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White Paper

How Cable Makes the SLA Grade With Business Services

Prepared by

Alan Breznick
Contributing Analyst, Heavy Reading
www.heavyreading.com

on behalf of

ACCEDIAN
Experience • Performance

accedian.com

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Introduction: The Evolution of Cable Business Services

By all accounts, the major U.S. MSOs have come a very long way with business services over the past decade. Commercial data, voice and video services, which contributed just a trickle of revenues for the large MSOs back in 2006, now constitute one of the biggest growth drivers for operators. In fact, the ten largest MSOs combined to take home more than $12 billion in business revenues in 2015 and should scale the $14 billion mark in 2016, giving them nearly a 10 percent collective share of the roughly $150 billon U.S. commercial services market. Comcast alone generated more than $4.7 billion in commercial revenue last year, and should easily clear the $5.5 billion mark this year.

Figure 1: U.S. MSO Business Service Revenues, 2015

MSO	1Q15	2Q15	3Q15	4Q15	Full Year
Comcast	$1.1 billion	$1.2 billion	$1.2 billion	$1.3 billion	$4.7 billion
Time Warner Cable	$781 million	$803 million	$836 million	$864 million	$3.3 billion
Cox Communications*	$460 million	$470 million	$480 million	$490 million	$1.9 billion
Charter Communications	$269 million	$278 million	$286 million	$294 million	$1.1 billion
Cablevision Systems – Lightpath*	$91.1 million	$91 million	$91.2 million	$91 million	$365 million
Suddenlink Communications	$90.3 million	$91.3 million	$93.6 million	$94.8 million	$370 million

* Heavy Reading estimate

Source: Heavy Reading

At the same time that they have built their once-fledgling commercial divisions into billion-dollar and even multi-billion-dollar operations, MSOs have greatly extended their reach, moving well beyond the small firms and mom-and-pop businesses that were their early targets. Focusing more and more on small to medium-sized businesses (SMBs) and larger enterprises, MSOs have vastly expanded their portfolio of commercial services, products and features offered over their hybrid fiber-coaxial (HFC) plants, adding such increasingly sophisticated offerings as Metro Ethernet, managed services, hosted applications, and cloud-based products.

As a result, like the incumbent telcos and other telecom players focused on the business services market before them, MSOs have had to adapt to the more demanding needs of their larger commercial clientele. In particular, they have crafted service-level agreements (SLAs) for customers to guarantee consistently high performance levels and meet increasingly stringent requirements for things like network uptime, latency, jitter, reliability and redundancy. Some MSOs have also started expanding the coverage of those SLAs beyond the all-fiber sections of their HFC plant, putting in place service guarantees for the all-cable portions of their networks as well.

This paper explores the wide range of telecom services that the 10 biggest U.S. MSOs entering 2016 are now offering to their commercial customers. Examining each MSO separately in some depth, it spells out their main products for both smaller and larger

businesses, and compares and contrasts their various offerings. Plus, the paper lays out new commercial services and products that operators are planning to introduce in the next year.

In particular, this paper looks at the SLA-grade services that the leading MSOs are delivering to businesses over both their fiber and coaxial cable lines. It distinguishes between the service availability and reliability guarantees that operators offer over the two platforms, and delves into the pricing differences between the platforms as well. Finally, the paper addresses how operators intend to proceed with service guarantees and pricing in the near future.

Comcast

By far the biggest MSO in North America, Comcast is not surprisingly a dominant cable player in the business services space. Although it entered the market relatively late – years behind such cable pioneers as Cox Communications and Cablevision Systems – Comcast now easily leads the MSO field on the revenue front with nearly $5 billion in annual receipts, and probably boasts the most commercial customers as well. (Unlike other publicly owned cable operators such as Time Warner Cable and Charter, Comcast does not disclose its commercial customer totals.)

Figure 2: Comcast Business Revenue Overview

2014 Business Revenue	2015 Business Revenue	Year-to-Year Growth	Key Market Fact
$4.0 billion	$4.7 billion	20%	Boasts 20%-25% share of SMB market

Source: Comcast

As its revenues have steadily soared, Comcast has expanded its range of commercial service products and services and steadily pushed up-market. Reflecting that push, the MSO's commercial services lineup now covers all major verticals, including government, education, hospitality, financial and legal. Its strongest vertical is the healthcare market, where it boasts that it hosted roughly 1 million tele-health sessions last year.

Speaking at Light Reading's Future of Cable Business Services conference in New York last December, Glenn Katz, VP and GM of Comcast Enterprise Solutions, estimated that the enterprise market represents a $13 billion to $18 billion revenue opportunity for Comcast alone. For this reason, Comcast Business launched its new enterprise initiative in fall 2015, targeting the lower half of the nation's Fortune 1000 companies.

Reflecting this focus, Comcast offers some type of performance-based SLAs on most, if not all, of its business services, typically offering at least a minimum of availability and mean-time-to-repair (MTTR). Unlike many of its fellow MSOs, Comcast offers vertical-specific SLAs for its five biggest vertical markets – financial, government, education, healthcare and legal.

