Interview with Scott Weinstein

Vice President ANS PLM Business Strategy at CommScope

By Melissa Cogavin, Managing Editor, SCTE

With the announcement that CommScope has reached a new milestone with Comcast in the development of its DOCSIS® 4.0 Full-Duplex DOCSIS (FDX) amplifiers, heralding generated speeds exceeding symmetrical 4Gbps in lab testing, Broadband Journal talked to Scott Weinstein to hear more about their news.

What is DOCSIS 4.0 and how does it differ from previous iterations like DOCSIS 3.1?

It's an evolution from DOCSIS 3.1 which delivers significant gains in upstream and downstream speeds, high reliability, high security and low latency; no need to bury cables or dig trenches. It mostly works through existing HFC infrastructure that's in the field, depending on which flavour you choose, as it requires a little more replacement on the ESD side versus on the FDX side.

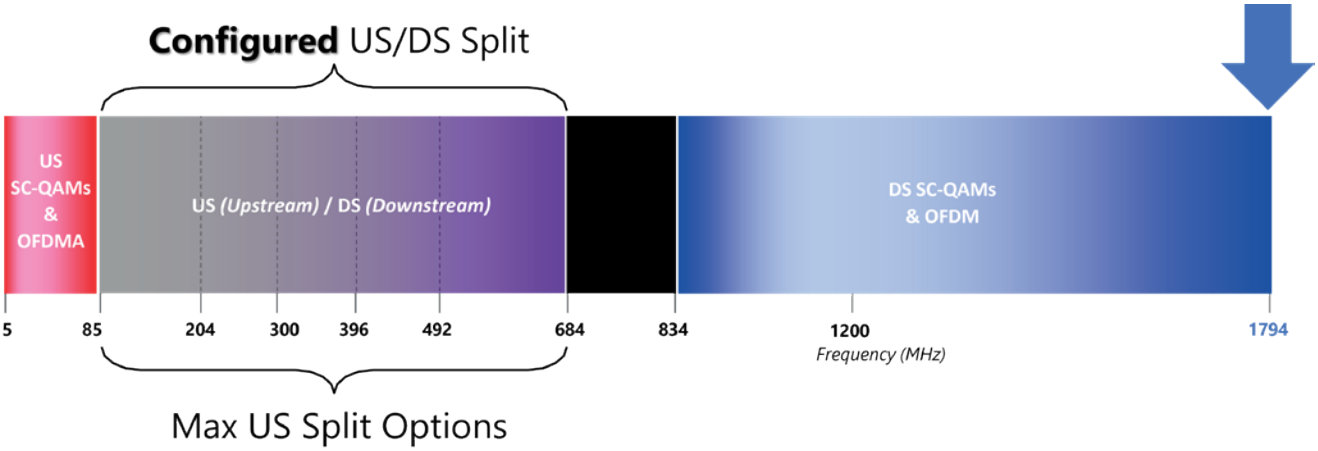
How will operators benefit?

They will use that same cable network, which has evolved over quite some time; DOCSIS 1.0 was first introduced in 1997 by CableLabs, more than 30 years ago now.

There are two different paths, both with the same objective. The first is called ESD (Extended Spectrum DOCSIS) and that's more of an evolutionary path, working with existing technologies that are being extended. It's taking the spectrum usage bandwidth from 1.2GHz to 1.8GHz. It uses a traditional system, the upstream and the downstream occupy different parts of the spectrum. That's the same that has been done since DOCSIS 1.0, all the way through DOCSIS 3.1. The only real difference is that you go to 1.8 instead of 1.2GHz for D4.0 with ESD. CommScope actually introduced the ESD concept in 2015, and then it sat on the shelf for a while until operators eventually approached us about adding it to the DOCSIS 4.0 standard. We ended up working with CableLabs, operators and other vendors to make it happen.

And what about ESD?

ESD works through bands that are separated in RF amplifiers and nodes by diplex filters. It's the same kind of structure that exists today; it prevents ingress/egress from happening across crosstalk between the upstream and the downstream. Now, each cable operator can choose a different split to figure out how much up and downstream bandwidth they want. DOCSIS 3.1 can go up to 204MHz in the upstream. But on ESD, you can configure the upstream up to 42, 85, 204, 300, 396, 492, or 684MHz. There's a couple of different flavours that you can configure it to.



