via web portal, et cetera, turn on and add services globally, universally, very quickly, adding virtual network functions will be very important. Our Ethernet portfolio with the Ensemble virtualization is playing an interesting role here.

Last but not least, I think that one topic that's often overlooked by the folks at focus and optical networking only is the need for much better synchronization.

We're talking new technologies, where end devices are talking with multiple radio heads, and the precision requirements for synchronizing these radio heads are just orders of magnitude more stringent than what we had in 3G, and also significant more predictable than what we've seen in the early 4G developments.

Andrew Schmitt: Is this an area where ADVA is devoting additional R&D? To do these things, is this just a sideways move for your existing hardware and software, or is this an area where you guys are making investments?

Stephan Rettenberger: We have made an investment. I think it has been noticed in the market, maybe not by everybody, but in 2014, we bought a company, Oscilloquartz. At the time, the number two in the market for synchronization solutions.

We've, in the last three and a half years, have completely redone the entire portfolio. I think it's the fastest growing sync product in the market.

It's a small revenue contribution to all of ADVA, but it is a strategically important technology that also is relevant in the Carrier Ethernet space when it comes to delivering the timing at the end of the network, as well as in having a sync aware and true time sync transport in the optical networking field.

It's a third technology leg that we have invested in that is growing very rapidly. Again, in the 5G environment, it's really only two companies that are doing it well. We're one of them, and we're excited that 5G is pretty much putting all our three technology legs in our bucket that we've invested in together as strategically important ingredients to make that type of network work.

Andrew Schmitt: Let me make sure I understand this. The three areas are optics, NFV, timing?

Stephan Rettenberger: Correct, yes.

Andrew Schmitt: Okay, got it. Let's move on. Another thing I wanted to talk about, Microsoft, Inphi, ColorZ and ADVA. This was at OFC a few years ago ... Every OFC has one huge blockbuster announcement that everyone talks about.

This was a big, big announcement. It was very disruptive when Inphi announced they were going to be providing the ColorZ direct detect 100G solution to Microsoft.

There were a lot of naysayers at that time. I don't know if people remember - they were saying it wasn't going to work. Lots of people looked at it. It was impossible. Almost, I think a year and a half later, we've got 30,000 units shipped into Microsoft from Inphi of this direct detect 100G solution. It's been a pretty major success considering there's one customer.

But ADVA was the partner to provide all of the common equipment that was the underlayer for this transport. What do you see for the near and long term trends for direct detect?

This technology has been successful at Microsoft. It hasn't been that successful outside of Microsoft. Is that going to change? And as we go out in time, what's going to happen with the viability of directly detect technology, in your opinion?

Stephan Rettenberger: That's a very good question, because I think there's multiple reasons where people think it may or may not have been adopted outside of this particular use case, but the larger picture around direct detect ...

I think, we can even take it slightly more general. There are applications in the optical networking space where it does make sense to look at the inter-data center technology space.

A component that has originally been designed to go maybe just two or three kilometers, is there something with those components that you can do to extend the reach to typically up to 80 km? And by doing that, can you tap into that component industry that is mass producing something very cheap and plentiful, and leverage, let's say, the top 20% of that yield to go the longer distance?



We've done that a few times in our company's history. A few years ago, by taking the 4x25 gig client interface and building a 4x28 gig, 100 gig metric solution where, together with Finisar, which was also commercially a really nice success for us, and our customer base just really likes those very cost-space, power efficient solutions that allow them to build up to 80 km point-to-point interconnect.

I think the Microsoft use case ... and I can speak about it because Microsoft's been very open in the public domain about that ... They were trying to do exactly that. Rather than building one monster hyper-scale new data center, they were trying to connect several smaller properties.

Those were all space and power constrained, and they're saying, we can interconnect them only with the same technology we would normally interconnect rows of racks on top of rack switches inside a data center, so it would have to be extremely space and power efficient. This is why they were going down the direct detect 100G optics route.

Now with that interface, that was originally not designed to go a long distance. You need to put additional functionality in the line system. So you're removing some of the cost and the power consumption that you would have with coherent optics, and you're moving some complexity back into the line system. I think, end-to-end, there was a really good business case for all parties involved.

A year ago, when this was presented at the conference, there was a vote in the audience, "Wouldn't it make sense for other customers to also adopt that scheme?" And there was a strong majority, "Yes, absolutely." There's an interesting thing to do.

The only caveat was that, I guess in the early days, Microsoft consumed all the capacity that Inphi could provide. That may have changed since. I don't have much insight there, but I think it was pretty much a supply constrained environment for a while.

Andrew Schmitt: All right.

Stephan Rettenberger: Going forward, is there another direct detect generation after the PAM-4? I would say, "Absolutely, yes."

