

# State School Connectivity Profiles

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# Arkansas

**Size:** 481,630 public school students (1,108 schools); 21,538 private school students (150 schools)

**E-Rate Commitments:** 2013: \$26.54 million P1; 2012: \$20 million P1, \$3.3 million P2; 2011: \$29 million P1, \$2.3 million P2

**BIP Infrastructure Awards:** None.

**BTOP Infrastructure Awards:** University of Arkansas System (\$102.1 million)

## REN and Statewide Structure:

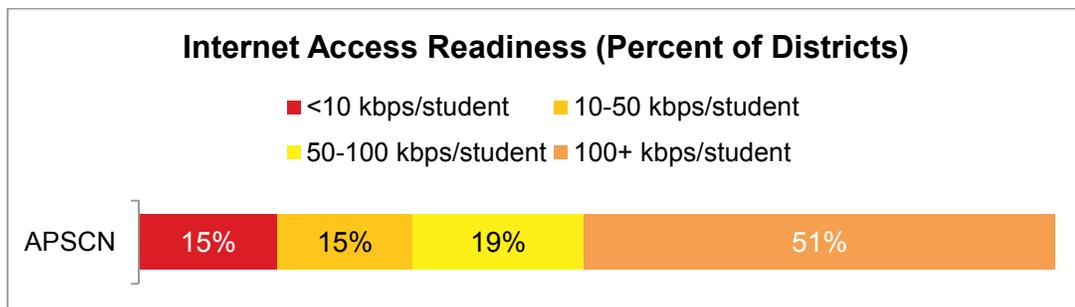
- By state law, K-12 schools may not utilize Arkansas’s research and education network (ARE-ON) for Intranet or Internet access. ARE-ON and the Arkansas Telehealth Network received \$102 million in BTOP grants to expand their broadband infrastructure. The two networks now connect over 450 higher education and health care institutions in all 75 Arkansas counties.
- The Arkansas Department of Information Systems (DIS) manages the Arkansas Public School Computer Network (APSCN), which connects all K-12 schools through leased connections from school district data centers or individual school buildings, depending on district network topography, to the public Internet. DIS files a consortium application for E-rate support and is the single largest E-rate recipient in the state. DIS received \$2.7 million in E-rate support for telecommunications and Internet access services in FY2012 and has received commitments totaling \$3.1 million FY2013 with \$6.1 million in applications pending. DIS also hosts the Arkansas Department of Education (ADE) and school districts’ financial management and student information software, and provides data storage.
- APSCN connects to five 1 Gbps Internet PoPs, three in Little Rock and one each in Pine Bluff and Fayetteville. These PoPs provide Internet access service for K-12 schools, some libraries, and state agencies that purchase service from DIS. DIS pays both a port fee and a per Mbps fee for Internet access. For the port fee, DIS pays AT&T a base fee of \$3,000/month/PoP for each 1 Gbps Internet ports and transport from the public Internet to the PoP. DIS then purchases Internet access service at the rates listed below. If bandwidth demand at a PoP exceeds the subscribed tier in a given month, the DIS contract allows for increased capacity billed per Mbps rather than requiring DIS to move up to a higher connection tier.

Connection	Monthly Price	Per Mbps Rate
150 Mbps	\$1,365	\$9.10
200 Mbps	\$1,678	\$8.39
250 Mbps	\$1,960	\$7.84
300 Mbps	\$2,244	\$7.48
400 Mbps	\$2,812	\$7.03
500 Mbps	\$3,375	\$6.75
600 Mbps	\$3,942	\$6.57
700 Mbps	\$4,508	\$6.44
800 Mbps	\$5,072	\$6.34
900 Mbps	\$5,670	\$6.30
1000 Mbps	\$6,280	\$6.28

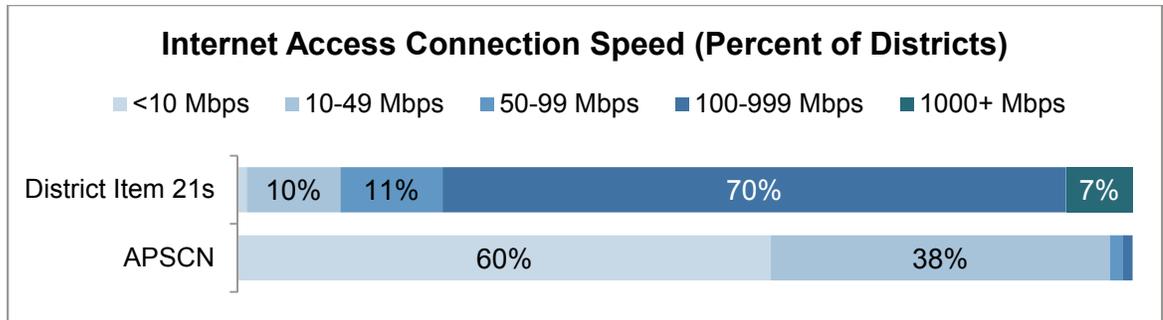
- ADE recently announced a partnership with EducationSuperHighway, a nonprofit organization focused on improving broadband infrastructure for K-12 public schools, with the goal of delivering high speed broadband to every K-12 public school in the state. ADE and EducationSuperHighway recently completed an initial study of digital learning readiness and broadband spending. The next steps include a plan to better leverage federal support and transition the millions of dollars that ADE spends annually on low speed copper networks to high speed broadband, and aggregate statewide purchasing of Internet access.

