

CT'S DOCSIS TECH GUIDE

October 2009

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DOCSIS: Speed, Ops and Innovation

By Timothy Sprinkle

Capacity is king in today's hyper-competitive services marketplace. But given the economic climate, it's important for operators to find ways to maximize their capabilities by upgrading rather than replacing.

That's one reason that DOCSIS has emerged as such an important technology. By allowing operators to offer advanced services without having to build new plant or lay fiber, DOCSIS has enabled MSOs to compete in the IP "speed wars" while minimizing CAPEX costs.

So what's new in DOCSIS?

Below you'll find a few summaries of the latest in trends, DOCSIS testing development and a quick update on where we stand with provisioning.

DOWN AND UP

The shift to DOCSIS 3.0 is naturally focused on the data services market. The competition is rapidly ramping up advertised bandwidth offerings in an effort to attract new customers, and MSOs are responding with bonded downstream channel offerings at 50Mbps to 100 Mbps.

But these days the talk isn't

just about peak throughput.

With the growing popularity of streaming video and other "long transaction" services, average throughput has moved to center stage, at least as far as the operators are concerned.

"You don't need a 100 Mbps connection to connect to most of the 480i video services out there," said Steven Krapp, director of product management at ARRIS.

"But now what we're seeing more of is users watching long videos—maybe the peak speed isn't as high, but it's an hour-long transaction. That increases the overall demand for bandwidth in general, and it forces the MSO to add capacity to their plant."

Channel bonding has emerged as a major player, with most major MSOs in this country and abroad now taking advantage of the throughput-enhancing technology. Even among those that aren't taking advantage yet, they are still investing in this future.

The maturing downstream market has also helped to highlight the upstream capabilities of DOCSIS, although that sector is just getting off the ground.

"Upstream channel bonding

is still in its infancy," said Brady Volpe, engineering director at JDSU. "The major CMTS vendors are still in beta (even alpha) code for upstream channel bonding, so live field testing is not necessarily feasible. Further, operators realize that there is a number of issues they will face in hardening and managing their upstreams for channel bonding."

Part of the problem, Volpe said, is that the upstream is crowded with existing DOCSIS carriers, legacy CBR voice networks, set-top box OOBs and ingress. Adding three more 6.4 Mhz upstream DOCSIS channels

to increase upstream capacity and is promoting synchronous code division multiple access (S-CDMA), a modulation technique that was baked into the DOCSIS 2.0 standard.

2009 DOCSIS Certification Wave Schedule

CW65	April 7
CW66	May 5
CW67	June 23
CW68	Aug 12
CW69	Sept 29
CW70	Nov 3
CW71	Dec 8
CW72	Feb 2, 2010

“You don't need a 100 Mbps connection to connect to most of the 480i video services out there.” —Steven Krapp ARRIS,

will require what he calls a "paradigm shift" in upstream spectral management.

Despite these hurdles—or perhaps because of them—Motorola has been working hard on existing techniques

"In North America, the new focus on upstream has a lot to do with competition," said Floyd Wagoner, Motorola's director of global product marketing and communications. "How do I prepare my network

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to compete with the likes of Verizon and AT&T, which have upstream capabilities that are much more scalable?"

To boost what is generally seen as a limited resource, Motorola's system enables the operator to take advantage of spectrum below 15 Mhz and above 40 Mhz by trimming out the noise and converting it to upstream space. The solution allows operators to refocus existing resources and dedicate more spectrum to data services.

"With this technology, operators can very realistically get to 100 Mbps in the upstream," Wagoner said, "and at that level I think they can remain very competitive."

Motorola is currently trialing this capacity-boosting technique in two live trials, according to Rob Howald, Customer Systems Architect in the Motorola CTO office, who was the featured speaker in a CT-hosted webcast S-CDMA. (The webcast is available on-demand at www.cable360.net/ct.)

As far as 3.0 rollouts are concerned, Comcast is in the lead, with most of the major operators planning to deploy services within the year.

Comcast said it hopes to reach 80 percent of its national footprint with DOCSIS 3.0 by the end of this year, with a full rollout by the end of 2010. The MSO launched its new 100 Mbps business-class DOCSIS

3.0 service in the Minneapolis-St. Paul area in early September. Up next: Boston, Philadelphia and Atlanta.

What about fiber? Arris' Krapp admitted that fiber likely would supplant DOCSIS down the road, but the technology is more than enough to keep operators competitive up to around 100 Mbps in the short term.