I think, for that distance, there will always be a subset of the market, an application that especially our customer base is active in, where also future higher speed direct detect solutions will have a credible commercial play.

We will keep our eyes open and work with our component partners to find the next big thing in that space.



Andrew Schmitt: Somewhat related to this, when you look at what some of the cloud operators are doing, and specifically, this case with Microsoft and Inphi ColorZ, is they are pulling the optics directly into their layer two switches.

Specifically, they're putting the ColorZ optics directly into the Arista equipment, and in the process, they're eliminating a lot of stand-alone optical equipment. There's another cloud operator that's been doing this via purchasing Acacia AC400 optics and building their own equipment, or they're buying CFP2 DCO's and putting those into their switches and routers.

You sell the common equipment for the ColorZ application, but how do you view this move to putting the optics directly in the switch? Is this a business model that you can adjust to?

Stephan Rettenberger: I think, overall, having been in this industry more than 20 years, it's actually something that's not so radically new. Even in the 90s, and the days of [inaudible] we've had line systems with colored optics, the old Nortel systems having four wavelengths going over the amplifier. Siemens had a solution there. Even mixing and matching some of the OC-192 over what was, at the time, probably the first optimized system, really.

We've done some work with Juniper in the past using colored optics in their PTX routers going over FSP3000. Cisco had offered IP over WANs. I think as a viable option, that colored WDM optics inside a higher layer or some terminal equipment going over somebody else's line system has been around and commercially available for a long time.

The change now is that, as you said, these hyperscalers are probably more open to that approach, and they make up to close to 20% of the optical networking market.

For the first time in the history of the optical networking market is maybe a bigger group and a bigger volume that goes down the tap, but it is still a subset of the market that is embracing that architecture and I think, for us, having had a very credible and extremely open approach always to that solution like we did with Microsoft. We're very happy to entertain that architecture. We then find a solution that consists of those ingredients. I don't think it will dominate our revenue, but it is a subset also of the applications that we serve and architecture that we support, and I think it is a nice add-on to the business that we have. Does it cannibalize a little bit of that market, the terminal market especially? Yes, but I don't think for ADVA that is a big problem because we've always supported it and it's an incremental addition to the revenue that we already have.

Andrew Schmitt: Okay. Well, we're running out of time and I want to make sure that we have time to get to questions that are coming in. Again, if you have any questions, go ahead and put them in through the interface.

Let me jump to the one last question that I had before we move on to the audience. And that is stand-alone compact modular systems. This is the term that we use for what people call pizza boxes. These are hardware systems that allow operators to disaggregate how they build their networks where the transponders are separate from the ROADMs and it's separate from the common equipment. And ideally, these operators can then start acquiring components from different vendors and stitching them together.

When we look at the systems that are coming from Cisco, Ciena, ADVA, Infinera, there's not a lot of differentiation and operators are talking about using disaggregated hardware. Do you view hardware disaggregation as an opportunity or a threat?

Stephan Rettenberger: I think there's probably elements of both in there. I would say the threat that some of the transponder business for the optical networking system vendors will disappear by having optics going directly into the data centers, which as we just discussed there in the previous question. But the next question would be who out of the remaining optical system vendors is the most open that can handle easily that open architecture, and I would say in that case we do have an advantage. I think some of the vendors have much stronger vertical integration, have invested in semiconductor technology, ASIC development, etc., and I think they have a vested interest in absolutely and always selling their own terminal equipment.

So while the lip service is open the actuals reality is maybe less so in terms of how open they are and willing to entertain those architectures. I think we could possibly see a positive movement towards our direction. How far this aggregation will go? Will people really go all the way to take a ROADM out of a line system and disaggregate those components further? I guess that remains to be seen because you're adding more granularity to the things that you're buying and you put more system integration responsibility onto your own shoulders, which may or may not be the right mix for every of these operators out there.

We could probably talk about Voyager and some of those other disaggregated consorts where you see, yes, the interest is there but the commercial traction may or may not really come through as expected.

Andrew Schmitt: You mentioned Voyager and that's actually a question that we got out of the audience. ADVA is announced as the distributor for the Voyager. How is that going? What can you share about that?

Uli Dopfer: So I guess it comes back to us entertaining pretty much every possible architecture and Voyager is yet another ingredient in our tool box. I think the big difference for Voyager, from our perspective, is on a technical front. It includes some layer 2 functionality with the (Broadcom) Tomahawk chip that's included. And of course it is a different commercial model, so the operator will have to buy the hardware. They will have to buy the plugs from somebody else.