Comcast delivers higher bandwidth to commercial customers that opt for SLA-grade services over DOCSIS, delivering top downstream speeds of 100 Mbit/s vs. 50

Mbit/s for those without SLA guarantees. The MSO plans to boost those top DOCSIS speeds to 500 Mbit/s and higher this year as it rolls out the cable industry's new, multi-gigabit-enabling DOCSIS 3.1 spec.

Figure 3: Comcast's Key SLA Stats

Performance-Based SLA Services	Performance Metrics Used	Offer Vertical-Specific SLAs	Offer Multiple Classes of Service	MEF-Based or MEF-Compliant	SLA Prices vs. Non-SLA Prices
● Fiber Access ● DOCSIS Access	●● Availability ●● Bandwidth Utilization ●● Latency ●● Delay Variation/ Jitter ●● Packet Loss Same SLAs and metrics over DOCSIS and fiber. Both have complete turn-up test to validate service performance from initial install.	●◒ Financial ●● Healthcare ●● Education ●● Government ◒○ Legal Strongest vertical is healthcare. 1 million telemedicine sessions hosted in 2015 (connecting clinics to large hospitals). Large customer is veterans' affairs.	● Fiber Access ◒ DOCSIS Access Multiple classes of service supported over DOCSIS as well as fiber, to support managed and hosted services.	● Fiber Access ◒ DOCSIS Access DOCSIS business services emulate fibered business services.	Typically charges SMBs 50% higher for SLA services. Bandwidth ranges are faster on SLA grade (100+ Mbit/s vs. 50) and soon to offer 300+ Mbit/s on DOCSIS 3.1 in 2016.

Legend: Fiber Access: Offered ● Partial/Custom ◒
DOCSIS Access: Offered ● Partial/Custom ◒ Not Offered ○

Source: Comcast

Comcast doesn't discriminate SLAs by access method, whereas most other MSOs only offer complete SLAs over fiber-based connections. The large majority of its business has been small-medium enterprises. Comcast is evolving this core business to fully assured, SLA-grade offerings that would normally not be available over the HFC plant. These customers are becoming more educated about SLAs, and these assurances allow Comcast to upsell premium and hosted services to its subscriber base. Comcast business, for example, will offer increased bandwidth, but also with guarantees with the improved service. Where required, Comcast will draw a dedicated fiber to the premises from an HFC node, or fibered site, to ensure quality of service.

Time Warner Cable (TWC)

For a long time the second-largest U.S. MSO up until its recent acquisition by Charter Communications, TWC has also emerged as the second biggest cable player in the business services market. With a longer track record in the market than Comcast, TWC has grown steadily in the commercial sector, notching a total of almost 700,000 commercial relationships by the end of 2014. That steady growth continued in 2015, with the MSO reporting more than 750,000 commercial customers at the end of the year, up from 687,000 at the close of the previous year.

Figure 4: TWC Business Revenue Overview

2014 Business Revenue	2015 Business Revenue	Year-to-Year Growth	Key Market Fact
$2.8 billion	$3.3 billion	15%	Says mid-market, enterprise & carriers >50% of revenue

Source: TWC

Likewise, TWC has been steadily expanding its fiber-network reach to more and more commercial buildings. The MSO closed 2015 with more than 900,000 fiber-lit buildings on its nationwide network, up 66,000 from the end of 2014. As a result, TWC saw its business services revenues climb at a strong, steady clip over the past decade, nearly matching the torrid pace set by Comcast. At its current pace, TWC – which operated in such major markets as New York, Los Angeles, Dallas, Columbus, Cleveland, Cincinnati, Kansas City, Milwaukee, Charlotte and Raleigh/Durham – should produce about $3.8 billion for Charter this year in TWC's legacy territories.

Actually moving before Comcast, TWC first plunged into the commercial sector by targeting small and home-based businesses, where it could compete most effectively against the large telco incumbents. After quickly capturing up to 20 to 25 percent of the small business market in some geographic regions, the nation's second-largest MSO has since gradually expanded to medium-size companies and enterprises, diversifying its revenue mix. Speaking at Light Reading's Future of Cable Business Services conference in New York last December, TWC EVP and COO of Business Services Phil Meeks predicted that mid-market, enterprise and carrier customers will generate more than half of his company's commercial revenues in 2016.

Figure 5: TWCs Key SLA Stats

SLA Metric	Details
Top Data Rates	Fiber – 10 Gbit/s; TWC Maxx markets – 300 Mbit/s & 20 Mbit/s; Other HFC markets – 50 Gbit/s & 5 Gbit/s. TWC offers faster HFC data speeds in its upgraded Maxx markets.
Performance-Based SLA Services	Fiber Access – SLAs; DOCSIS Access – SLOs
Performance Metrics Used	SLAs – service availability, latency, packet loss, jitter and mean time to restore; SLOs – service availability and mean time to restore.
Offer Vertical-Specific SLAs	No
Offer Multiple Classes of Service	Fiber Access – No; DOCSIS Access – No. TWC aimed to offer multiple, classes of services later this year.
MEF-Based or MEF-Compliant	Carrier Ethernet 2.0 certified. TWC boasts eight different varieties of Ethernet products.
SLA Prices vs. Non-SLA Prices	Roughly 3X as much for SLA-backed services over fiber. Prices vary according to data transmission speeds offered.

