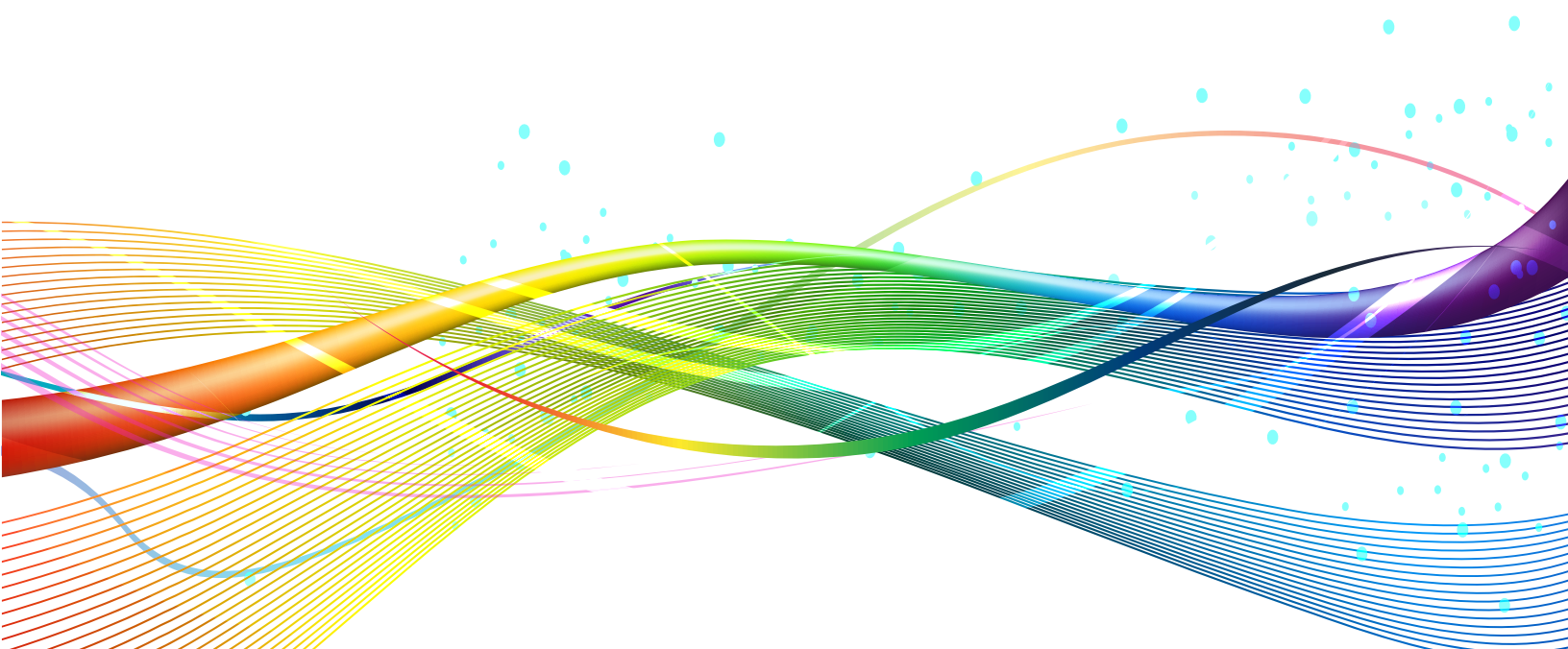# CoSN's 2015 Annual E-rate and Infrastructure Survey

In Partnership with
AASA (the School Superintendents Association) and MDR

CoSN is the premier professional association for school system technology leaders and represents over ten million students nationwide. The mission of CoSN is to empower educational leaders to leverage technology to realize engaging learning environments. Visit cosn.org or call 866-267-08747 to find out more about CoSN's focus areas, annual conference and events, advocacy and policy, membership, and the CETL™ certification exam.

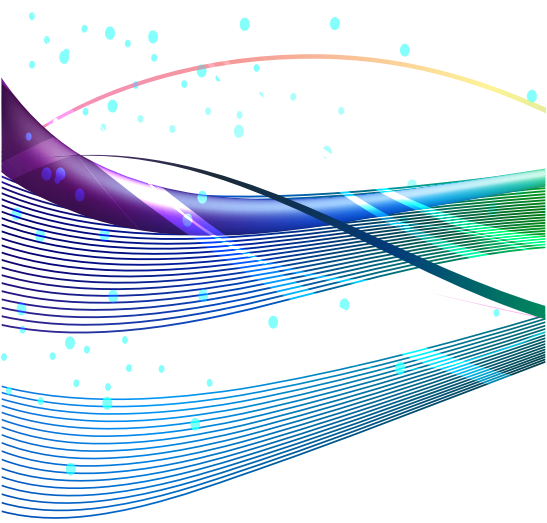AASA, The School Superintendents Association, founded in 1865, is the professional organization for more than 13,000 educational leaders in the United States and throughout the world. AASA advocates for the highest quality public education for all students, and develops and supports school system leaders.

We are expert marketers with unmatched expertise in education— that's what makes MDR a different kind of integrated marketing services agency. Since 1969, MDR has pioneered development of a rich, comprehensive database of educator and institutional information across K-12, higher ed, public libraries, and early childhood.

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Executive Summary

In August of 2015, CoSN partnered with AASA, The School Superintendents Association and education researchers at MDR to survey school district leaders regarding the current state of broadband and technology infrastructure in U.S. school systems. Since this is the third year of the survey, we now have more trend information on the current state of education technology infrastructure and access to the connectivity challenges educators encounter.

The findings are organized around three major themes: **Affordability** remains the primary obstacle for robust connectivity; **Network Speed and Capacity** pose significant challenges for schools; finally, too many school systems report a **Lack of Competition** for broadband services in many parts of the U.S., particularly in rural America.

In addition, these new survey results include information on the impact of changes to the E-rate, and the growing concern of digital equity related to outside of school access to technology, particularly broadband.

1. Affordability

Affordability continues to be the primary impediment for securing robust connectivity; this is particularly true for monthly service fees but also for initial capital costs.

Challenges:

- **Biggest Barrier is On-Going Expenses**: For the third year in a row, nearly half of school systems (46%) identify cost of ongoing recurring expenses as the biggest barrier to robust connectivity. Capital or up-front expenses are also a significant barrier (34%) to increasing robust Internet connectivity.