With ESD, on the chart you could configure the upstream/downstream over various splits from 85MHz, here this is 5 to 85MHz. You can go from 5 to 684MHz. It depends on how much traffic you want to go up and down, which is dependent upon the operator. Then on the right-hand side is the rest of the downstream and OFDM data, or spectrum usage.

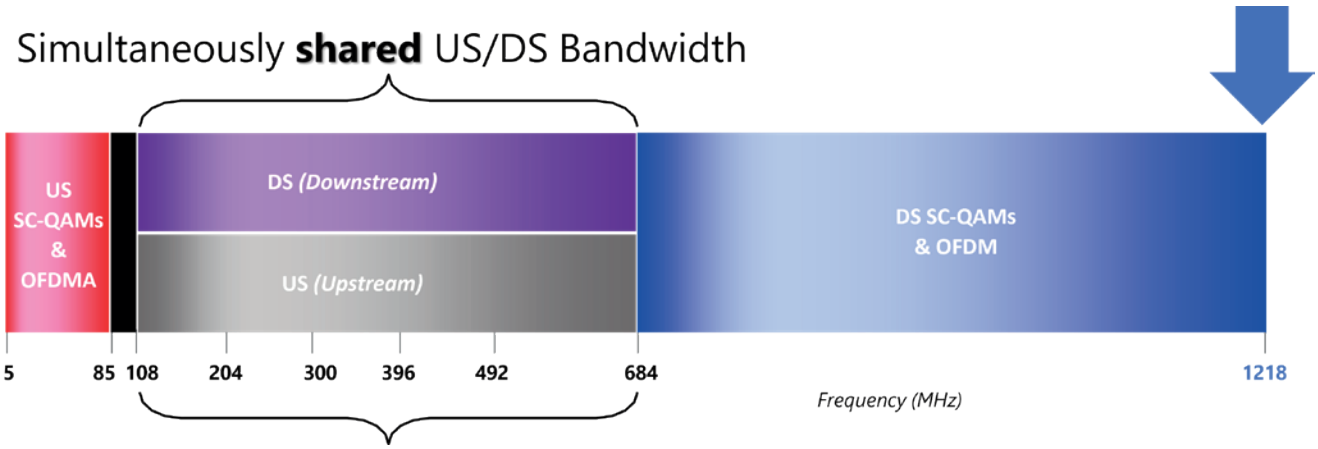
ESD requires upgrading all of the outside plant product to be able to operate at 1.8GHz, which means upgrading the RF trays in existing fibre nodes or hanging new nodes, in addition to upgrading all the taps and passives that are out in the field to 1.8GHz in order to be able to take advantage of the change. You can see it is more of an extension of the existing D3.1 architecture than anything brand new in concept. ESD also requires a migration to a Distributed Access Architecture (DAA), most likely Remote PHY (R-PHY), where the signal generation portion (i.e., the PHY) of the Cable Modem Termination System (CMTS) is moved to a Remote PHY Device (RPD) that resides in the node.

An evolutionary step, as you say.

Quite. Then on the revolutionary side, you have FDX (Full Duplex DOCSIS) where you're actually simultaneously sharing upstream and downstream bandwidth in a large portion of the spectrum. So it's a more dynamic use.

What makes FDX so special?

It facilitates sharing and it's configurable as well. You can still use different specific FDX bands that range from 108 up to 684MHz, but the technology requires a complicated algorithm for echo cancellation, which eliminates interference between upstream and downstream transmissions by removing reflections in the downstream from the upstream. Otherwise, you would get a shadow on your upstream performance, preventing it from being able to scale to the speeds that you wanted to scale to. But this means that you can continue to share significant sections of the FDX 1.2GHz spectrum, as opposed to having to extend it to 1.8GHz.



What's the upside to this?

It enables a higher degree of spectral efficiency from the viewpoint of being able to achieve higher upstream and downstream speeds in less spectrum than ESD utilises. The rest of the outside components, the taps for example, can remain at 1.2GHz as opposed to having to be changed to 1.8GHz.