Given prohibitive costs of laying fiber and various opportunities to squeeze more bandwidth out of existing plants, DOCSIS should remain the technology of choice for the next five years or so. "In the foreseeable future, the cost of DOCSIS and upgrading the plant as we know it will be less expensive than switching out for a PON solution," said Krapp.

"We are definitely hedging our bets in terms of other access technologies, but for right now the industry still seems to be focused on HFC delivery with DOCSIS," he said.

T&M

Since both DOCSIS 2.0 and DOCSIS 3.0 are based on similar technologies, the shift to 3.0 won't change too much in terms of testing.

Technicians will continue to test MER, level, pre- and post-FEC throughput, through new technologies will allow techs to dig into RF and IP impairments and other issues. But the step up to higher-level (read: more

Table 2: DOCSIS 3.0 CMTS Qualification

CW56	Cisco	ubR10012	Bronze, expired
CW56	Casa Systems	C2200 CMTS	Silver
CW56	ARRIS	C4-CMTS-2100-1	Bronze, expired
CW58	Motorola	BSR 64000	Bronze, expired
CW58	Cisco	uBR10012	Bronze, expired
CW58	Casa Systems	C3200 CMTS	Full
CW58	Casa Systems	C2200 CMTS	Full
CW58	ARRIS	C4-CMTS-2100-1	Bronze, expired
CW64	Casa Systems	C10200	Full

“With this technology (S-CDMA), operators can very realistically get to 100 Mbps in the upstream.” — Floyd Wagoner, Motorola

expensive) services will most definitely change customer expectations.

That's especially the case among business users who know what extra throughput can mean for their bottom line.

"Most users doesn't really look at their bits," said Cyrille Morelle, president of T&M test equipment vendor VeEX, "but customers that are willing to pay for more bandwidth are usually getting the throughput for a reason and they tend to be more savvy"

"They can have VoIP, data and

other services on the network, so it's getting much more complicated," Morelle said. "At that point we want to be sure that they're getting what we say they're getting and that we can verify those services."

For VeEX and other T&M vendors, this deliver-what-you-say-you-deliver idea has led to an increased focus on field technicians, with new testing tools and procedures designed to better guarantee on-site accuracy and minimize future service calls.

The shaky economy of late has played a role in this push for

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Table 3: DOCSIS 3.0 Cable Modem and EMTA Certification

CW58	CM	SMC
CW58	CM	Scientific-Atlanta
CW58	CM	Motorola
CW58	CM	Motorola
CW58	CM	ARRIS
CW58	CM	Ambit
CW58	EMTA	Motorola
CW58	CM	ARRIS
CW64	EMTA	ARRIS
CW60	EMTA	Scientific-Atlanta
CW60	CM	Netgear
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CW63	EMTA	Scientific-Atlanta
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CW63	EMTA	Motorola
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CW65	EMTA	Zyxel
CW65	EMTA	Thomson
CW65	CM	Thomson
CW65	CM	SMC
CW65	EMTA	Netgear
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CW65	EMTA	Ambit
CW65	CM	Ambit
CW66	EMTA	Motorola
CW66	CM	Hitron
CW66	EMTA	Cisco
CW66	EMTA	Ambit
CW67	CM	Ubee Interactive
CW67	CM	SMC
CW67	CM	Motorola
CW67	CM	ARRIS
CW67	EMTA	ARRIS
CW68	EMTA	Motorola

Source: CableLabs

TOP 12 DEPLOYMENT ISSUES

In February, Comcast Senior Director Network Architecture Chris Bastian updated attendees at the SCTE Canadian Summit on Comcast's deployment of DOCSIS 3.0 technology.

Reached in mid September, Bastian confirmed that this the following top-12, lessons-learned topics from Comcast's massive deployment project still apply:

- CPE availability and firmware stability
- Test schedule confirmation
- Defining upgraded service areas
- Sharing data with divisions
- New NCPs/re-cabling
- Schedule balance
- Spares plan
- DOCSIS 3.0 MIBs/OSS test support
- Lock down product requirements
- Timeframe to train service and field personnel
- Updating end-of-life (CPE) list
- Distributing trial test results

automated DOCSIS tools as well, as operators look to trim spending wherever possible, while the industry's reliance on outside contractors to handle most field work has only amplified the call.

"For the MSOs, there is more and more work to do and less and less skilled people to do it," Morelle said.

JDSU's Volpe agreed that advanced T&M tools are the future of the industry.