Source: TWC

Like the other big MSOs, TWC serves nearly every type of vertical market over both its standard HFC plant and dedicated fiber lines. But, also like most, it primarily focuses on a smaller number of key verticals – namely, the government, education, healthcare, hospitality, and media/entertainment. It sees its biggest verticals as healthcare and hospitality.

In a unique move among U.S. MSOs, TWC provides either performance-based SLAs or SLOs (service-level objectives) for many of its business products, focusing particularly on its dedicated Internet access (DIA) and Ethernet offerings. The stricter SLA guarantees are for services delivered over fiber lines, while the looser SLO goals are for DOCSIS-based services delivered over HFC. The fiber-based SLAs cover such standard metrics as service availability, latency, packet loss, jitter and mean time to restore, while the SLOs cover just service availability and mean time to restore.

Cox Communications

A true cable pioneer in the commercial services market, Cox was one of the two early U.S. MSO leaders in the space, along with Cablevision Systems. Indeed, Cox plowed into business services before business services were cool for cable, building a strong portfolio of basic telecom and data products back in the early 2000s. As a result, despite a much smaller potential market than such national giants as Comcast, TWC and now Charter, the privately owned MSO closed out 2015 with more than 350,000 small and regional business customers throughout its six regional cable clusters in 18 states. Its biggest markets are Phoenix, San Diego, Las Vegas, Omaha, northern Virginia and Connecticut/Rhode Island.

Not surprisingly, then, Cox actually became the first U.S. MSO to reach the annual $1 billion mark for business revenues in late 2010. Even though both Comcast and TWC have since zipped well past its revenue totals, Cox still remains a major player in the business services space. Following in the footsteps of Comcast and TWC, it plans to scale the $2 billion revenue mark this year and has its sights set on reaching $3 billon by the end of the decade.

Figure 6: Cox Business Revenue Overview

2014 Business Revenue	2015 Business Revenue	Year-to-Year Growth	Key Market Facts
$1.8 billion	$1.9 billion	15%	Small Firms – 80% of customers & 65% of revenues Midsized and larger – 20% of customers & 35% of revenues

Source: Cox

Smaller firms, which were Cox's original target in the commercial space, still remain its biggest market, accounting for about 80 percent of all business customers and 65 percent of all business revenues. Midsized firms are now gaining momentum, though, generating about 35 percent of all revenue and growing as Cox heightens its focus on large regional businesses, or "large locals," and keeps expanding its range of commercial services.

Due to such gradual expansion efforts over the past 15 or so years, Cox now offers a vast portfolio of data, voice, video and networking services to businesses of all shapes and sizes. Similar to Comcast and TWC, Cox caters to nearly every type of business vertical over both its standard HFC plant and dedicated fiber lines, including such promising sectors as financial services. But it boasts a "dedicated focus" on four key verticals – namely, government, education, health/medical, and hospitality.

While they are not necessarily standard parts of its commercial portfolio, Cox offers some type of performance-based SLAs on nearly all of its business services upon customer request, offering a minimum of service availability and MTTR over both fiber and HFC lines. Performance-based SLAs are most prevalent for the MSO's suite of data services, which include both Internet access and networking services. For these services, Cox commonly sets latency, data delivery rate and jitter targets, although these targets can vary by type of service and access method.

Figure 7: Cox's Key SLA Stats

SLA Metric	Details
Top Data Rates	Wavelength – 100 Gbit/s; Fiber – 10 Gbit/s HFC – 300 Mbit/s downstream
Performance-Based SLA Services	Internet Access & Networking services. Cox offers a minimum of service availability and mean-time-to-repair (MTTR) over both fiber and HFC lines.
Performance Metrics Used	Availability, MTTR, Latency, Data delivery rate, Jitter. Performance-based SLAs are most prevalent for Internet access and networking services. Cox sets latency, data delivery rate and jitter targets, although these targets can vary by type of service and access method.
Offer Vertical-Specific SLAs	No, but will customize DLAs for individual customers
Offer Multiple Classes of Service	Yes, 4. Cox offers several (four) classes of services. The four classes are: Real Time, Interactive, Priority Data and Best Effort.
MEF-Based or MEF-Compliant	Carrier Ethernet 2.0 certified
SLA Prices vs. Non-SLA Prices	Charges add-on fees for SLA-based services. Cox says all its business services rely on "market-based pricing."

Source: Cox

Charter Communications

Hampered by heavy debt loads until the past few years, Charter has traditionally been a laggard in the commercial services area, trailing behind the other five biggest legacy U.S. MSOs. Despite its ranking as the fourth-largest MSO in the nation up until recently, and now the second biggest one, Charter has also lagged behind its peers because, compared to the other five, it has served relatively few large or even medium-sized markets.