- **Some School Systems Pay Extremely High Costs for Internet and Wide Area Network (WAN) Connections**: 1 out of 5 (19%) of responding school systems are paying $50/Mbps or more per month for their Internet Connection, and 18% pay the same high amount for their WAN connection.

Despite these challenges, there are some positive trends.

Progress:

- **Monthly Internet Costs Decreasing:** Internet connection affordability improved over previous surveys with 36% of school systems indicating that their monthly cost per Mbps for Internet connection was less than $5 per Mbps compared to 27% reporting that in 2014.

- **Fewer School Systems with Exceptionally High Monthly Internet Costs:** School systems with exceptionally high monthly costs (over $50 per Mbps) for Internet bandwidth decreased 13% (32% in 2014 vs. 19% in 2015).

"Education is going digital. Yet school system technology leaders face many challenges as they plan their education networks for the future.
While progress is happening, policymakers and educators will need to keep their eyes focused on continued investments in robust, reliable education networks with broadband access and WiFi to enable digital learning and address issues of digital equity."

Keith Krueger, CEO, CoSN.

2. Network Speed & Capacity

Too many schools still lack the broadband speeds necessary to deliver 21st century learning, encounter major problems with capacity, and do not meet current industry wireless standards. Having adequate capacity and bandwidth is critical for educators and students to utilize digital tools and resources effectively, particularly streaming content and videos that require more bandwidth.

Challenges:

- **Inadequate Connection Speeds**: 23% of respondents reported Internet bandwidth speeds of 10 Mbps or less for 1000 students – in other words, nearly one quarter of all school systems have only reached 10% of the FCC's short-term broadband connectivity goal (100 Mbps per 1000 students).

- **Some Internet Providers Lack Capacity to Offer Broadband**: 12% of all respondents and 14% of rural school system respondents reported that their Internet providers were at capacity and could not offer additional bandwidth.

- **Transport Capacity**: 10% of respondents reported that their own transport connection type was at capacity.

- **Not Using Current Wireless Standards**: 1 out of 3 school systems indicated that they do not use current wireless industry standards (such as 802.11 a/b/g/n/ac).

- **Nearly 1 Out of 4 School Systems Report that None of their Schools Meet the FCC's Short-Term Broadband Goal**: 23% of school systems reported that none of the schools in their system can meet the short-term broadband goal, virtually unchanged from last year.

- **Inadequate Internet Bandwidth**: Over two-thirds (68%) of school systems report they do not have sufficient Internet bandwidth for today and the coming 18 months. 1 out of 4 respondents projected mind-boggling growth for Internet connectivity in the next 18 months – projections of between 100% and 499% – driven by three primary factors: online assessments; more student devices; and digital content.

- **Internet Downtime**: 1 out of 4 respondents reported unplanned Internet downtime in their school system of 3 days during the year. Another 36% reported unplanned downtime in their school system of 1 day per year.

Progress:

- **Expanding Use of Lit Fiber***:* 72% of respondents indicated that they are using lit fiber for transport types for WAN operations, a dramatic one-year increase from 2014, when it was 46%. This means many more schools have the capacity to provide broadband speeds to the school door.

- **Improving Wide Area Network Connection Speeds**: 59% of respondents reported WAN speeds of 1 Gbps or more, a modest improvement from 53% in 2014

- **More Schools Have Faster Wireless Access Points:** 63% of school systems reported typical connection speed of fast 1 Gbps access, slightly more than 54% in 2014.

- **Increased Confidence in Wireless Connectivity:** Two thirds of school systems (64%) now say their WiFi could handle a 1:1 initiative (28% very confident/ 36% somewhat confident). This is up from 54% last year.

3. Lack of Competition

Lack of robust competition among Internet providers serving school systems continues to be a major issue adversely affecting affordability and decreasing the ability for education leaders to plan for redundancy (a best practice).

Challenges:

- **Lack of Competition for Internet Persists:** 46% of respondents indicate that lack of competition is a problem with only one Internet provider in the area. However, this is an improvement from the 60% that reported this problem last year.

- **Lack of Redundancy:** Without multiple providers and multiple paths, it is impossible for school systems to have network redundancy —considered a best practice. In 53% of school systems they have only one Internet provider or two providers using the same path.

- **Rural Areas Report that Geography Limits Competition**: The challenges are magnified in rural areas where 54% of respondents reported only one Internet provider in the area.

- **Lack of Qualified Bids**: Nearly one-third (29%) of school systems reported receiving 1 or fewer qualified bids for E-rate connectivity services in 2015 (Category 1), essentially no progress from the 32% last year.

- **Problem Amplified in Rural Areas**: Lack of competition is even more severe in rural school systems, with 38% indicating that they received 1 or fewer proposals for connectivity services.

Looking Forward

Education is going digital and will become more so in the years to come. Yet school system technology leaders face many challenges related to cost, poor connections, network reliability, and lack of competition. The survey found that these challenges are not static:

- **Dramatic Increase in the Number of Devices**: Respondents predict that in 3 years the number of devices per student on their network will dramatically increase -- 55% expect two or more devices per student.

- **Insufficient WAN Bandwidth:** 56% indicated that they do not have sufficient WAN bandwidth for today and the coming 18 months.

- **Exponential Internet Bandwidth Expectations**: 1 out of 4 project exponential growth expectations for Internet connectivity in the next 18 months (between 100% and 499%).

Policymakers and educators will need to keep their eyes focused on continued investments in robust, reliable education networks with broadband access and WiFi to support and enable digital learning.

Overview

This survey on the current state of infrastructure and network access in K-12 school systems is particularly timely. More and more schools are going digital and issues around affordability, speed and reliability, and competition are key factors critical to providing learning opportunities for students. The past year has been a time of significant change for technology in schools. In 2014, the FCC modernized and significantly expanded funding (60%) for E-rate, the fourth largest federal program impacting our nation's K-12 schools. The modernized E-rate focuses on investments that increase bandwidth and improve WiFi/Local Area Networks (LAN) with the goal of reaching President Obama's vision, 99% of classrooms with broadband and wireless.

In August of 2015, CoSN partnered with AASA, The School Superintendents Association and education researchers at MDR to survey school district leaders regarding the current state of broadband and technology infrastructure in U.S. school systems. The survey collected data from K-12 school district administrators and technology leaders/Chief Technology Officers about E-rate, broadband, and infrastructure in school systems across the country. Since this is the third year the survey has been conducted, we now have more trend information on the current state of education technology infrastructure and the access and connectivity challenges educators encounter. Educators, without question, face increasing demand for bandwidth for many reasons, including virtual/online learning, online assessments, growing numbers of devices in school settings, and digital content.