**Connectivity Overview:**

- **District edge to Internet.** DIS has approximately 570 demarcation points across Arkansas’s 238 school districts. ADE pays for 5-10 Kbps per student, depending on ISP circuit pricing, to each school through DIS/APSCN. Schools can purchase both Internet access and transport service between the demarcation point and an Internet point of presence from APSCN.
  - After analyzing 95% of the available Item 21 data (approximately 80% of school districts reporting), EducationSuperHighway presented a number of key findings related to bandwidth availability, Internet access readiness of school districts, and comparisons of connectivity between APSCN and private providers.
  - School districts have the option of purchasing additional bandwidth from DIS or directly from service providers. Approximately 91% of districts purchase bandwidth in addition to the 3 GB provided by APSCN. DIS Staff explained that districts choose to buy additional bandwidth from APSCN for several reasons, including a lack of bids from other providers, the management services offered by the APSCN, or the assistance that DIS provides with E-rate forms.
  - According to FY2014 Item 21 data from Arkansas school districts, APSCN accounts for 5% of total bandwidth used by schools. Schools procure an additional 55 GB outside of APSCN directly from providers. Approximately 9% of districts rely completely on APSCN.
  - The Item 21 data also showed that 51% of school districts meet the current SETDA recommendations of 100 Kbps per student, as reflected in the following diagram.



- 77% of districts that procure directly from service providers purchase 100+ Mbps Internet access, while 60% of districts on APSCN receive less than 10 Mbps, as reflected below.



- The three largest providers in Arkansas are Windstream, CenturyLink, and AT&T. There are many smaller providers that historically did not bid on state contracts but do bid on service for individual districts across the state. Schools that access broadband through APSCN often pay the smaller providers' tariffed rates in those situations.
- **School edge to district edge.** Districts are responsible for bidding out and purchasing their own wide area networks (WANs). DIS has contracts that districts can use to build or upgrade their WANs and contracts for WAN transport. There are state experts at DIS available to assist districts, and DIS is currently working on templates for district WANs, internal network design, and completing FCC forms. DIS recovers the costs of these services from either the district or ADE. The published rates for DIS services are posted on the DIS website (<http://www.dis.arkansas.gov/productsServices/Documents/Rate-sheet-2013.pdf>).
- **Classroom edge to school edge.** Schools are responsible for their own local area networks (LANs). The General Assembly is procuring a statewide study of current WAN/LAN environments, which should be complete by the end of 2014.

**Library Connectivity.** Few libraries connect to APSCN, primarily because it is typically more cost effective to purchase directly from service providers and because the review process takes 12 to 18 months for large library consortia and state consortia applications. Libraries can procure services directly from the service provider and receive discounts on the service providers invoices before the review of the consortia applications is completed. The impact on the libraries' budgets was a large factor in libraries disconnecting from the state network.

**Voice:** No statewide data available.

**Other Services:** ADE has not conducted a statewide technology survey on topics other than bandwidth. Arkansas school districts spent a total of \$917,193 on webhosting in FY2013, \$592,066 of which was paid for by E-rate. DIS pays \$599,251 for a 36-month statewide content filtering license.

**Dedicated State Ed-Tech or Broadband Funding:** Legislation enacted in 2013 requires all public schools and public charter schools to provide at least one digital learning course as either a primary or supplementary method of instruction beginning in the 2014-2015 school year. The General Assembly in

conjunction with Governor Beebe set up a Broadband Facilities Matching Grant program, allocating \$5 million to be used by approved school districts in 2014.

**Large/noteworthy districts:** Smackover School District is the only district in the State currently meeting the 2018 SETDA recommendations for bandwidth. They currently pay around \$1.29 per Mbps per month for all fiber connections and a 2.5 GB circuit. Smackover SD is rural and small, and is located in southern Arkansas.