But now, with its finances on solid footing and an aggressive management team in place, Charter is furiously playing catch-up in the business services space: In 2015, for instance, it formally split its commercial operations into two distinct units – one focusing on small businesses, and one on larger ones. It also rebranded its entire

business services operation as Charter Spectrum, copying the strategy of Cablevision Systems, where Charter CEO Tom Rutledge used to work.

So far, the moves appear to be paying off for the MSO's ambitious management team. Charter wound up last year with about 420,000 commercial "customer relationships," up from 357,000 at the close of 2014. This surge of growth came after the MSO either shed or at least didn't gain business customers in prior years. Likewise, Charter just became the latest MSO member of the $1 billion revenue club, after narrowly missing that milestone in 2014. At that pace, it should approach $1.3 billion in 2016 in just its legacy cable footprint, which covers parts of 28 states around the U.S.

Figure 8: Charter Business Revenue Overview

2014 Business Revenue	2015 Business Revenue	Year-to-Year Growth	Key Market Facts
$993 million	$1.1 billion	14%	Split into two units last year to tackle SMB and large business markets

Source: Charter

These figures will increase dramatically, though, now that Charter's purchases of TWC and Bright House have gone through. With those two acquisitions in hand, Charter has now become the nation's second-largest MSO, right behind Comcast, and possibly the biggest cable player in the commercial space. Combined, the Charter, TWC and Bright House commercial customer bases give the New Charter more than 1.1 million business services customers and about $5 billion in annual revenue as its starting base, slightly more than even Comcast generated last year.

Figure 9: Charter's Key SLA Stats

SLA Metric	Details
Top Data Rates	Fiber – 10 Gbit/s; HFC – 30 Mbit/s
Performance-Based SLA Services	Yes, Ethernet services over fiber.
Performance Metrics Used	Packet loss ratio, delay variation, round-trip delay and network availability.
Offer Vertical-Specific SLAs	No
Offer Multiple Classes of Service	Yes, 3 classes: Premier (the highest performance level), Express (the middle level) and Standard (best-effort service).
MEF-Based or MEF-Compliant	Carrier Ethernet 2.0 certified. The MSO is shooting for MEF 2.0 certification this year.
SLA Prices vs. Non-SLA Prices	Charges add-on fees for SLA-based services. Charter bases extra fees on the class of service and the bandwidth speed offered Spectrum Business also adds a monthly recurring surcharge (MRC) on top of the standard bandwidth charges.

Source: Charter

With these two big deals under its belt, Charter has also taken over exclusive or prime control of some lucrative major markets. The list includes New York, Los Angeles, Dallas, Columbus, Cleveland, Cincinnati, Milwaukee, Orlando, Tampa, Charlotte and Raleigh/Durham, adding to such current Charter strongholds as St. Louis and parts of southern California, Michigan, North Carolina and Connecticut.

Similar to its large MSO peers, Charter now offers a wide range of products and services for businesses of all sizes and stripes, including Internet, voice, video and both coax and optical Ethernet networking services. But, more so than its peers, Charter still focuses more on smaller firms with few or no employees. In its fourth-quarter 2015 earnings release, the MSO reported a total of 671,000 small and medium-sized business primary service units (PSUs) and just 30,000 enterprise PSUs.

Like its peers once again, Charter caters to nearly every type of business vertical over both its standard HFC plant and dedicated fiber lines. But, like those three major MSOs, it emphasizes a select number of core verticals – namely, state government, education, healthcare, retail, financial services and professional services. Its sales and marketing strategies have been organized around those verticals.

Cablevision Systems

Like Cox, Cablevision Systems – acquired, along with Suddenlink Communications, by French communications giant Altice in December 2015 – was an early cable pioneer in the U.S. business services market.

Operating exclusively in the greater New York City metro area as an industry lone wolf, Cablevision has concentrated on building its own dedicated fiber-optic network to serve the telecom needs of SMBs and larger enterprises both in the city itself and throughout its dense suburbs in the tri-state area. But, like its large MSO peers, the nation's former fifth-largest MSO also serves smaller, neighborhood-based mom-and-pop firms and medium-sized companies through its main cable division.

Cablevision's most visible vehicle for serving the greater New York business community is Lightpath, which the company established as a competitive local exchange carrier (CLEC) back in 1994 to serve both residential and business phone customers on Long Island. More than two decades later, Lightpath runs an extensive fiber network throughout the region to serve its midsized and larger commercial customers. That network now spans 6,500 route miles, stretches more than 200,000 fiber miles and boasts more than 8,000 fiber-lit commercial buildings connected to it.

Unlike the other large, publicly traded U.S. MSOs, Cablevision only discloses financial data for Lightpath, not its separate unit dedicated to small and midsized firms that's incorporated into the parent company. So Cablevision's commercial customer count and revenue can't be fairly compared to the other large operators. But Lightpath at least provides a gauge of Cablevision's overall commercial efforts.