Demographics of Survey Respondents

The 2015 survey is based on 531 responses from district administrators/technology leaders/Chief Technology Officers, and came from 48 states. Survey respondents represented urban, rural, and suburban school systems as well as large, medium, and small school systems. This diversity in respondents provides data for school systems with different needs, including identifying priorities and challenges facing our schools as they transition to the digital learning environments that students need to become college, career, and life ready.

Geography

In 2015, fewer survey respondents (48%) were from rural areas compared to 2014 (58%). Survey respondents from both urban and suburban areas increased slightly: 20% urban and 32% suburban. The 2015 survey is closer to the actual number of urban districts. The survey may over-represent suburban responses. That said, we believe on whole, the distribution is still similar to percentages reported by the National Center for Education Statistics so that overall findings are statistically significant.[1]

School System Student Population

Consistent with prior year surveys, almost half of respondents (45%) are from school systems with student populations under 2,499. In 2015, we received more survey respondents from school systems with student populations over 15,000 (22% compared to 14%).

Student Population of School System	NCES	2014	2015
Under 2,499	17%	46%	45%
2,500-9,999	30%		28%
2,500-14,999		41%	
10,000-14,999			6%
10,000-24,999	19%		
15,000-49,000		10%	15%
25,000 and over	35%		
Over 50,000		4%	7%

Source: https://nces.ed.gov/programs/digest/d11/tables/dt11_092.asp

Geographic setting of school system	NCES Statistics	2014	2015
Urban	23%	14%	20%
Suburban	20%	28%	32%
Rural	57%	58%	48%
*Urban NCES statistics include towns and cities			

NOTE: [1] The 2015 CoSN/AASA survey is based on 531 responses from district administrators/technology leaders/Chief Technology Officers, and came from 48 states. Results have a +/- 4.3% reliability.

Key Findings

The findings are organized around three major themes: **Affordability** remains the primary obstacle for robust connectivity; **Network Speed and Capacity** pose significant challenges for schools; finally, too many school systems report a **Lack of Competition** for broadband services in many parts of the U.S., particularly in rural America.

1. Affordability

The high cost of internet access remains the single biggest barrier to robust connectivity in schools today. For the third year in row, the cost of monthly recurring/ongoing expenses (46%) was the top concern for school districts across the country. Capital, upfront non-recurring costs (34%) weighed in as the second biggest barrier to increasing Internet connectivity.

Significant Barriers to Increasing Internet Connectivity in School Systems
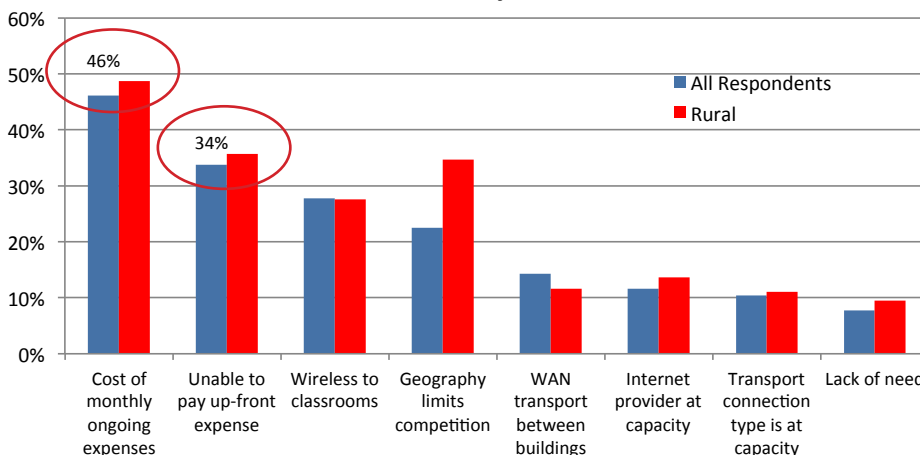
Internet and WAN Connection Costs

Nearly 1 in 5 responding school systems paid exceptionally high monthly costs (over $50 per Mbps per month) for Internet and WAN connections. This is a significant improvement in one year when nearly 1 in 3 reported paying exceptionally high Internet monthly costs. That said, costs remain a major problem for many school systems. The good news is one-third of districts pay low Internet connection fees (less than $5/Mbps a month) and more than half pay a similar amount for WAN connections.

Cost per Month	Internet Connection	WAN Connection
No cost - $4.99/Mbps	36%	52%
$5.00 - $49.99/Mbps	45%	30%
High Cost - $50.00/Mbps or more	19%	18%

Challenges:

Biggest Barrier is On-Going Expenses: For the third year in a row, nearly half of school systems (46%) identify cost of ongoing recurring expenses as the biggest barrier to robust connectivity. Capital or up-front expenses are the second biggest barrier (34%) to increasing robust Internet connectivity.

Some School Systems Pay Extremely High Costs for Internet and Wide Area Network (WAN) Connections: 1 out of 5 (19%) of responding school systems are paying $50/Mbps or more per month for their Internet Connection, and 18% pay the same high amount for their WAN connection.

Progress:

Monthly Internet Costs Decreasing: Internet connection affordability improved over prior years' surveys with 36% of school systems indicating that their monthly cost per Mbps for Internet connection was less than $5 per Mbps compared to 27% reporting that in 2014.

Fewer School Systems with Exceptionally High Monthly Internet Costs: Schools systems with exceptionally high monthly costs (over $50 per Mbps) for Internet bandwidth decreased 13% (32% in 2014 vs. 19% in 2015).

2. Network Speed & Reliability

Too many schools still lack broadband speeds, encounter major problems with capacity, and do not meet current industry wireless standards. Schools have major "pinch points" within the network that can affect connectivity and capacity, such as inadequate connection speeds for WAN and LAN, with wireless access points that lack capacity. Having adequate capacity and bandwidth is critical for educators and students to utilize digital tools and resources effectively, particularly streaming content and videos that require more bandwidth.

Current Bandwidth Capacity

While some school systems are making some progress towards increasing Internet connectivity, the majority of school systems are still far from reaching their projected growth goals to fully utilize digital tools and resources. In addition to the upfront capital expenses and recurring monthly expenses, additional barriers to increasing Internet connectivity to reach projected growth goals are the Internet capacity of the school system and the capacity of the Internet provider. Twelve percent of school systems reported that their Internet providers were at capacity and could not offer additional bandwidth and another 10% reported that their own transport connection type was at capacity.