Now, there's a tap basically for every four homes, depending upon your exact network topology. In order to go change a tap, you actually have to send somebody out to the tap. With ESD you have to go change out all those taps to take full advantage of ESD. There's a fair amount of truck rolls and changing involved. With FDX, as you're simultaneously sharing the bandwidth, you can leave those 1.2GHz taps in place, though an operator will still have to upgrade its nodes to FDX. Similar to ESD, to deploy FDX, an operator would need to also migrate to a DAA, most likely R-PHY.

Are the benefits purely technical?

You see the trade-off really in terms of the pricing. The 1.2GHz FDX technology and echo cancelling costs more for the devices, but it limits the number of truck rolls theoretically that you have to make to go replace every tap that's out there in the field. The 1.8GHz products are less expensive, but you have to change out more of them. At CommScope, we believe in both evolution and revolution, we like being able to supply the network configurations that our operators desire as opposed to pounding the table, demanding a particular way to do things. We prefer the role of trusted advisor. We want to offer all the technologies that an operator could use and try to help them make the most cost-effective decisions for their network.

Do those CapEx and OpEx costs you outline trickle down to the end user or the consumer or do you absorb those?

In both cases, you're right. Each operator is making their decision about what's more available to them from an ongoing basis. In the US market, for example, the FTTH solutions that are being bantered about are one end of the spectrum; a 10Gbps fibre service, on the one hand. On the other hand, you might have competition from the low end. Our customers, the cable operators, the MSOs, have to be able to leverage their investment as best as they can out of the existing equipment they have in the field. Those decisions about what kind of tiering of service to offer, in many cases we believe it's going to be more of an offload type.

Is it variable, depending upon the needs of particular areas?

Yes. It might be an area where you do FDX as opposed to the whole network being FDX. Comcast is on a pretty determined rollout of how they're going about their solution. Other operators in the future might choose between FDX and ESD and think of it as more of the appropriate tool for the job.

There are going to be opportunities to use FDX in a network that may have a fair amount of ESD installed for example. Much will be based upon potential profit from the subscriber base of course. If the subscriber needs more bandwidth, you want to be able to offer a multi-Gigabit symmetrical service to compete with FTTH providers. DOCSIS 4.0 gets you there, and it gets you there in a more cost-effective way than ripping out your entire network and replacing it with fibre or over-building yourself.

There is an interplay between that which is capital and that which is operational expense. It remains to be seen just if there's going to be any significant difference between FDX and ESD from an overall leaning one way or the other. What we think is that both are effective and both come out priced about the same when it comes to the equipment side when looking at upgrading a whole network area.

How does DOCSIS 4.0 enhance network capacity and efficiency?

DOCSIS 4.0 ESD and FDX share the same goals. The most significant increases are seen in the upstream where it's about 4X. So, you can get up to about 1.5Gbps raw throughput today with DOCSIS 3.1, while DOCSIS 4.0 supports upstream raw throughput capabilities of about 6Gbps. So, it's about a 4X increase in the upstream.

"At CommScope, we believe in both evolution and revolution."

The downstream, it's about a 2X increase. Therefore, today, 3.1 you can get maximum raw throughput capacity of about 5Gbps, while DOCSIS 4.0 supports 10Gbps down or more, depending on the configuration. There is a compelling opportunity to provide up to 5Gbps up, 5Gbps down type service using either one of these technologies.

It's obviously a way to further future proof your network without having to cut over entirely to PON right off the bat. What about in terms of capacity and efficiency?

Solving and detecting network interruption issues before they happen is part of what DOCSIS 4.0 is all about. There are a number of security approaches that help reduce the risk of data loss, theft and intrusion. With DOCSIS 4.0 there is even lower latency, enabling you to get down to just milliseconds for many applications.

Are consumers going to be on the hook for more equipment? What's the deal?

Yes, you would need to replace the cable modem to take advantage of the full DOCSIS 4.0 capabilities. Many times, it's that one box that does both DOCSIS termination and routing, and most of the time also has Wi-Fi embedded in it. In order to take full advantage of the speed capability, you would have to put a DOCSIS 4.0 cable modem in the house.