**Sources:** Interviews with AR DOE and DIS staff; ADE 2013 Bandwidth Survey ([http://www.arkansased.org/public/userfiles/Legislative\\_Services/Quality%20Digital%20Learning%20Study/Reports/2013\\_ADE\\_Bandwidth\\_Survey\\_10242013\\_Status\\_Update.pdf](http://www.arkansased.org/public/userfiles/Legislative_Services/Quality%20Digital%20Learning%20Study/Reports/2013_ADE_Bandwidth_Survey_10242013_Status_Update.pdf)); Arkansas State Broadband Manager's Report, January 2014 ([http://www.stc.arkansas.gov/Documents/arkansas\\_broadband.pdf](http://www.stc.arkansas.gov/Documents/arkansas_broadband.pdf)); EducationSuperHighway Item 21 Analysis.

# California

**Size:** 6,226,989 public school students (10,169 schools), 478,021 private school students (3,237 schools)

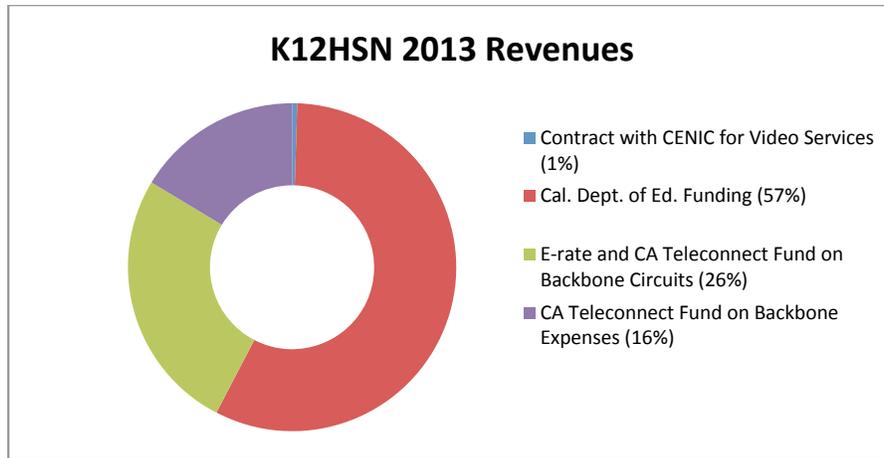
**E-Rate Commitments:** 2013: \$427.9 million P1; 2012: \$468.1 million P1, \$277.9 million P2; 2011: \$405.4 million P1, \$401.9 million P2

**BIP Infrastructure Awards:** Ponderosa Cablevision (\$2 million); Audeamus (\$2.7 million)

**BTOP Infrastructure Awards:** California Broadband Cooperative, Inc. (\$81.1 million); Central Valley Independent Network, LLC (\$46.6 million); Level 3 EON, LLC (\$3.3 million); Plumas Sierra Rural Electric Coop (\$13.8 million)

## **REN and Statewide Structure:**

- County Offices of Education (COEs) have general oversight of school districts but school districts are independent financially. COEs take advantage of economies of scale to provide services such as IT support and educational technology assistance for smaller districts with limited resources. Larger districts provide more services in-house and are less dependent on COEs. Each of the 58 COEs serve as gateways to the California Research and Education Network (CalREN). CalREN's role as a network aggregator is discussed below.
- COE funding is based on student population and, as of 2014, student poverty.
- The California K-12 High Speed Network (K12HSN) is both a statewide program and an infrastructure project created by statute and funded by the California Department of Education (CA DOE) with the primary focus of connecting schools, districts, and COEs to high capacity broadband by encouraging their participation in CalREN. K12HSN's mission is to connect all K-12 schools, although it is not mandatory that schools connect through K12HSN.
  - K12HSN delivers Internet connectivity to 83% of school sites, 88% of school districts, and 100% of COEs.
  - K12HSN provides Network Connectivity and Internet Services, Teaching and Learning Application Coordination, and Videoconferencing Coordination and Support.
  - K12HSN is operated as a consortium by the Imperial County COE, Butte County COE, and Mendocino County COE. The Imperial County COE serves as manager and lead education agency. The California Superintendent of Public Instruction is responsible for evaluating and measuring the success of K12HSN. A twelve-member Advisory Board, selected to represent educators from across the state, provides policy direction and operational guidance.
  - The 2014-2015 California State Budget requires K12HSN to conduct a statewide analysis to determine the level of broadband infrastructure available in schools and gauge their readiness for computer adaptive testing. K12HSN will start surveys in October/November 2014 and issue a report by March 2015. The budget bill also provides funding (\$26.7M) for K12HSN to distribute to hard-to-serve schools to solve the most severe connectivity challenges.
  - The following chart summarizes K12HSN's 2013 funding.