When asked about the types of transport for WAN operation, including circuits among buildings within a school system and between the school system and the Internet connection point, 72% of respondents indicated that they are using lit fiber, a significant increase from 2014.
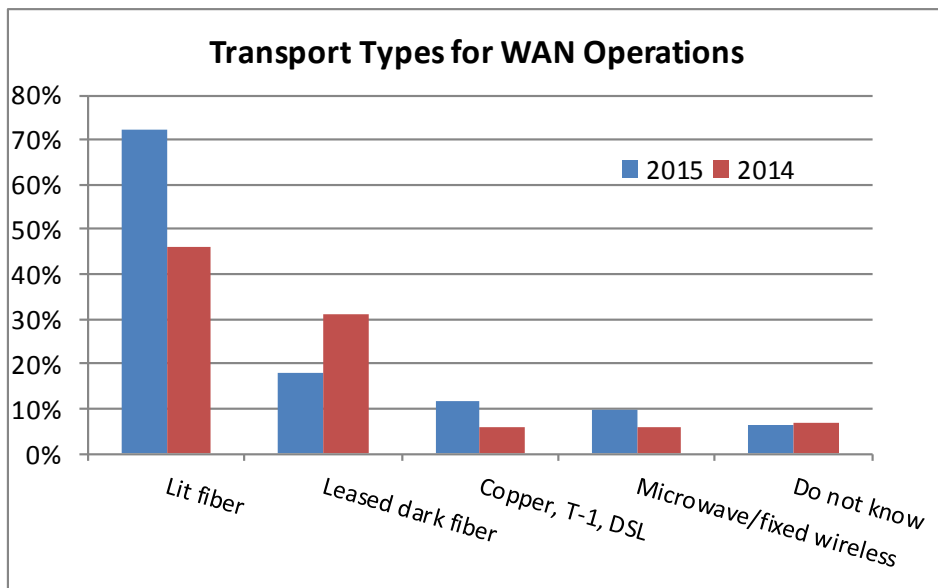

Transport Types for WAN Operations

Schools Meeting FCC Goals

Twenty-three percent of school systems reported this year that **none of the schools in their system** can meet the short term broadband goal – a slight improvement from the 27% reporting that last year. The majority of school systems (55%) do not yet fully meet the minimum Internet bandwidth recommendations at every school, forty-five percent are reaching this goal, representing a significant improvement from 19% in 2013. More and more schools are going in the right direction, yet there is still significant work to be done in the majority of schools to meet the immediate bandwidth goal.
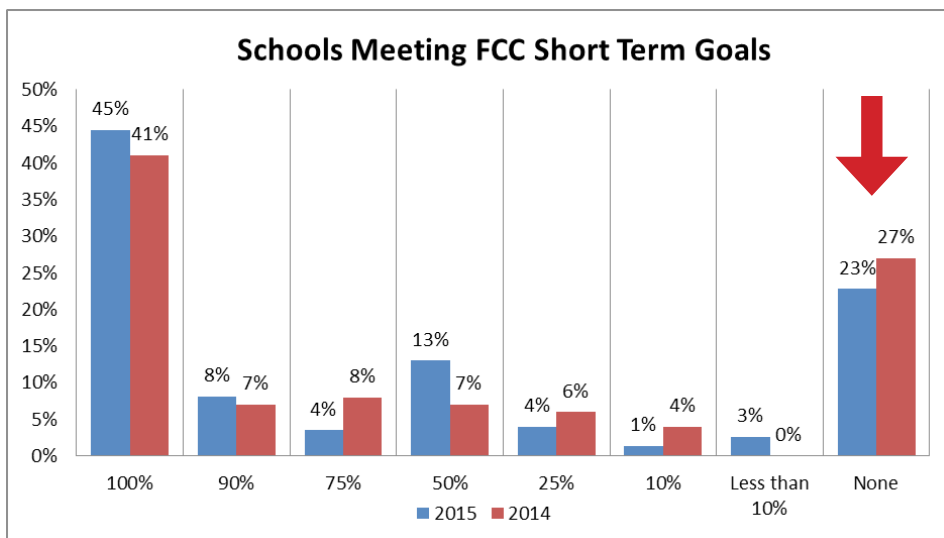
When asked what percent of the schools in their system have Internet bandwidth to the schools that meet the long term FCC national broadband goal of 1 Gbps per 1000 students, only 8% of all school systems reported that 100% of schools met that goal. Similar to last year, 68% of all school systems replied that *none* of their schools meet the FCC long-term goal.

Pinch Point: Network Equipment Components

Survey respondents reported on whether Internet infrastructure components (e.g., firewall, content filter, DMZ switching, and gateway routers) required upgrades to support the FCC's short and long-term goals. Similar to 2014, the majority of school systems reported that they will need to upgrade, with 41% indicating that they will need both short-term and long-term upgrades and 43% indicating that they only need long-term upgrades.

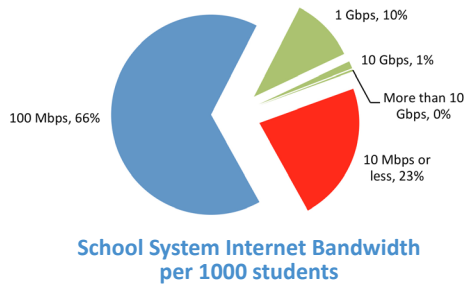| Upgrade Options	Response
Yes, we need upgrades for both short-term and long-term	41%
No upgrades are needed for short-term, but we will need long-term upgrades	43%
No upgrades are needed for short-term or long-term	12%
Do not know	4%

Pinch Point: School System Internet Connection (Bandwidth)

School System Internet Bandwidth per 1000 students

Sixty-six percent of respondents reported that their school system reached the FCC short-term goal (100 Mbps per 1000 students of Internet bandwidth). However, 23% of school systems reported much lower speeds with 10 Mbps of Internet bandwidth, significantly less than the FCC's short-term goal but slightly better than in 2014 (30%). School systems with Internet bandwidth speed of 10 Mbps are at 10% of the FCC's short-term goal and 1% of the FCC's long-term goal, indicating that these school systems face a severe pinch point in delivering adequate bandwidth. Furthermore, only 10% of school systems reported reaching Internet bandwidth of 1 Gbps per 1000 students – the long-term FCC goal.