"Top management [at the MSOs] want two things," he said, "Detailed visibility into every test their technicians make, and T&M tools that are much more intelligent, compact and low cost."

So far, this has meant adding features like GPS tracking, digital work orders and WiFi connectivity to test meters, all of which help management keep tabs on their workforce. These advanced reporting tools will not only keep contractors and field technicians honest, but will help operators cut down on service costs by ensuring each installation is done to spec properly the first time.

Moving forward, vendors expect to release DOCSIS 3.0-specific tools that expand on the MER, level and FEC tests now in use to diagnose channel bonding issues and enable troubleshooting on increasingly complex networks.

"Not only will customers be paying more for higher data rates in the near future, but more bandwidth will be occupied in the downstream and upstream by a CMTS," Volpe said. "The CMTS will balance the transfer of data across the bonded channels. Test equipment will be essential to both monitor and troubleshoot when data rates fall below those expected, or when services degrade due to

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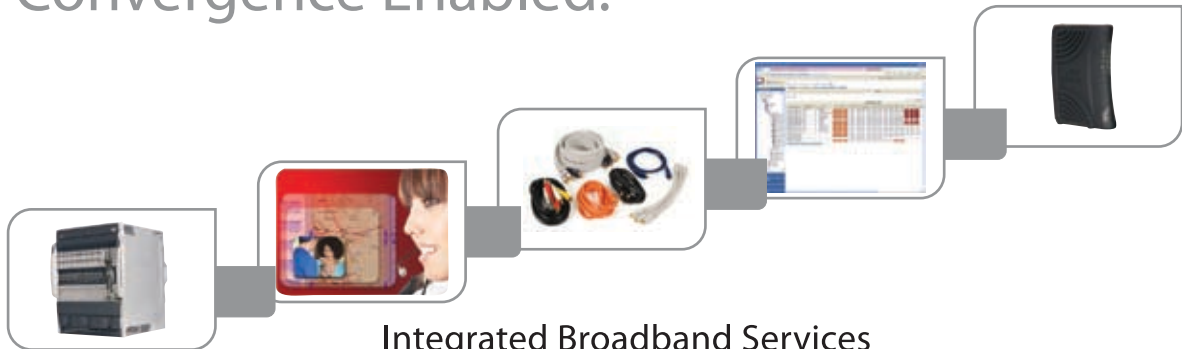
SELECT DOCSIS TEST EQUIPMENT

JDSU		
Product	Application	Key Features
DSAM-6000	Network Maintenance Sweep Meter	Combines high-level triple-play functions of other DSAM modles with JDSU's Stealth Sweep technology to test and maintain both the downstream forward path and upstream return path. Compatible with individual DOCSIS 3.0 carriers; downstream throughput testing to up to 36Mbps; comprehensive testing of digital and analog video, voice; fully featured SLM with QAM analysis and integrated DOCSIS modem; Tech Complete TPP software; troubleshooting with DQI, QAM Ingress and VoIP Check; weatherproof, rugged, lightweight.

Trilithic		
Product	Application	Key Features
860 DSPi DOCSIS 3.0 Option	Field Analyzer	860 DSPi field analyzer equipped with embedded DOCSIS 3.0 modem. Performs complete statistics analysis, including levels, MER, and pre-and post-FEC BER; high-speed throughput tests to full 4x4 bonded signal transmission speeds; capabilities range from triple-play signal analysis to installations to plant maintenance tasks; platform grows to meet needs of technicians; easy-to-read display and simple interface; integrates with OSS and workforce management systems for improved productivity.

VeEX		
Product	Application	Key Features
VePAL CX150	Installer Meter with DOCSIS 2.0 modem	Features: SLM up to 1GHz; support deep interleave and constellation; DOCSIS 2.0 emulation/testing; Ingress (forward/reverse); VoIP and CAT 3/5 Testing; system scan and installation check for fast troubleshooting; long operation battery (12 hours); color touch screen; electronic signature capture; 15sec power up time

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- DOCSIS emulation
- On-board MPEG analysis
- Upstream Generator
- Forward/Reverse Path sweeping
- Remote view

CX180R/F

- 19" rackmount monitoring system
- QAM characterization
- On-demand test with QAM & spectrum analysis
- Centralized architecture

CX120+

- Ultra portable
- Color touch-screen
- Upstream generation with QAM 16/64/128/256
- SLM up to 1GHz
- Long lasting battery