CommScope has been proposing an interim step toward DOCSIS 4.0 by just upgrading the cable modem only and utilising what is otherwise a DOCSIS 3.1-capable cable plant. The official CableLabs name is Hybrid DOCSIS 3.1/4.0. This feature utilises a DOCSIS 4.0 modem but could also use newer, higher-bandwidth DOCSIS 3.1 modems that are also in development to drive a higher throughput into subscriber homes. We validated that if operators use a DOCSIS 4.0 modem with existing cable plant and DOCSIS 3.1 CMTSs (in Hybrid D3.1/4.0 configuration)—whether Integrated CMTS, Virtualised CMTS, Remote PHY, or Remote MACPHY—– they can get raw throughput of about 8.7Gbps downstream. So, operators can get 80+% of the way to a full DOCSIS 4.0 implementation from the perspective of downstream bandwidth without having to implement all the network hardware and only providing new DOCSIS 4.0 modems to subscribers who opt for the highest tiers of service. The upstream is a little more limited, but it's well in excess of 1Gbps.

So, an operator can get to a 1.5Gbps upstream and 8Gbps downstream service tier without sweating it too hard, as an alternative to deploying either a full DOCSIS 4.0 ESD or FDX implementation. In short, the operator can apply additional capacity licenses on existing DOCSIS 3.1-capable CMTS technologies to offer much higher tiers of service yet only needs to deploy DOCSIS 4.0 modems to subscribers to take the new service tiers that require them. This is a very economical and surgical application of DOCSIS 4.0 that can help operators smooth the transition to full end-to-end DOCSIS 4.0 deployments.

In terms of the expected timeline for the rollout, what do you think that's going to be, and how long will it take?

Mostly the second half of 2024 for rollouts in earnest. We have a number of trials and testing that are in place; it's going to take a long time to fully roll out DOCSIS 4.0. It depends on which generation you have, whether it was DOCSIS 1.0, 2.0, 3.0, 3.1. If that started in '97 and we're here in 2023, you're still looking at a seven plus year cycle, even seven to 10 years, in order to fully roll it out.

We've had a lot of disruptors in the last five years; how does CommScope manage that disruptive landscape? What's coming down the road and how are you going to adapt to it?

The company has seen the landscape change again with other competitors coming in with different types of solutions. A couple of years ago, we found ourselves going down one path to the exclusion of others and had to make the hard choice to get back to our core tenet, which is we're not telling customers the only thing they should go build. Whether it's existing legacy, CMTSs, E6000 Converged Edge Router (CER) for us, whether it's a Remote PHY Device (RPD) or Remote MACPHY Device (RMD), whether it's a Virtual CMTS (vCMTS), or even PON modules for the nodes that are out there in the field, we needed to get back to a place where we could offer all of them and help our customers understand what their needs really are, as opposed to just trying to drive a particular agenda.

That was a hard decision to make. CommScope's Guy Sucharczuk helped steer that decision within the last eighteen to twenty-four months. We are more nimble now compared to four or five years ago. We may be a large player in the

industry, we have competitors that are getting bigger because they've done a nice job of championing their technologies. I think that our legacy of knowledge regarding the inner workings of CMTSs is unparalleled, and the CMTS software base that we are leveraging is feature-rich and field-hardened, with decades of development and field exposure behind it. We've got the longest history and we're the only real supplier of anything that could stretch all the way back to DOCSIS 1.0 from where we sit today.

How is CommScope doing this in terms of DOCSIS 4.0, in terms of leading the charge and deployment?

We support hundreds of cable operators worldwide, more than 130 million DOCSIS devices served via our eCore, vCore (vCMTS), our CMTS, our CCAP systems. We've got more than 200 million homes supported by over 800,000 fibre nodes that are out there in the field today. We have quite an expansive network of products out there in the field. Our deployed base and innovation positions us well to support our customers in their next stage of development.

In other words, while your competition is focused on one side or the other, you can be agnostic across both.

Correct. It positions us well for this DOCSIS 4.0 rollout over the longer horizon it's going to take when you move past just the very large customers that are moving very quickly today.

Can customers using older CommScope nodes and amplifiers easily upgrade to devices that are DOCSIS 4.0 compatible?

Yes, they are actually designed that way. There are significant cost savings to realise both in hardware and labour without a large upfront investment of rebuilding current plant. So you can go to most of our nodes that are out in the field and put in a new RF tray, put in a module for FDX or ESD and get on with your day. So it allows us to maintain legacy while optimising for that path to 10G.