Pinch Point: LAN Connection

Typical Connection Speed Between LAN Switches and the Core Switch
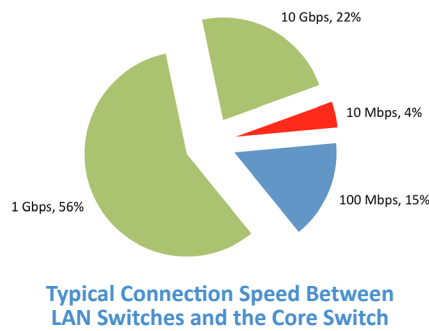
In 2015, respondents reported current typical connection speeds between LAN switches and the core switch. Connection speeds between LAN switches and the core switch are slightly better than WAN access speeds (connections between schools). Twenty-two percent of respondents reported speeds of 10 Gbps and 56% reported speeds of 1 Gbps compared to 15% and 43%, respectively for WAN access. As with WAN access, rural areas reported slower connection speeds between LAN switches and the core switch. Twenty-five percent of rural areas reported connection speed of 100 Mbps or less compared to 19% for all respondents.

Pinch Point: WAN Connection

WAN Access (connection between schools)
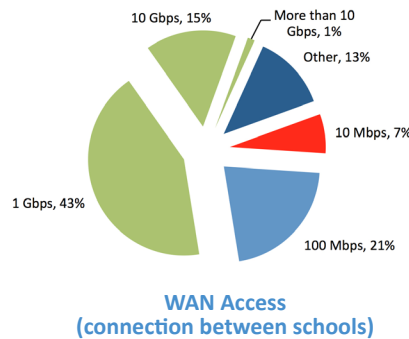
Twenty-eight percent of survey respondents indicated reaching WAN speeds of 100 Mbps or less per 1000 students. This is an improvement from 2014 when 34% of respondents reported speeds of 100 Mbps or less. Inadequate WAN access will impact a school system's ability to maximize digital learning, including access to digital instructional tools and resources, as well as the ability to conduct online assessments, which was ranked as the number one factor driving the need for Internet bandwidth growth. 36% of rural area respondents reported slower WAN connections of 100 Mbps or less compared to 28% for all respondents, highlighting that rural areas are stilling lagging behind. Similar to 2014, 43% of school systems report that they met the FCC's long term goal of 1 Gbps. The "other" category represents 1 Gbps, multiple 10 Gbps, and other connection speeds.

Proxy Server or WAN Acceleration

For the first time in 2015, survey respondents were asked about their use of a caching proxy server or WAN acceleration technology. The majority of school systems (69%) do not use a proxy server or WAN acceleration. Only 20% of survey respondents indicated that they use proxy servers, 3% reported using WAN acceleration, and another 3% reported using both. One way of managing the ever increasing need for bandwidth is to have smart use of proxy servers or WAN acceleration.

Proxy Servers or WAN Acceleration	Response
Use proxy servers	20%
Use WAN acceleration	3%
Use both	3%
Do not use either proxy servers or WAN acceleration	69%
Do not know	5%

Pinch Point: Wireless Connectivity

In 2015, school systems reported on the existing wireless connectivity for high school, middle school, and elementary school. Only 1% of school systems reported that high schools did not have wireless access compared to 13% for middle and 10% for elementary schools. This is significant progress from 2013 when school systems reported that 43% of high schools and 36% of middle schools did not have wireless connectivity in the classroom. Although wireless is now available in nearly every classroom, many places still struggle to provide sufficient capacity.
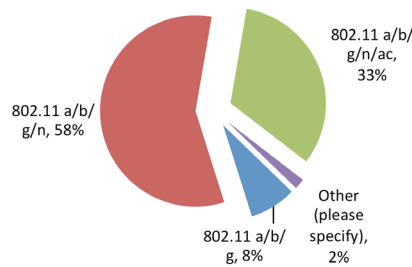
Current Standard for the Majority of Wireless Access Points (WAP) in Network

802.11 a/b/g/n/ac, 33%
802.11 a/b/g/n, 58%
802.11 a/b/g, 8%
Other (please specify), 2%

As more students are using devices in the classroom and often times multiple devices, the need for robust wireless is increasing rapidly, and just having basic connection to a classroom is not sufficient. Recent improvements in wireless standards have accelerated the obsolescence of a typical school system's wireless infrastructure. When asked about the predominant wireless standard for classrooms, 58% of the school systems reported that they are using old and outdated wireless speeds (802.11 a/b/g/n). Only 33% of the school systems indicated that they were able to accommodate the wireless standard, 802.11 a/b/g/n/ac (new devices come with the ac standard).
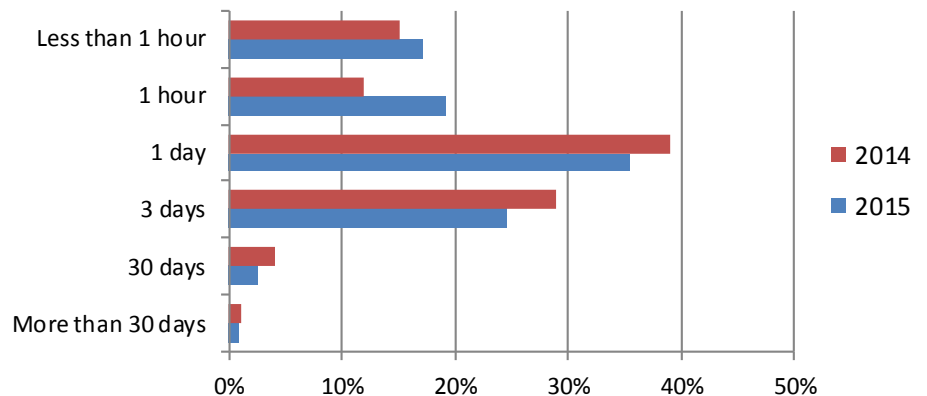
The internal school backbone, connection speed between a wireless access point (WAP) and a switch should be at least 1 Gbps to accommodate the aggregation of all the WAP connections. Survey respondents reported a typical connection speed between a WAP and the LAN switch. In 2015, 63% of school systems reported the typical connection speed of 1 Gbps, slightly more than the 54% in 2014. While it appears school systems are moving in the right direction to address connection speeds, there are still nearly one-third of school systems (31%) reporting WAP connection speeds of 100 Mbps or less.

Respondents were asked how confident they are that the current wireless networks in their schools have the capacity to handle one device per student or more – 64% were confident (28% very confident and 36% somewhat confident). This is an improvement over 2014, when 54% of respondents were either very confident or somewhat confident.