- The Corporation for Education Initiatives in California (CENIC) is a non-profit public corporation formed by California higher education institutions in 1998. CENIC designs, manages, and operates CalREN. CENIC is governed by representatives from member institutions. CENIC files consortium applications with both E-rate and the California Teleconnect Fund (CTF), described below, to support its K12 pass-through circuits.
  - CENIC keeps Internet access costs low through peering agreements with Internet2, commodity network providers, other State Research and Education Networks, and peering partners from Canada, Mexico, South America, and the Pacific Rim at international peering exchange facilities.
  - CENIC also has 40 Gbps of capacity of commodity access to the Internet at Tier 1 Points of Presence (PoPs).
- CalREN is a statewide fiber network that connects to K-12, community colleges, and public and private universities. The network is a mixture of leased circuits and some private fiber. CalREN provides members with a dedicated research and education intranet with specific applications and use cases. CalREN began connecting to K-12 public schools in 2000. K12HSN manages the participation of all K-12 schools in CalREN.

**School Connectivity Overview:**

- **K12HSN node site to CalREN.** K12HSN aggregates traffic at 73 node sites, one node in each of the 58 COEs with additional nodes in 15 counties. CalREN circuits link each of the 73 node sites to one of 14 CalREN hub sites. CalREN connects to the public Internet as described above.

<b>K12HSN Node Site Circuit Capacity*</b>					
	<b>2006</b>	<b>2008</b>	<b>2010</b>	<b>2013</b>	<b>2014</b>
<b>45 Mbps</b>	107	34	19	10	7
<b>155 Mbps</b>	10	1	0	0	0
<b>1 Gbps</b>	0	64	70	66	59
<b>10 Gbps</b>	0	0	4	13	25

*\*In order to promote reliability, most node sites are served by more than one circuit.*

**Node to Hub Pricing**

<b>Circuit Size</b>	<b>Number of Circuits</b>	<b>Monthly High</b>	<b>Monthly Low</b>	<b>Average</b>
<b>45 Mbps</b>	13	\$17,776	\$2,247	\$7,360
<b>1 Gbps</b>	66	\$10,235	\$2,817	\$4,301
<b>10 Gbps</b>	13	\$14,755	\$5,635	\$6,517

- K12HSN pays CalREN a flat annual rate of \$225,000 for unlimited Internet access bandwidth for all member school districts. Districts and schools that are not part of K12HSN are responsible for their own Internet access costs.
  - Peering relationships are the primary factor keeping K12HSN’s Internet access costs low. Less than 40% of network traffic from K12HSN reaches the commercial Internet.
  - Some COEs offer districts a bundled Internet access and transport service that is competitively bid under E-rate by districts. Those COEs that respond have E-rate service provider identification numbers (SPINs).
- K12HSN tracks connectivity at the COE, district demarcation point, and at each school building. Detailed connectivity data is available at <http://www.k12hsn.org/data/reporting/>. K12HSN also provides schools and districts access to real time network utilization data through its monitoring system.
- **School edge to COE node site.** Individual schools either connect directly to the K12HSN node site at the COE or connect to a district WAN, which connects to a K12HSN node site through a circuit from the district data center.
  - School districts are responsible for bidding out their WAN circuits. Districts receive funding from the E-rate program and the CTF for WAN connectivity and are responsible for the remaining costs.

**Reported WAN Bandwidth to School Sites as of May 5, 2014\***

<b>Bandwidth</b>	<b>Sites</b>
1.5 Mbps	39
>1.5 – 10 Mbps	2036
>10 – 45 Mbps	915
>45 – 100 Mbps	3099
>100 – 1000 Mbps	439
1 Gbps	3051
>1 Gbps	163

*\*Does not include charter schools*

- **Classroom edge to school edge.** No statewide data available.

**Voice:** No statewide data available.

**Library Connectivity.** California libraries are organized into 183 jurisdictions, with 1,115 total branches. The 2013-2014 California State Budget directed the State Librarian to prepare a needs assessment to evaluate library connectivity, identify options for connecting all libraries, and estimate the cost of connectivity options. In response, the California State Library, California Library Association, the non-profit library consortium the Califa Group, and CENIC created the High-speed Broadband in California Public Libraries Project (Project). The Project conducted a statewide survey and produced a report recommending California libraries form a statewide consortium and join CENIC as a sixth “segment.” The report estimated an annual cost of \$4.5 million, including all network services, to connect all California public libraries to the CENIC backbone at 1 Gbps plus an additional \$2 million to cover one-time network equipment upgrades. The 2014-2015 California State Budget included \$3.3 million for library broadband infrastructure, consisting of \$2.3 million to connect public libraries to CENIC and an additional \$1 million in grants for network equipment upgrades. Additional findings from the survey and report are below.