Operating one of the densest metro area fiber networks in the U.S., Lightpath is an industry leader in providing advanced Ethernet-based data, Internet, voice, video transport solutions and managed services to large and medium-sized organizations throughout the New York metropolitan area. In particular, Lightpath is now emphasizing its portfolio of managed services. In the education market, for instance, it promotes its hosted voice, private fiber network and comprehensive data services offer an attractive solution for schools, colleges and universities.

Figure 10: Cablevision Business Revenue Overview

2014 Business Revenue	2015 Business Revenue	Year-to-Year Growth	Key Market Facts
$353.0 million	$364.4 million	3.3%	Lightpath focuses on mid-sized and larger firms

Source: Cablevision Systems

Similar to its big MSO peers, Cablevision's Lightpath unit serves just about every type of business vertical over its dedicated fiber lines. However, like those other major MSOs, it emphasizes a handful of core verticals – namely, the healthcare, education, government, financial services and other service providers. Lightpath boasts customized suites of products for each of these five verticals.

Figure 11: Cablevision's Key SLA Stats

SLA Metric	Details
Top Data Rates	Wavelength – 100 Gbit/s
Performance-Based SLA Services	Yes (for Carrier Ethernet services)
Performance Metrics Used	Packet loss, latency, jitter, network availability and mean-time-to-repair. MMTR guarantees for HDC customers.
Offer Vertical-Specific SLAs	Yes (medical, legal, education, government, financial)
Offer Multiple Classes of Service	Yes
MEF-Based or MEF-Compliant	Carrier Ethernet 2.0 certified
SLA Prices vs. Non-SLA Prices	Charges add-on fees for SLA-based, specific to vertical and specific customer requirements.

Source: Cablevision Systems

Bright House Networks

Bright House – long viewed as the baby brother or junior partner of TWC – was the nation's sixth-largest MSO, with slightly more than 2 million residential video and broadband subscribers, before the Charter deal closed. Bright House emerged as a separate, independent entity out of the old Time Warner Entertainment-Advance/Newhouse partnership, under a deal struck among the various parties in 2003. Now, like big brother TWC, it has become part of the New Charter.

Similar to TWC, Bright House has been an aggressive player in the commercial market, building a robust business in both coax-based and fiber-based commercial services over the past decade or so. After inheriting some prime, high-growth markets in California, Florida, Indiana, Michigan and elsewhere from the old TWE-Advance/Newhouse partnership, Bright House has made the most of it, establishing itself as a strong, up-and-coming player in the commercial sector.

Figure 12: Bright House Business Revenue Overview

2014 Business Revenue	2015 Business Revenue	Year-to-Year Growth	Key Market Facts
$400+ million	$475 million	NA	60% SMBs, 40% enterprises

Source: Bright House Networks

Central Florida is by far Bright House's biggest region, where it is the dominant MSO in the lucrative, swiftly growing markets of Orlando/Daytona Beach and Tampa/St. Petersburg. Outside Florida, the MSO controls such smaller but still attractive markets as Indianapolis, suburban Detroit, Birmingham, Ala. and Bakersfield, Calif.

Working with these assets, Bright House has strung 18,000 miles of fiber though its regions and developed a base of 135,000 commercial customers despite its relatively small size. As a result, the privately owned MSO generated an estimated $475 million in business services revenues last year, placing it well ahead of Cablevision's Lightpath operation and a solid fifth behind the much bigger Comcast, TWC, Cox and Charter.

Figure 13: Bright House's Key SLA Stats

SLA Metric	Details
Top Data Rates	HFC – 300 Mbit/s downstream.
Performance-Based SLA Services	Yes, mainly Ethernet networking products over fiber.
Performance Metrics Used	Packet loss, latency, jitter, network availability and mean-time-to-repair. MMTR guarantees for HDC customers.
Offer Vertical-Specific SLAs	No, but MSO will customize SLAs for particular clients and does that frequently, most notably for local hospitals.
Offer Multiple Classes of Service	No, but… Bright House does not offer multiple classes of service to customers at the network core but it does offer them at the network edge.
MEF-Based or MEF-Compliant	Carrier Ethernet 2.0 certified
SLA Prices vs. Non-SLA Prices	Charges add-on fees for SLA-based services. Bright House says an apples-to-apples pricing comparison between fiber and HFC is impossible.

Source: Bright House Networks

Similar to the five biggest legacy MSOs, Bright House offers a wide range of products and services for businesses of all shapes and sizes, including Internet, voice, video and both coax-based and fiber-based Ethernet networking services. In particular, it now emphasizes its suite of cloud-based, managed products, such as managed LAN, managed router, managed WiFi and managed security services, as it seeks to lure bigger, more sophisticated companies.

Unlike Cablevision's Lightpath division but like Comcast, TWC, Cox and Charter, Bright House caters to nearly every type of business vertical over both its standard HFC plant and dedicated fiber lines. However, like those four major MSOs, it emphasizes a select

number of core verticals – namely, healthcare, hospitality, education, local government, financial services and, especially in the SMB space, professional services.