CX350

- 7" color touch-screen
- SLM up to 1GHz
- DOCSIS emulation
- 1Gb/s throughput testing
- Coaxial TDR
- Upstream Generator
- Workforce management, GPS tracking
- Leakage detection
- Remote view

VeEX

Product	Application	Key Features
vePALCX35-	Next-Gen DOCSIS 3.0 Install/Maintenance Tool	SLM up to 1GHz; support deep interleave and constellation; upstream generation (optional) and analysis of CW, QPSK, QAM16, QAM64 and QAM128 with FEC; advanced spectrum analysis; system scan and installation check for fast troubleshooting; optional DOCSIS2.0 and/or 3.0 Testing; optional TDR testing; long operation battery (8 hours); 7" color touch screen; electronic signature capture; 21sec power up time.

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jitter, packet loss or delay."

The issue for MSOs, he said, is that multiple bonded channels will make "blind" troubleshooting much more complicated, requiring technicians to adopt advanced tools that can identify

and locate both RF- and IP-based trouble spots.

Specialized hardware, some of which is already in production, will be needed to address these challenges and keep up with the new testing needs of 3.0.

"With the economy being what it is, DOCSIS 3.0 has not launched at the pace that everyone expected," said Morelle, "so next we're expecting to see a lot more activity and more demand for verification services. The thing is, the upgrade from DOCSIS 1.0 to 2.0 was kind of easy, but DOCSIS 3.0 adds all new features and higher throughput, so there's more that needs to be tested."

increased after its acquisition of the FastFlow provisioning system that had been part of the CUDA CMTS platform acquired (and then relinquished) by BigBand Networks. As far as the other CMTS vendors, ARRIS is a re-selling partner of Incognito; Casa Systems has not aligned; and Cisco has its own system.

DOCSIS IN THE NEWS

Bresnan Selects ARRIS

ARRIS announced that Bresnan Communications has selected the ARRIS DOCSIS 3.0 C4 CMTS platform to deploy high-speed data, hosted VoIP and commercial services in four of its Northwestern U.S. markets, Kalispell and Helena, MT, and Gillette and Casper, WY.

Comcast Launches 100 Mbps

Comcast Corporation has launched a 100 Mbps high-speed Internet service to businesses in Minnesota's Twin Cities region. For \$369.95 per month, Comcast is offering business customers up to 100 Mbps downloads and up to 15 Mbps uploads.

"100 Mbps service is ideal for data-intensive businesses that need this kind of speed and want an alternative to slower, more expensive T1 lines," said Bill Stemper, president of Comcast Business Services, in a statement.

Rogers Launches 50Mbps

Rogers Cable Communications launched its new 50Mbps Internet service, Rogers Ultimate High-Speed Internet.

The Ultimate Internet service is now available in select areas of the Greater Toronto Area for \$149.99 a month, with respective download and upload speeds of up to 50Mbps and up to 2Mbps and a monthly usage allowance of 175GB. This service will be rolled out further in the coming months.

This new service follows Rogers Cable's launch last month of the fastest wireless home networking device available in North America, the DOCSIS 3.0 N gateway.

PROVISION ME

Any unfinished business on the DOCSIS 3.0 front? "What we are seeing is the development of market solutions, enabled through the DOCSIS standard," Stephane Bourque, CEO and president of Incognito Software said. "For residential needs, we are seeing an increased interest in cable residential gateways for converged IPTV over DOCSIS applications"

Residential 'on-demand' bandwidth is rising accordingly. Then there is the business side of the equation, already heralded by Comcast's 100 Mbps downstream launch in Minneapolis.

"DOCSIS 3.0 is a natural fit with the SMB (small to medium-sized business) customers looking for either higher burst and/or sustained bandwidth products," Bourque said.

Incognito's place within the DOCSIS ecosystem arose in part as a partner to Motorola in provisioning Motorola, and

MORE CERTS

While the pace of CMTS qualifications has been slow, certification of DOCSIS 3.0 cable modem and embedded multimedia terminal adapters has kept up at a steady pace.

As of CW68, the leaders of that pack are Moto and Cisco, with eight products each. ARRIS and Ubee Interactive (formerly Ambit) have seven each. NetGear and SMC tie for third with five a piece. The results of CW69 should be out by early October, with two more waves and results due to be posted before the year is out. As per Bourque, residential gateways with IPTV applications and business services packages are likely to fit into the framework of new end devices.

Other interesting combinations, such as 801.11n WiFi and DOCSIS 3.0 as deployed by Rogers in Canada, could result. The cycles of deployment and innovation may yet accelerate further. 