Down Time

Districts struggle to achieve reliable internet connectivity. Since 2014, we find slightly better results for unplanned Internet downtime. Respondents reporting Internet downtime of 3 days per year decreased from 29% to 25% and unplanned Internet downtime of 1 day per year decreased from 39% to 36%. Unfortunately, 4% of school system survey respondents reported unplanned Internet downtime of 30 days or more per year. Without reliable Internet, educators cannot adequately integrate digital tools and resources into teaching and learning.

Unplanned Internet Downtime in a Year

3. Lack of Competition

There continues to be a lack of competition among Internet providers, although we are seeing some progress. In 2014, 60% of schools systems reported being in this difficult situation. That number dropped to 46% in 2015. Even with this progress nationally, there is still a significant lack of Internet provider competition for broadband connectivity (Category 1 E-rate service). This is especially true for rural school systems — 54% of rural respondents reported only having one provider for internet services.

Given the lack of Internet providers in some areas, nearly one-third (29%) of school systems reported receiving 1 or fewer qualified providers or proposals for broadband services in 2015 (Category 1, E-rate). This is a slight improvement from 2014, when 32% of respondents reported receiving 1 or fewer qualified providers or proposals for E-rate services. This lack of competition among qualified Internet providers is amplified in the rural areas, with 38% of rural survey respondents indicating that they received 1 or fewer proposals for E-rate services. Geography also limits competition in rural areas - over one-third (35%) of rural survey respondents reported that geography is *as significant a barrier* as upfront capital expenses.

Impact of E-rate Changes

In 2014, the FCC modernized the E-rate and increased its funding by 60%. Data from the 2014 CoSN/AASA Infrastructure survey was cited over 50 times by the FCC in their decision to focus E-rate on improving broadband to the classroom and enabling WiFi/Local Area Networks. The FCC also adopted a short-term broadband goal of 100 Mbps per 1000 students and a long-term goal of 1 Gbps per 1000 students for Internet connectivity. A majority (51%) of respondents indicated that the FCC's short-term goal of 100 Mbps per 1000 students for Internet connectivity was about right and those who had already achieved the goal thought it could be more ambitious. Survey respondents indicated that some of the major obstacles preventing their school system from meeting the FCC's short term broadband goal were funding (55%) and staffing (25%). Nearly one-third (30%) of school systems reported that there are no major obstacles to meeting the FCC's short term goal.

We asked survey respondents which statement best describes the impact of E-rate changes on their school system. Most school systems (48%) have positive views vs. 28% giving negative views (another 24% were "not sure"). Those that were positive about the changes had a range of views: 15% of respondents liked the new funding for internal connections/WiFi and 15% liked the new focus on broadband and WiFi. Another 14% of respondents noted that they would gain more under the new focus on WiFi and broadband even though they lost telephone funding.

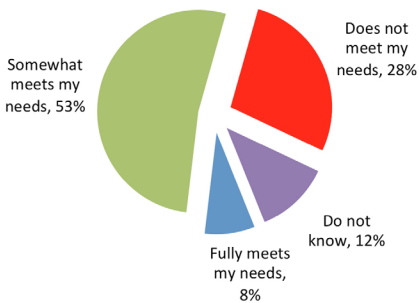| Impact of E-rate Changes on School System	Percent
VERY POSITIVE The new funding and focus on broadband and WiFi were much needed and will help my school system.	15%
VERY POSITIVE The new funding for internal connections/WiFi are important improvements.	15%
SOMEWHAT POSITIVE While we lost funding for telephone, we will gain more with new focus on broadband and WiFi.	14%
POSITIVE The new funding for broadband, including connectivity goals is helpful to my school system.	4%
NEGATIVE The changes resulted in a loss of funding for my school system.	28%
NOT SURE Too soon to know the impact of changes on my school system.	24%

As part of the FCC modernization of E-rate, the program is phasing out telephony as a covered service. The majority of survey respondents reported that the phase down of the plain old telephone service (POTS) significantly impacts or somewhat impacts their school system.

Impact of Phase Down of Plain Old Telephone Service (POTS) on School Systems (2015)	
Significantly impacted by POTS phase down	45%
Somewhat impacted by POTS phase down	47%
No impact by POTS phase downs	8%

New Funding

The survey also asked if the new $150 Category II formula over five years for Internal Connections/WiFi was meeting their needs. It should be noted that this is the first year of the formula and it may be early for school systems to know the full impact. Two thirds of responding school systems indicated that the new formula of $150 per student *somewhat or fully meets* the school system's needs to upgrade internal/WiFi infrastructure goals. Conversely, 28% of respondents report that the formula funding does not meet their needs. The remainder seem to be taking a "wait and see" approach.

Consortium Buying

The FCC and others have promoted consortium buying to lower overall E-rate costs. Consortium buying advantages for school systems are described as threefold: bulk buying reduces cost; capital expenses help build investments; and consortium expertise shares highly technical staffing. As in prior years, school systems primarily use a consortium to file on their behalf for E-rate for bandwidth/Internet access. In 2015, 43% of the districts surveyed reported using consortium buying services for bandwidth/internet access. Survey respondents also reported that their school system allows a consortium to file on their behalf for E-rate for statewide backbone support (16%), WAN circuits (16%), transport/digital transmission (14%), and equipment (15%). Consistent with prior years, 26% of survey respondents reported that consortium buying services are not available for their school system.

Current E-rate Funding Formula Meets School System Needs

- Does not meet my needs, 28%
- Somewhat meets my needs, 53%
- Do not know, 12%
- Fully meets my needs, 8%

How School Systems Participate in Consortium Services for E-rate
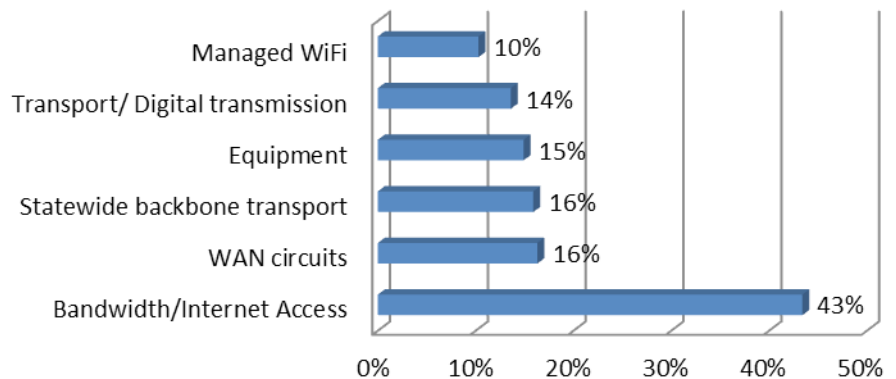
- Managed WiFi 10%
- Transport/ Digital transmission 14%
- Equipment 15%
- Statewide backbone transport 16%
- WAN circuits 16%
- Bandwidth/Internet Access 43%