They will have to buy the operating system yet from somebody else. Typically, our line system, our network management solution, possibly some system integration services from us, and I guess there's a few folks that are interested in that because they like the openness of the system. Or they like the integration of the layer 2 two functionality. Or they may have the Cumulus operating system already inside the data centers and want the same look and feel and operational feel for the technology that interconnects the site.

So there's reasons why people are interested in Voyager. Have we seen much commercial traction yet? No. Do we believe it will dominate the DCI market or our revenue? No. I guess Voyager is a white box response to something that is also served also fairly well by a lot of DCI-specific developments that probably four or five very credible vendors have made to building a good DCI-specific box. So I think it will be an interesting option but nothing that will really dominate this.

Andrew Schmitt: So easy question for you then, Stephan. I guess one way you could say it is the reason you're acting as a distributor for the Voyager is because it's representative of ADVA as being a company that's open to all kinds of different solutions and not exclusive to selling your own hardware. Is that ... that's how I would kind of characterize it.

Stephan Rettenberger: I mean that's definitely another proof point, a validation point that we really mean it when we say open. We are open. And again, there's two technical functionalities that are different from what we do with our CloudConnect platform. If people want that different functionality, the cumulative operating software with a layer 2 functionality, this is something that we can provide through the Voyager platform.

Andrew Schmitt: I think we've got time for one more question here. ADVA's Ethernet Access device market. After that Overture acquisition, how is NFV changing your business model? Is there still a market for stand-alone ethernet access hardware in the future?

Uli Dopfer: I guess there's definitely a market for stand-alone; if you look at the addressable market, we talk about probably a billion US dollar annual. NFV's definitely changing. Changing the game because the edge is now not only physical, it's virtual as well. And the market is converging with the adjacent market for access switching and routing. So actually our market gets bigger as we speak and so you could say that the total addressable market almost quadrupled thanks to the VNF.

So I think it's a good thing, but we definitely see also customers who continue to only buy the hardware-based solution, but the trend is clear.

Stephan Rettenberger: The classical, traditional, plain vanilla EAD business continues, but I think that market is not growing much. But as things are becoming virtualized, I guess you

could say switching routing, you can get those functions as virtual network functions. And therefore, those adjacent markets, the more transport centric EAD versus the more switching routing layer 2 to layer 3 type of access technology, you could build a fat pipe with some server capability at the end and then just add everything else that you need as a VNF.

We believe it's a very attractive service model going forward. We believe the service providers are understanding better and better what benefits there will have for them, and so, yes. We like to think of it as a physical and virtual packet edge market where EAD's a solid foundation for a fat pipe that is needed to deliver it with a good guaranteed performance. All kinds of virtual network functions.

Andrew Schmitt: Okay. We're over time but I have one more question I think is a good one, and I'd like to get to it. Maybe you can address it quickly.

If you look at the revenue from the Cloud operators, specifically for ADVA, this has been a both a feast and a famine. Can you talk about what the purchasing life-cycles of these large Cloud operators look like? How often do they rotate their spending? And as those customers become more mature, are they going to change the way they build their networks? Are they going to change the way they buy equipment and become more like the incumbents?

Uli Dopfer: Well, that's a good question. So we have a few years of experience with these guys and we saw some really great quarters. Maybe 2016 was a little bit distorted by the so-called "optical super cycle." We probably saw some overbuying there.

In general, I guess, the business is not quite as visible as with the traditional guys. It's probably also not quite as sticky, but I guess what is most important for these guys is the credibility as a supplier in terms of innovation, response times, the ability to deliver, and also quality. This is, I guess, very important to be invited to the table there.

Actually, we've seen a lot of interest strongly increasing recently in some of our newer and other technologies. So that's, I guess, for us the opportunity going forward with different products, new technologies. Get back in this game on a larger scale.

Andrew Schmitt: Okay. Anything you'd like to add, Stephan?

Stephan Rettenberger: No. I think, as Uli said, slightly less visibility. Not quite as sticky because the networks tend to be simpler. But in terms of the ability to innovate and respond quickly, deliver, etc., I guess, yeah. It's important to have a seat at the table and be seen as one of the possible options there. And just recently options have become fewer, so I think it's definitely for us an interesting market where we

continue to plan to grow and invest heavily in having a competitive solution at that table.

Andrew Schmitt: You talk about fewer options. If we had another half hour, I could bring up the Infinera and Coriant merger, but we don't.

I want to thank both of you for joining today and, at least, helping kick-off a new series here at Cignal AI. Lots of interesting conversation.

Everyone who is in attendance and those who registered will get a copy of the replay as well as a fully written transcript. I know I always prefer to read the transcripts than to listen, but I know people have different preferences.

Thanks again for joining Stephan, Uli, and I hope to see you both soon.