**Current Reported Internet Connectivity**

<b>Bandwidth</b>	<b>Number of Libraries</b>
<10 Mbps	334
10 Mbps	97
20 Mbps	158
25-50 Mbps	107
100 Mbps	79
155-500 Mbps	37
1 Gbps	16

**Current Internet Connection Type**

<b>Connection Type</b>	<b>Number of Libraries</b>
ATM circuit	118
Cable modem	82
DSL	71
Metro Ethernet	175
Point-to-point	242
Other	62

**Current Bandwidth Utilization**

<b>Utilization Level</b>	<b>Number of Libraries</b>
<25%	30
25-50%	70
50-75%	115
75-100%	376
Unknown	226

**Dedicated State Ed-Tech or Broadband Funding:** The CTF subsidizes telecommunications, Internet access, and related technology services for schools, libraries, community colleges, community-based organizations, and non-profit healthcare providers. CTF provides a flat 50% discount rate to the eligible entity's post-E-rate discount costs. Applicants apply for CTF eligibility once and then automatically qualify for CTF discounts and are not required to re-apply annually. The CTF Eligible Services List (ESL) is consistent with the E-rate ESL. The CTF is funded by a state surcharge on telecommunications services that is adjusted annually. The budget is also adjusted annually, and will be \$110 million for FY2014.

The 2014-2015 California State Budget created the Broadband Infrastructure Improvement Grant (BIIG), a one-time allocation of \$26.7 million for last mile projects for public school districts, COEs, and direct-funded charter schools that are unable to administer Internet-based assessments due to low bandwidth. K12HSN is currently conducting a statewide survey to identify eligible sites and plans to award BIIG grants in late Fall 2014 so that projects can be completed by June 2015.

**Large/noteworthy districts:** The Los Angeles Unified School District (LAUSD), the second largest district in the country, recently suspended a district-wide 1:1 initiative that had planned to provide a tablet to each of the district's approximately 650,000 students. LAUSD staff reports that per-student bandwidth usage has increased 5x to 10x since the beginning of the 1:1 initiative in the 2013-2014 school year. LAUSD is provided with 20 Gbps Internet access service by the K12HSN program. It also purchases an additional 40 Gbps of Internet access from AT&T to cover anticipated increases in demand.

**Sources:** Interviews with and data provided by K12HSN and LAUSD staff; California K12HSN 2013 Annual Report ([http://www.k12hsn.org/files/publications/K12HSN Annual Report 2013.pdf](http://www.k12hsn.org/files/publications/K12HSN%20Annual%20Report%202013.pdf)); High-speed Broadband in California Public Libraries Project Needs Assessment & Spending Plan ([http://www.cenic.org/wp-content/uploads/2013/08/Public\\_Library\\_Broadband\\_Assessment\\_2014.pdf](http://www.cenic.org/wp-content/uploads/2013/08/Public_Library_Broadband_Assessment_2014.pdf)).

# Florida

**Size:** 2,632,268 public school students (4,212 schools); 254,068 private school students (1,705 schools)

**E-Rate Commitments:** 2013: \$119.7 million; 2012: \$64.5 million P1, \$54 million P2; 2011: \$64.4 million P1, \$13 million P2

**BIP Infrastructure Awards:** None

**BTOP Infrastructure Awards:** North Florida Broadband Authority (\$30.1 million); Florida Rural Broadband Alliance (\$23.7 million); Level 3 EON, LLC (\$2.1 million)

## **REN and Statewide Structure:**

- K-12 public schools can purchase a bundled service through the Florida Information Resources Network (FIRN), a statewide broadband network procured by the Department of Management Services (DMS), Division of Telecommunications.
  - DMS leases lit fiber from AT&T and offers a secure Internet bundle that includes Internet access, transport from the district or school demarcation point to the public Internet, customer premises equipment, and a firewall.
  - Though the majority of school districts do not purchase service through DMS at this time, DMS staff reports that interest has increased in recent years.
  - DMS recently established an E-rate team to handle the increased workload and, beginning in 2013, DMS will be the billed entity for districts that purchase services through DMS. Previously DMS had filed separate Forms 471 for each school or school district customer under the customer's billed entity number (BEN). DMS applied for \$10.4 million in E-rate funds for 2013.
- The DMS contract with AT&T includes dedicated transport throughout the state to Internet PoPs in several major cities. Neither DMS nor any state REN owns middle or last mile circuits that connect to K-12 schools or libraries. The Florida LambdaRail is a statewide higher education network that does not connect with K-12 schools or libraries.

## **School Connectivity Overview**

- **District edge to Internet.** The current state E-Rate contract for Internet access and telecommunications services expires June 30, 2015. The contract has been in place for five years and DMS received multiple bids on the request for proposals (RFP). DMS does not have data comparing master contract pricing to pricing for districts that have negotiated their own rates, but is seeking pricing data as part of a new statewide survey. Monthly rates for the FIRN Secure Internet Bundle are below.