Looking Forward

Education is going digital. Yet school system technology leaders face many challenges as they plan their education networks for the future, especially around factors of cost, poor connections, and network reliability, as well as a lack of competition for broadband services in too many communities. Digital equity is another issue facing schools today and in the future. Students who lack Internet access service outside of the traditional school day cannot maximize learning opportunities in a digital environment –the so called "Homework Gap." The survey found that these challenges are not static:

- **Exponential Growth Expectations**: 1 out of 4 project exponential growth expectations for Internet connectivity in the next 18 months (between 100% and 499%)

- **Insufficient WAN Bandwidth:** 56% indicated that they do not have sufficient WAN bandwidth for today and the coming 18 months.

- **Dramatic Increase in the Number of Devices**: Respondents predict that in 3 years the number of devices per student on their network will dramatically increase -- 55% expect two or more devices per student.

Projected Growth in Internet Connectivity

Over two-thirds (68%) of school systems report they do not have sufficient Internet bandwidth for today and the coming 18 months. One quarter (25%) of respondents projected significant growth for Internet connectivity in the next 18 months - between 100% and 499%.

Fifty-six percent of survey respondents indicated that they do not have sufficient WAN bandwidth for today and the coming 18 months compared to 61% in 2014. 17% of school systems project significant growth expectations for WAN connectivity in the next 18 months – between 100% and 499%.

Similar to previous surveys, the three primary factors driving the projected growth in Internet bandwidth are online assessments, increased student devices, and digital content. Rural respondents indicated that streaming content was the second most important factor after online assessments.

Student Access to Devices

Effective digital learning requires wireless connectivity as well as student access to devices to utilize digital instructional tools and resources. Survey respondents were asked to project the number of devices used in schools on a typical day now and the number of devices needed in 3 years. Currently, 40% of school systems report *one device per two students* and 28% report *one device per student.*

Interestingly, respondents projected dramatic increases in 3 years with 55% expecting two or more devices per student and 20% expect students to have access to three or more devices in three years. It is clear that school systems need to plan for robust, ubiquitous learning environments, often with students accessing multiple devices.

Challenges:

Inadequate Internet Bandwidth: Over two-thirds (68%) of school systems report they do not have sufficient Internet bandwidth for today and the coming 18 months. 1 out of 4 respondents projected mind-boggling growth for Internet connectivity in the next 18 months – projections of between 100% and 499%. The need for more bandwidth is being driven by three primary factors: online assessments; more student devices; and digital content.

Devices	Currently	3 Years
Less than one device per five students	14%	1%
One device per two students	40%	8%
One device per student	28%	36%
Two devices per student	15%	35%
Three devices per student	2%	14%
More than three devices per student	1%	6%

In 2015, to learn more about student access to devices, survey respondents provided information about the percentage of students who had access to non-shared (1:1) devices either provided by the school or through a BYOD program. Approximately 25% of school systems reported that 100% of students have access to non-shared devices at high school and middle school compared to 13% at the elementary school level.

Percentage of Students with Internet Access through non-shared (1:1) devices at school
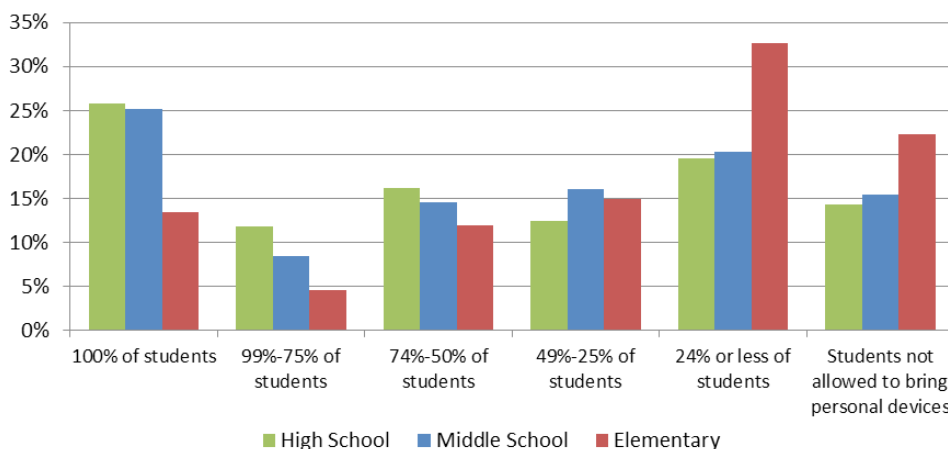
Digital Equity: Off Campus Access

Students who lack Internet access service outside of the traditional school day cannot maximize learning opportunities in a digital environment –the so called "Homework Gap." This survey found that few school systems are focused on this critical problem.

Students in digital learning environments need access to digital instructional materials and resources outside of the classroom. According to the CoSN 2014 IT Leadership Survey, digital content will begin to replace print textbooks at scale over the next three years. Off campus access requires broadband, device, and content access.

Unaffordable Internet at Home:
Overwhelmingly, 88% of respondents stated that affordability was the biggest barrier for families lacking Internet access at home.

Limited Service: Lack of available broadband service to the home (42%) was also noted as a key barrier for families without access.

Lack of Digital Equity Strategies:
3 out of 4 school systems surveyed do not have *any* off campus strategies for providing connectivity to students at home and after school. While this is a slight improvement from the 82% who responded last year, the vast majority of schools have not yet addressed this fundamental problem for students expected to do homework digitally.

The White House recently launched the Connect Home initiative, a pilot initiative to help accelerate broadband adoption by children and families living in HUD-assisted housing. Other organizations are also working to increase home broadband access, including EveryoneOn, and several ConnectED partners. CoSN has a blog series on Digital Equity and ways school systems can get started.