Suddenlink Communications

Similar to Charter, Suddenlink has become a much more aggressive commercial services player over the last couple of years. Suddenlink – which was the nation's seventh-largest MSO with about 1.5 million residential subscribers until it was taken over by Altice in December 2015 – has been adding commercial data and telephony customers at a steady clip as it expands its reach throughout its largely small-city, rural and suburban markets in 16 states across the heart of the U.S.

Suddenlink – based in St. Louis, with particular clusters of cable systems in Texas, Louisiana, Arkansas, Oklahoma, West Virginia and Arizona – closed out last year with 98,300 commercial customer relationships, up about 10 percent from nearly 90,000 at the end of 2014. Given the makeup of its markets, the vast majority of those customers are smaller firms opting for broadband and/or phone service, with the phone customers averaging just 2.8 lines per account.

Those small businesses, though, are starting to make a big impact on Suddenlink's financials. The MSO ended 2014 with $333.8 million in commercial revenue, up 12 percent from its 2013 total and nearly matching the total for Cablevision's Lightpath unit in the much bigger New York market. Suddenlink then generated about $375 million in commercial revenues last year, up more than 10 percent from its 2014 total.

Figure 14: Suddenlink Business Revenue Overview

2014 Business Revenue	2015 Business Revenue	Year-to-Year Growth	Key Market Facts
$333.8 million	$375 million (Heavy Reading estimate)	10+%	Passed 100,000 total commercial customers in March 2016

Source: Suddenlink Communications

Like its much bigger peers, Suddenlink boasts a sizable portfolio of products and services for firms in its territories, including Internet, voice, video and both coax-based and fiber-based Ethernet networking services. Detailed information about the company's SLA-grade products and services were not available.

Mediacom Communications

Mediacom, which had long been the eighth-largest U.S. MSO, has suddenly become the fifth-largest in the wake of Charter's twin takeovers of TWC and Bright House and Altice's twin takeovers of Cablevision and Suddenlink last year. Based in the Hudson Valley of New York State, Mediacom primarily serves more than 1.3 million residential subscribers in 22 states throughout the U.S., largely in smaller markets across the Midwest and South. Its biggest clusters of cable systems are in Illinois, Iowa, Missouri, Minnesota and Georgia.

Figure 15: Mediacom Business Revenue Overview

2014 Business Revenue	2015 Business Revenue	Year-to-Year Growth	Key Market Facts
$190 million	$210 million	11.0%	Small business – nearly 80% of total customers Enterprises – 27% of total revenues

Source: Mediacom Communications

Like Suddenlink and Charter, Mediacom has pursued the commercial market much more spiritedly in recent years as it has sensed the growing opportunity in its markets. Operating through two different subsidiaries – Mediacom Broadband LLC and Mediacom LLC – the MSO ended last year with about $210 million in commercial revenue, up almost 11 percent from $190 million in 2014.

Unlike most other larger U.S. MSOs, Mediacom does not report how many commercial customers it has. But, given the healthy revenue increases it's seeing, its customer count is clearly on the rise. Based on the revenue totals, Heavy Reading estimates the MSO has at least 60,000 commercial customers, with small firms of five employees or fewer accounting for nearly 80 percent of the total.

Figure 16: Mediacom's Key SLA Stats

SLA Metric	Details
Top Data Rates	Wavelength – Up to 100 Gbit/s; Fiber – 10 Gbit/s; HFC – 105 Mbit/s down-stream and 20 Mbit/s upstream.
Performance-Based SLA Services	Yes, for all customers. The level of SLA guarantees depends upon the company's size and the network it uses.
Performance Metrics Used	HFC – up-time percentages and MTTR. Fiber – jitter, latency, packet loss and other standard metrics. Metrics depend on the customer's size and the network it uses.
Offer Vertical-Specific SLAs	No, but Mediacom will customize SLAs for individual firms.
Offer Multiple Classes of Service	No
MEF-Based or MEF-Compliant	Carrier Ethernet compliant
SLA Prices vs. Non-SLA Prices	Basic SLAs on all services; more detailed SLAs come with add-on charges. Service prices largely depend upon cost of delivery.

Source: Mediacom Communications

Similar to the other big U.S. MSOs, Mediacom offers a wide range of products and services for businesses in its markets, including Internet, voice, video and both coax-based and fiber-based Ethernet networking services. Like the others, it concentrates on several core vertical markets – namely, education, healthcare, financial (regional banks and insurance firms) and local government agencies. Unlike the other MSOs,

however, it's also developing the agribusiness sector because of its heavy coverage of rural Midwestern farming communities.

Unlike many of its MSO peers, Mediacom offers some kind of SLA-grade services to just about all of its commercial customers, no matter how big or small the companies are or whether they are linked by all-fiber lines or HFC networks. The SLAs do vary widely, though, by the size of the company and the type of network connections it has, with big companies that rely on fiber receiving the highest service guarantees.