<b>FIRN Secure Internet Bundle Monthly Pricing - Table 1.0</b>				
<b>Ethernet Bandwidth</b>	<b>Erate Eligible Cost – Category 1 (Pre-Discount)</b>	<b>DMS Admin Fee</b>	<b>Total For Basic Internet &amp; Security</b>	<b>Non-Erate Eligible</b>
	<b>Bundled Cost - Core + Unlimited Access + CPE + Basic Firewall Security</b>			<b>Additional Cost for Advanced Security and Content Filtering and URL blocking</b>
10 Mbps	\$1,121.07	\$78.47	\$1,199.54	\$273.45
50 Mbps	\$2,053.83	\$143.77	\$2,197.60	\$273.45
100 Mbps	\$2,605.37	\$182.38	\$2,787.75	\$273.45
200 Mbps	\$3,622.63	\$253.58	\$3,876.21	\$546.89
300 Mbps	\$4,632.43	\$324.27	\$4,956.70	\$820.34
400 Mbps	\$5,162.24	\$361.36	\$5,523.60	\$1,093.78
500 Mbps	\$5,636.83	\$394.58	\$6,031.41	\$1,367.22
600 Mbps	\$6,106.70	\$427.47	\$6,534.17	\$1,640.66
700 Mbps	\$6,372.29	\$446.06	\$6,818.35	\$1,914.11
800 Mbps	\$6,562.81	\$459.40	\$7,022.21	\$2,187.55
900 Mbps	\$6,739.15	\$471.74	\$7,210.89	\$2,461.00
1000 Mbps	\$6,914.97	\$484.05	\$7,399.02	\$2,734.44
2000 Mbps	\$10,877.40	\$761.42	\$11,638.82	\$4,101.66
5000 Mbps	\$15,597.94	\$1,091.86	\$16,689.80	\$6,152.49
10000 Mbps	\$22,688.85	\$1,588.22	\$24,277.07	\$9,228.73

- DMS gathers data on district and school connections through the annual Florida Technology Resources Inventory Survey (Florida Survey). The tables below are derived from the 2013 Florida Survey. DMS staff explained that for each school in the state, respondents were asked to select a range of that “best represents your school’s bandwidth to the Internet.”

<b>Bandwidth (Mbps)</b>	<b>Districts</b>	<b>Percentage</b>
<b>&lt;100</b>	8	12%
<b>100</b>	11	16%
<b>101-499</b>	25	37%
<b>500-999</b>	5	7%
<b>1000+</b>	19	28%

<b>Kbps/User</b>	<b>Districts</b>	<b>Percentage</b>
<b>&lt;10</b>	9	13%
<b>10-25</b>	25	37%
<b>26-50</b>	22	32%
<b>51-100</b>	7	10%
<b>101-250</b>	4	6%
<b>251-500</b>	1	1%

- **School edge to district edge.** Of the 2,993 schools included in the 2013 Florida Survey respondent pool, 2,634 reported the school had a fiber connection to the district WAN. The tables below summarize responses to the 2013 Florida Survey at the school level

Bandwidth (Mbps)	Schools	Percentage
<10	138	4%
10-50	1186	34%
51-99	107	3%
100	737	21%
101-200	201	6%
201-999	310	9%
1000+	768	22%

Kbps/User	Schools	Percentage
<10	150	4%
10-25	495	14%
26-50	455	13%
51-100	403	12%
101-250	735	21%
251-500	328	10%
500+	863	25%

- **Classroom edge to school edge.** In 2011 the Florida Department of Education conducted a statewide analysis of WiFi availability and costs to provide comprehensive WiFi for all K-12 schools. DMS is currently analyzing new district survey data that details connectivity within the schools such as the number of classrooms and devices connected to the Internet. Previous surveys did not collect this type of data.

**Voice:** DMS also offers telephony, though not every school that purchases the Internet bundle also purchases telephony.

**Other Services:** DMS provides E-rate training that includes an explanation of the state master contract. Every Florida high school student may elect to attend high school online through the Florida Virtual School, which receives very little E-rate support because most students participate from home.