Biggest Barriers to Internet Access Outside of School for Students
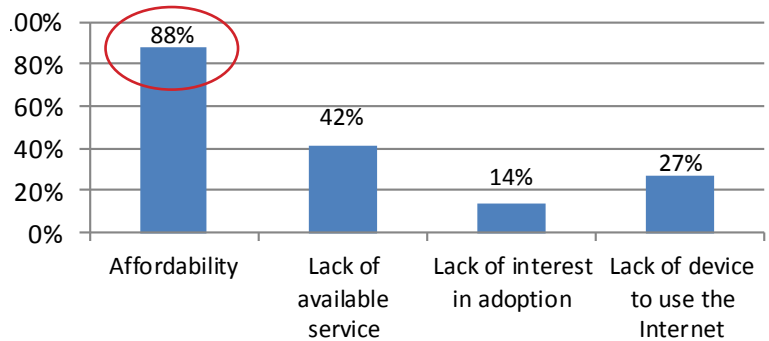
Overwhelmingly, 88% of respondents in this survey stated that affordability for students, particularly those from low income families, was one of the biggest barriers to outside of school access. Lack of available service (42%) and lack of a device (27%) were also noted as barriers. Few survey respondents believed that lack of adoption was a barrier to Internet access outside of school for students. Rural respondents indicated that a lack of available service was a key barrier (56% rural compared to 42% overall).

Three out of four school systems *do not* have any off campus strategies for providing connectivity to students. This is a slight improvement from 2014 when 82% indicated no digital equity strategies. That said, some school systems are addressing off campus digital equity gaps through free/subsidized Internet access, community/business WiFi hotspots, or participation in provider sponsored programs. In 2015, 15% of school systems report that there are community/business WiFi hot spots available for students, an increase of 5% from 2014. Similar to 2014, 11% of school systems reported that students utilized provider-sponsored services like Connect2Compete. Only 4% of school systems provide free/subsidized home Internet access for low income families and 3% of school systems provide free/subsidized district sponsored wireless access to homes and the community.

Off Campus Strategies	2015	2014
Do not provide any off campus services	75%	82%
Community/business WiFi hot spots available for students	15%	10%
Participate in provider-sponsored services like Connect2Compete	11%	10%
Free/subsidized home access for low income families	4%	2%
Free/subsidized district sponsored wireless access to homes and the community	3%	1%

In addition, students need devices and access to broadband outside of school. Very few school systems reported that 100% of students have access to devices at home or in the community. Thirty-one percent of school systems reported that 75%-99% of students have shared access to a device at home. In rural areas, fewer students have shared access at home with 22% of respondents reporting that 75% -99% of students have shared access to devices at home.

Access to Devices	Shared at Home	1:1 Home	1:1 Community
100% of students	2%	2%	6%
99%-75% of students	31%	19%	17%
74%-50% of students	22%	18%	14%
49%-25% of students	11%	20%	10%
24% or less of students	6%	15%	12%
Do not know	28%	26%	42%

FCC Lifeline Program

Supporters of increasing broadband access for all students advocate for the expansion of FCC's Lifeline program, which serves millions of households with discounted monthly telephone service, to include Internet connectivity. Students who lack Internet access service outside of the traditional school day cannot maximize the learning opportunities in a digital learning environment. Given that the current Lifeline program only covers basic telephone service, it is not surprising that only 35% of survey respondents are aware of the Lifeline program. If the program changes to allow low income families to choose between a basic phone and broadband at home, school systems will need to familiarize themselves with this program to educate eligible families on the benefits broadband provides for learning at home.

Communication

In an effort to learn more about digital equity issues, survey respondents identified how often schools communicated with members of their community about digital equity for students. Sixty-three percent of school systems reported that communication with the community occurs at least once a year, with 19% reporting quarterly communications. As we look to narrow the equity gap, it is important for school systems to employ off campus strategies to help students access broadband 24/7 and to communicate those needs with the community.

Communicate with the Community	Response
Once a year	22%
Twice a year	22%
Quarterly	19%
Not at all	11%
Do not know	22%
Other (please specify)	5%

Summary

Education is going digital. Yet school system technology leaders face many challenges as they plan their education networks for the future, especially around factors of affordability; network speed, capacity, and reliability; and the lack of competition for broadband services in too many communities. Having adequate capacity and bandwidth is critical for educators and students to utilize digital tools and resources effectively, particularly streaming content and videos that require more bandwidth.

- **Affordability:** Affordability continues to be the primary impediment for securing robust connectivity. This is particularly true for monthly service fees but also for initial capital costs. Despite these challenges, there are some positive trends; monthly Internet costs are decreasing and there are fewer school systems with exceptionally high monthly costs (over $50/Mbps per month).

- **Network Speed & Capacity**: Too many schools still lack the broadband speeds necessary to deliver 21st century learning, encounter major problems with capacity, and do not meet current wireless standards. Nearly one-quarter of survey respondents reported inadequate connection speeds for Internet bandwidth at both the system and school level. Twelve percent of all respondents and 14% of rural school system respondents reported that their Internet providers were at capacity and could not offer additional bandwidth. One out of three school systems indicated that they do not use current wireless industry standards (such as 802.11 a/b/g/n/ac) and one out of four respondents reported unplanned Internet downtime in their school system of 3 days during the year. On a positive trend, 72% of respondents reported using lit fiber for transport types for WAN operations, a dramatic one-year increase from 2014, when it was 46%. With lit fiber, many more schools have the capacity to provide broadband speeds to the school. Respondents also reported increased confidence in wireless connectivity, with 64% of school systems reporting that their WiFi could handle a 1:1 initiative.

- **Lack of Competition:** Lack of robust competition among Internet providers serving school systems continues to be a major issue adversely affecting affordability and decreasing the ability for education leaders to plan for redundancy (a best practice). The challenges are magnified in rural areas, where 54% of respondents reported only one Internet provider. Nearly one-third (29%) of school systems reported receiving 1 or fewer qualified bids for E-rate connectivity services in 2015 (Category 1), essentially no progress from the 32% last year. Lack of competition is worse in rural school systems, with 38% indicating that they received 1 or fewer proposals for connectivity services.

Looking Forward

Education is going digital and will become more so in the years to come. In addition to the key barriers identified, survey respondents predict that in three years the number of student devices on their network will dramatically increase. School systems are also facing digital equity challenges for students today that will only get worse if they do not start implementing off campus strategies for connectivity and access to devices now. While progress is happening, policymakers and educators will need to keep their eyes focused on continued investments in robust, reliable education networks with broadband access and WiFi to enable digital learning and address issues of digital equity.

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