

SPECIAL REPORT

# BTR

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## Ready for DOCSIS 3.1?

*By Stephen Hardy*

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# Ready for DOCSIS 3.1?

After a fast-tracked specification development process, multiple interops, and several product announcements, DOCSIS 3.1 appears ready for its debut. But while momentum continues to build toward first deployments in 2016, a few I's still need to be dotted and T's crossed before cable operators can feel confident in the technology.

The goals for DOCSIS 3.1 are clear: Establish a foundation for the provision of gigabit services (and potentially multi-gigabit services) while maintaining backward compatibility with previous generations of DOCSIS. The technology is designed to support an aggregate of 10 Gbps downstream and around 1 Gbps upstream.

Foundational elements include:

- ❑ Downstream spectrum of 1.216 GHz now and 1.794 GHz in the future
- ❑ Support of downstream channels as wide as 192 MHz
- ❑ The use of orthogonal frequency division multiplexing (OFDM) to transport as many as 4,000 to 8,000 subcarriers in each of these channels
- ❑ A switch from Reed-Solomon forward error correction to Low Density Parity Check (LDPC)

However, other aspects of the specification that haven't received as much attention as these elements also could prove important. "I

think one of the biggest benefits or additions to DOCSIS 3.1 is the concept of a modulation profile, and multiple modulation profiles," Jorge Salinger, vice president of access architectures for Comcast, told attendees at a *BTR*-sponsored breakfast panel on DOCSIS 3.1 at the most recent SCTE Cable-Tec Expo. "With these big blocks of spectrum that we're going to have, we don't have to configure the entire spectrum in the same way as we do with single-carrier QAM channels and DOCSIS 2.0, 3.0 downstream. We can configure the spectrum in the best possible way for the plant that we're serving."

"And in addition to that, we can have different modulation profiles in the same downstream for groups of modems, and then be able to do that proactively and manage it during the day as conditions of the plant change," he continued. "We're going to get more capacity out of the plant through the use of modulation profiles and the ability to change them."

## Nearing readiness

The technology to support the new capabilities is nearing readiness. The first set of specifications appeared in 2013, giving vendors the opportunity to develop DOCSIS 3.1 products. CableLabs has conducted six interoperability exercises in the past year or so as well as a "demo day" this past September that attracted 22 vendors.



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“Even at this early stage of development, we’ve seen CMTSs work with multiple [cable modems], delivering multi-gig. We’ve seen solutions range from 3 gigs to 4.5 gigs – and that’s still early in the development cycle,” observed Belal Hamzeh, CableLabs’ director of network technologies, at the same *BTR* event.

As Comcast approaches its first field trials, Salinger reported that he likes what he’s seen so far. “I can tell you very confidently that the equipment development has been moving very rapidly; it’s very advanced. We’ve had many tens of versions of software already, both for the CMTSs and the cable modems, and things are getting ready for deployment,” he said.

Operators likely will require fully certified products before they’re comfortable moving forward with DOCSIS 3.1 deployments. CableLabs is open for business as far as running products through the certification process. However, neither CableLabs sources nor



**Figure 1.** The efficient support of gigabit broadband services is the most commonly cited catalyst for deploying DOCSIS 3.1

systems vendors are commenting on how far along products are in the certification process or whether any have even started to run this gantlet. Nevertheless, Salinger said he expects to see certified products “very soon.”

Meanwhile, Comcast and other operators are doing what they can to free the necessary spectrum to take full advantage of DOCSIS 3.1’s capabilities. Salinger said that Comcast began this process several years ago as part of its embrace of digital transmission technology and support of HD video. The two primary steps have included:

1. Removing analog channels. Salinger reported that Comcast reclaimed 80 channels through this step, which was part of its HD video rollout.
2. Moving from MPEG-2 to MPEG-4 encoding on its HD channels, which freed roughly half the channels Comcast had devoted to HD.

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# Migrating to DOCSIS 3.1?



## It Doesn't Have to be an Upstream Battle

As DOCSIS 3.1 technology evolves, Cable Operators must face major deployment challenges that can affect service delivery and reliability. More than ever, MSOs must fully characterize every aspect of the cable network, from the headend to the home.

Whether it is OFDM, RFoG or HFC Upgrades, contact VeEX to discover how migration to DOCSIS 3.1 doesn't have to be an upstream battle.



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**DOCSIS 3.1** solutions

Salinger reported that other operators have looked to switched digital video (SDV) as way of migrating long-tail content from a broadcast approach to multicast. This, of course, also opens spectrum for DOCSIS 3.1 purposes.