**Dedicated State Ed-Tech or Broadband Funding:** None.

**Sources:** Interviews with and documents provided by Florida DMS and DOE staff; [www.fldoe.org](http://www.fldoe.org).

# Georgia

**Size:** 1,748,974 public school students (2,541 schools); 106,646 private school students (644 schools)

**E-Rate Commitments:** 2013: \$101.9 million P1; 2012: \$65.8 million P1, \$28.8 million P2; 2011: \$67.5 million P1, \$31.8 million P2

**BIP Infrastructure Awards:** Flint Cable TV (\$4.1 million)

**BTOP Infrastructure Awards:** Columbia County IT Dept. (\$13.5 million); North Georgia Network Cooperative (\$33.5 million); Appalachian Valley Fiber Network (GA & AL) (\$21.3 million)

## **REN and Statewide Structure:**

- The University System of Georgia manages PeachNet, a statewide fiber REN that connects 31 colleges and universities. The Georgia Department of Education (GA DOE) is transitioning all K-12 schools to PeachNet. By July 2015, GA DOE will provide all districts with 100 Mbps Internet access per school (e.g., a district with 10 schools will receive a 1 Gbps PeachNet connection).
- PeachNet's backbone connects to local PoPs, but fiber to the K-12 facility depends on local service providers. PeachNet can provide 10 Gbps connections to districts and also offers a range of enterprise applications and cloud services. PeachNet gives districts access to Internet2, and has agreements with several organizations (NASA, National Geographic) to put content online.

## **School Connectivity Overview:**

- **District edge to Internet.** GA DOE currently provides 3 Mbps Internet access per public school, aggregated at the district level, at a cost of \$12.7 million/yr. GA DOE files a consortium E-rate application for Internet access at the 80% discount level. Total committed E-rate support for FY2013 was \$10 million
  - Districts may also purchase additional Internet access through a state master contract with AT&T. However, the majority of Georgia school districts have rolled off the master contract in recent years as prices offered by other providers have dropped and now purchase Internet access independently.
  - Four K-12 school districts currently purchase PeachNet service, all other districts and schools purchase from private service providers. GA DOE estimates the total cost of Internet access connectivity through PeachNet will be \$20 million/yr, far less than the total amount that districts currently pay.
  - The table below provides Internet access speeds to each district and per student, as reported in the GA DOE's annual technology inventory.

### Internet Access Bandwidth

Total Internet Access Purchased	Number of Districts	Total Students
1 Gbps+	21	739,376
500-999 mbps	11	295,378
200-499 mbps	24	256,355
100-199 mbps	49	229,868
50-99 mbps	40	162,028
20-49 mbps	23	51,329
0-19 mbps	15	14,491
<b>Totals</b>	<b>183</b>	<b>1,748,974</b>

Kbps/Student	Number of Districts	Total Students
250+	8	18,760
100-249	12	49,760
50-99	24	80,509
25-49	68	674,673
10-24	51	651,251
0-9	18	274,001

- **School edge to district edge:** According to a recent GA DOE survey, 2,209 of 2,300 K-12 schools are connected to fiber.
- **Classroom edge to school edge:** GA DOE conducts an annual technology inventory that focuses on the number of devices and peripheral equipment available to students. Though the inventory asks districts to report the number of “mobile wireless labs” in each school, Georgia does not have detailed data on WiFi availability.

**Library Connectivity.** Georgia has 61 public library systems and 370 library branches that contain 8,085 public access computers. In order to lower the cost of management and gain an increase in bandwidth statewide, the Georgia Public Library Service (GPLS) is transitioning from a statewide library consortium to a hybrid model under which the GPLS collaborates with local library systems to create mini-consortia consisting of all libraries that purchase service from an ISP.

- Consortia will thus be formed along vendor lines, not geographic lines. The transition is ongoing, but to date GPLS has increased average per library bandwidth from an average of 3 Mbps to an average of 28 Mbps (a 9x increase) and realized a reduction of total cost of ownership of \$180,000, or 18.2%.
- Libraries do not currently purchase from PeachNet because they prefer to purchase basic commodity Internet service without the filtering and security features that are packaged with PeachNet services.
- GPLS began collecting WiFi statistics in 2014 and also publishes WiFi best practices on its website.

# of Library Systems	Bandwidth Pre-Upgrade	Bandwidth Post-Upgrade
37	0-3 mbps	Min. 10 – Max. 100 mbps
23	3-10 mbps	Min. 20 mbps – Max 1G
1	500 mbps	1G

**Dedicated State Ed-Tech or Broadband Funding:** The Georgia Legislature’s FY2014 budget included \$7 million for competitive grants for school districts to improve technology implementation and upgrade broadband infrastructure. GA DOE is formulating rules for the grants program. The State Education Finance Study Commission, created in 2011 to conduct a comprehensive review of education funding in Georgia, has recommended that the legislature renew those funds for two additional years.

**Sources:** Interviews with and documents provided by staff from GA DOE and three school districts; [www.gadoe.org](http://www.gadoe.org); [www.usg.edu](http://www.usg.edu); [www.legis.ga.gov](http://www.legis.ga.gov).