WideOpenWest (WOW)

Although not considered a traditional MSO because of its roots as a telco-based cable overbuilder, WOW has increasingly emerged as a major player in the U.S. cable space. Previously the ninth-largest MSO in the nation, the privately owned company has now jumped up to become the sixth-largest with about 780,000 residential subscribers, thanks again to the twin acquisitions of TWC and Bright House by Charter and the twin acquisitions of Cablevision and Suddenlink by Altice.

Based just outside Denver, WOW operates in 19 markets, mainly serving suburban communities around major Midwestern cities such as Chicago, Cleveland, Columbus and Detroit, as well as Baltimore and various Southeastern cities. Getting off to a later start than its larger peers, it did not invest much in commercial services until the past couple of years, when it finally began realizing the opportunities offered by the business market. Furiously playing catch-up, it has now signed up 38,000 commercial customers, but still lags behind even the smaller CableOne, which plunged into the commercial market earlier.

Due to its recent push into commercial services, WOW produced about $130 million in business revenues last year, up about 8 percent from $120 million in 2014. More impressively, the MSO has raised its commercial take substantially from just $12 million in 2012 and is seeking at least 20 percent growth this year. The company boasts about 38,000 commercial customers.

Figure 17: WOW Business Revenue Overview

2014 Business Revenue	2015 Business Revenue	Year-to-Year Growth	Key Market Facts
$120 million	$130 million	8%	Sees $2 billion opportunity in its markets

Source: WideOpenWest

Similar to its much larger peers, WOW has a substantial suite of products and services for firms in its markets, including Internet, voice, video and both coax-based and fiber-based Ethernet networking services. Also similar to the others, it concentrates on a few core vertical markets – namely, healthcare, finance, state and local government bodies, and wireless carriers. Unlike most other MSOs, however, it also focuses on the U.S. armed forces because of a high concentration of military bases in its territories.

Similar to Mediacom, WOW offers SLA-grade services to just about all of its commercial customers, no matter how big or small the companies are or whether they are

linked by all-fiber lines or HFC networks. As in Mediacom's case, though, the SLAs vary widely by the size of the company and the type of network connections it has, with big companies that rely on fiber enjoying the highest service guarantees.

Figure 18: WOW's Key SLAs Stats

SLA Metric	Details
Top Data Rates	Wavelength – 100 Gbit/s; Fiber – 10 Gbit/s; HFC – 300 Mbit/s
Performance-Based SLA Services	Yes, on fibered and HFC services.
Performance Metrics Used	HFC – availability, utilization. Fiber – packet loss, latency, delay variation, availability, utilization.
Offer Vertical-Specific SLAs	Yes (medical, legal, education, government, financial)
Offer Multiple Classes of Service	Yes
MEF-Based or MEF-Compliant	Carrier Ethernet compliant
SLA Prices vs. Non-SLA Prices	Basic SLAs on all services; more detailed SLAs come with add-on charges.

Source: WideOpenWest

CableOne

Like Mediacom, CableOne has suddenly climbed up the U.S. MSO ladder this year, thanks to the acquisitions made by Charter and Altice. Previously the tenth-largest MSO in the nation, it is now the seventh-largest operator in the U.S., with just shy of 620,000 residential cable subscribers spread across 19 states, including the South-east, Southwest, Midwest and Northwest.

Similar to Mediacom and Suddenlink, Phoenix-based CableOne has also been more aggressive in building up its commercial presence in its market. The MSO closed out last year with more than 47,000 commercial customers, up nearly 11 percent from slightly under 43,000 at the end of 2014. Most of its commercial customers opt for data networking services.

Thanks to this vigorous customer growth, CableOne generated nearly $89 million in business revenues last year, up more than 15 percent from close to $77 million in 2014. At that rate, it should clear the $100 million revenue mark this year, joining all of its larger MSO peers.

Figure 19: CableOne Business Revenue Overview

2014 Business Revenue	2015 Business Revenue	Year-to-Year Growth	Key Market Facts
$76.8 million	$88.7 million	15.5%	Poised to hit $100 million in annual revenues in 2016

Source: CableOne

Similar to its much larger peers, CableOne has a substantial suite of products and services for firms in its markets, including Internet, voice, video and both coax-based and fiber-based Ethernet networking services. Detailed information about the company's SLA-grade products and services were not available.

Conclusion

As this report has shown, commercial services are critical to the cable industry's future. With the business communications market now generating at least $12 billion annually for the industry and still growing at nearly a 20 percent clip, U.S. MSOs are investing more and more heavily in the market. They are extending their networks, building more fiber lines, connecting more buildings, developing new services, upgrading existing product lines, beefing up their sales forces, expanding into new vertical sectors and moving up-market to pursue larger firms.

In accordance with these efforts, at least eight of the nation's ten largest MSOs entering 2016 are now delivering SLA-grade services to their commercial customers, promising certain service performance, reliability and redundancy levels and offering various types of written service guarantees to back up those promises. (The other top two MSOs probably do so as well but did not participate in this research study.)