## Playing nicely with others

However, sources agree that operators don't have to free large chunks of spectrum to take advantage of DOCSIS 3.1 equipment. The backward compatibility with DOCSIS 3.0 and other versions of the technology provide several benefits.

One is a smooth transition from current DOCSIS architectures to 3.1. For example, operators can carve out "exclusion bands" within a DOCSIS 3.1 channel to avoid interference with existing DOCSIS 3.0 channels that can't be moved. DOCSIS 3.1 channels and 3.0 channels also can be bonded together for both spectral efficiency and simultaneous support of DOCSIS 3.1 and 3.0 customers within the same transmission. Salinger reported that this practice will be common within Comcast, as the operator will likely bond 24 single-carrier QAM channels



**Live from the Show: VeEX at SCTE Cable-Tec Expo 2015**



**Figure 2.** DOCSIS 3.1 will open the door to a greater product portfolio for cable operators and more choices for their customers.

with a DOCSIS 3.1 OFDM channel. A number of systems vendors have demonstrated such a bonding capability in their early DOCSIS 3.1 implementations, implying they expect other operators to find this approach appealing as well.

Even if operators don't have plans to implement DOCSIS 3.1 in 2016, they may find it useful to begin deploying the equipment with an eye toward the future. Again with backward compatibility in mind, 3.1-enabled systems will do a fine job of supporting existing DOCSIS 3.0 services, sources report. Salinger said that he expects DOCSIS 3.1 transmission equipment to support 32 downstream channels and 8 upstream channels of DOCSIS 3.0 with exceptional performance.

## Maintaining the network

Advanced transmission capabilities require equally advanced monitoring and troubleshooting. DOCSIS 3.1 tackles this latter

A woman's face is the central focus, looking upwards with a thoughtful expression. Overlaid on her face are digital elements: a network diagram with nodes and lines, a line graph with data points, and a city skyline with server racks in the foreground. The background is a bright, cloudy sky with birds flying.

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requirement through a set of [Proactive Network Maintenance](#) (PNM) capabilities, which enable 3.1 CMTS and CPE systems to treat or report on a variety of transmission impairments automatically. The ability to address problems before they require a truck roll should result in significant cost savings.

However, it's not expected that all of the PNM capabilities within the DOCSIS 3.1 specification will be available in the first generation of transmission hardware, reports Brady Volpe, president and founder of The Volpe Firm and founder of Nimble This, a company specializing in PNM. At the *BTR* breakfast, Volpe listed vector signal analyzer and a few network analysis capabilities as likely PNM add-ons in future equipment revisions. However, useful features such as pre-equalization analysis should be available; in fact, products featuring this capability have already been announced.

These announcements are part of a rapid evolution within the test system provider space to ready the necessary installation and troubleshooting tools in time for next year's deployments. In particular, accommodating the

addition of OFDM is a point of emphasis among test equipment vendors. Some have been able to incorporate such capabilities within existing test instruments, while others have launched new instruments with DOCSIS 3.1 needs in mind. Test set announcements should be almost as frequent in 2016 as DOCSIS 3.1 CMTS and cable modem unveilings.

“Operators don't have to free large chunks of spectrum to take advantage of DOCSIS 3.1 equipment.”

### Initial targets

Salinger reported that Comcast will use DOCSIS 3.1 to support not only 1 Gbps downstream offerings but also the company's 2 Gbps Gigabit Pro service it has rolled out via fiber to the premises (FTTP). Tom Cloonan, CTO of ARRIS Group, reports that gigabit services will be a major catalyst for DOCSIS 3.1 deployments by other operators. However, he says that how operators will choose to partition their networks, particularly in terms of how many subscribers to support per headend, varies widely among the customers with whom ARRIS has engaged.

While most of the DOCSIS 3.1 attention has focused on downstream capabilities, upstream capacity may prove critical in environments where competitors offer symmetrical high-speed services. Cloonan reports that operators have discussed using anywhere from two to six upstream channels initially, with four being a typical configuration.





Meanwhile, discussions already have begun about how to support downstream services greater than 1 Gbps across a typical subscriber footprint. ARRIS, for example, is exploring what it calls “Extended Spectrum DOCSIS” that would support 50 Gbps or higher speeds. Residential demand for such data rates is probably a few years down the road, however. Cloonan reports that the first generation of DOCSIS 3.1 technology will aim to support the 1 Gbps service requirement; support of 8 to 10 Gbps services might appear a year later, he estimates.

So the pieces for the first deployments of DOCSIS 3.1 appear to be falling into place. While a few bumps along the road to these deployments should be expected, the industry remains confident that operators will soon be able to use the technology to keep pace with the demand for high-bandwidth broadband services.



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