As **Figure 20** shows, all eight operators offer increasingly stringent SLA guarantees over their high-performance fiber lines. Moreover, several MSOs offer looser guarantees over their somewhat lower-performance HFC lines as well.

The eight top MSOs use very similar, if not exactly identical, performance metrics to measure and track the quality of service delivery over fiber links. By far, the five most common metrics are service availability, latency, packet loss, jitter and MTTR. For HFC lines, operators tend to use some version of service availability and MTTR.

Most of the biggest MSOs do not yet offer vertical-specific SLAs but the cable industry does seem to be moving in that direction. At the least, a number of MSOs will now customize their SLAs for commercial clients if the client is big or important enough and the request is made.

Led by Comcast, Cox and Charter, more than half of the Big Eight now offer multiple classes of service over their fiber lines, while the other three operators seem to be working their way there. All eight have achieved some level of MEF certification, with most of them achieving Carrier Ethernet 2.0, the highest level available. Plus, nearly all of them charge significantly more for SLA-grade services than non-SLA services.

Clearly, then, SLA-grade services have become table stakes in the commercial telecom world. No MSO can compete seriously for much business without them. As MSOs seek to climb further up-market, they will need to keep enhancing and refining their SLAs to meet the increasingly demanding needs of their customers. And, as they deploy more advanced Internet and Ethernet services over DOCSIS 3.0 and 3.1 technology, operators will likely need to offer more SLA-grade services over HFC links as well.

In short, SLA-grade services are here to stay for cable. The big question now is how far cable will take these services.

Figure 20: Comparing MSOs on SLA-Grade Services

MSO	Performance-Based SLA Services	Performance Metrics Used	Offer Vertical-Specific SLAs	Offer Multiple Classes of Service	MEF-Based or MEF-Compliant	SLA Prices vs. Non-SLA Prices
Comcast	Yes, on fibered and HFC services	Availability, bandwidth utilization, bidirectional latency, jitter, packet loss	Yes	Yes	Carrier Ethernet 2.0 certified	Typically charges SMBs 50% higher for SLA services
Time Warner Cable	Yes, Fiber Access – SLAs; DOCSIS Access – SLOs	Availability, latency, packet loss, jitter and MTTR; SLOs – service availability and MTTR	No	Fiber – Yes; DOCSIS – No	Carrier Ethernet 2.0 certified	Roughly 3X as much for SLA-backed services over fiber
Cox Commu-nications	Yes	Availability, MTTR, bidi-rectional latency, band-width utilization, jitter	Yes	Yes	Carrier Ethernet 2.0 certified	Charges add-on fees for SLA-based services
Charter Commu-nications	Yes, Fiber Access – SLAs; DOCSIS Access – SLOs	Packet loss ratio, delay variation, round-trip delay and availability	No	Yes	Carrier Ethernet 2.0 certified	Charges add-on fees for SLA-based services
Cable-vision Systems – Lightpath	Yes	Packet loss, round-trip delay, jitter, availability and MTTR	Yes	Yes	Carrier Ethernet 2.0 certified	Charges add-on fees for SLA-based, specific to vertical and specific customer requirements
Bright House Networks	Yes	Packet loss, round-trip delay, jitter, availability and MTTR	On request	Yes	Carrier Ethernet 2.0 certified	Charges add-on fees for SLA-based services
Media-com Commu-nications	Yes	Fiber – jitter, round-trip delay, packet loss, other standard metrics; HFC – availability and MTTR	On request	No	Carrier Ethernet compliant	Basic SLAs on all services; more detailed SLAs come with add-on charges
Wide-Open-West	Yes, on fibered and HFC services	Fiber: packet loss, bidi-rectional latency, delay variation, availability, uti-lization; HFC: availability, utilization	Yes	Yes	Carrier Ethernet compliant	Basic SLAs on all services; more detailed SLAs come with add-on charges

MTTR: Mean time to repair
SLO: Service-level objective

Source: Various companies

About Accedian

Accedian delivers exceptional end-to-end network performance visibility, for control over the best possible user experience. Accedian enables providers to maximize quality of service (QoS), overcome network complexities, and ensure unparalleled quality of experience (QoE). Accedian has been turning performance into a key competitive differentiator since 2005.

Accedian solutions assure the networks for seven of the top ten U.S. MSOs, including nationwide coverage at Comcast to support their business services offering to small and medium enterprises. These deployments cover large-scale 3G and 4G LTE backhaul networks, as well as virtualized customer premises equipment (vCPE) and HFC-based Carrier Ethernet – applications where precise service-level agreement (SLA) monitoring and low-latency traffic conditioning are critical to delivering competitive QoS and differentiating beyond best-effort access.

Designed for seamless deployment and integration into MSO networks and operations, Accedian solutions optimize and assure network performance from service activation to ongoing monitoring, remote fault isolation and reporting – driving down the cost of doing business while delivering new growth opportunities.