# Kansas

**Size:** 474,370 public school students (1,359 schools); 35,177 private school students (200 schools)

**E-Rate Commitments:** 2013: \$22.1 million P1; 2012: \$21.1 million P1, \$2 million P2; 2011:\$19 million P1, \$222,156 P2

**BIP Infrastructure Awards:** Rural Telephone Service Co. (\$49.6 million); South Central Telephone Assn. (\$3.6 million); Madison Telephone, LLC (\$3.6 million); J.B.N. Telephone Co., Inc. (\$5.5 million)

**BTOP Infrastructure Awards:** Level 3 EON, LLC (\$1 million)

## REN and Statewide Structure:

- Kansas K-12 schools and school districts purchase broadband connectivity directly from service providers. Kan-Ed, a statewide initiative established in 2003 with the goal of connecting all schools, libraries, and hospitals, was de-commissioned by the state legislature in 2011. All former Kan-ed members were required to migrate off the Kan-Ed network during the 2012-2013 school year.
- The Kansas Department of Education (KS DOE) is collaborating with the Kansas Department of Commerce’s Statewide Broadband Initiative, an effort to promote broadband deployment and adoption in order to foster economic growth and improve education and healthcare. The first phase is to collect baseline data that has led to creation of the Kansas Broadband Map, available at [http://maps.kgs.ku.edu/broadband\\_home](http://maps.kgs.ku.edu/broadband_home).
- KS DOE released the 3<sup>rd</sup> annual Digital Learning Report for Kansas K-12 districts (2014 KS Digital Learning Report) in March 2014. The 2014 KS Digital Learning Report includes data from a statewide survey of school districts designed to better understand districts’ broadband connectivity now that Kan-ed has been decommissioned. 210 of the 286 school districts in Kansas responded to the survey sent out to collect data for the report.

## School Connectivity Overview

- **District edge to Internet:** In 2013 KS DOE worked with EducationSuperHighway to collect data on K-12 Internet access connectivity and costs. 110 of the state’s 286 school districts submitted data. 81 districts provided data on monthly Internet access costs and bandwidth.

Internet access bandwidth	No. of Districts
<25 Mbps	24
26-50 Mbps	22
51-100 Mbps	16
101-300 Mbps	6
>1 Mbps	3

<b>\$/Mbps (monthly)</b>	<b>No. of Districts</b>
<\$10/Mbps	13
\$10-20/Mbps	17
\$20-50/Mbps	20
\$50-100/Mbps	22
>\$100/Mbps	9

176 of the 210 districts that responded to the Digital Learning Report survey connect to the Internet at a single demarcation point. The remaining districts reported that they connect at multiple sites/schools.

- **School edge to district edge:** Kansas does not collect statewide data on school district WAN connections
- **Classroom edge to school edge:** Kansas does not collect statewide data on WiFi or LAN costs. 103 of the 210 districts that responded to a survey conducted for the 2014 Digital Learning Report for Kansas K-12 Districts are currently implementing a 1:1 device initiative.

**Library Connectivity.** The following data is from an August 2012 state survey.

**Library Internet Access Bandwidth August 2012 (download)**

<b>Bandwidth (Mbps)</b>	<b>Libraries</b>
<5	222
5-9.9	51
10-19.9	41
20-30	8
60+	3

**Dedicated State Ed-Tech or Broadband Funding:** None.

**Sources:** Interviews with KS DOE staff; 2014 KS Digital Learning Report (<http://www.ksde.org/Portals/0/IT/TAKE/KsDL2014.pdf>); Technology Assistance for Kansas Educators (<http://www.ksde.org/Agency/FiscalandAdministrativeServices/InformationTechnology%28IT%29/TAKE.aspx>).

# Maine

**Size:** 178,989 public school students ( 621 schools), 15,452 public school students (154 schools)

**E-Rate Commitments:** 2013: \$8.4 million P1; 2012: \$8.2 million P1, \$311,931 P2; 2011: \$8.2 million P1, \$151,792 P2

**BIP Infrastructure Awards:** None

**BTOP Infrastructure Awards:** Maine Fiber Company (\$25.4 million)

## REN and Statewide Structure:

- Maine purchases and manages broadband connectivity for virtually all K-12 schools (public and private) and libraries through a statewide program called the Maine School and Library Network (MSLN).
  - MSLN was unofficially formed in 1996 when a rate case funded Internet access to all Maine schools and libraries. MSLN now operates as a “program” or “project” of Networkmaine, a unit of the University of Maine System. Networkmaine operates through a coordinating council which is comprised of the University of Maine System, the Maine State Department of Education, the Maine State Library, and the Maine State Government Office of Information Technology. For E-Rate purposes, Networkmaine is a consortium applicant. MSLN does not have a formal status within E-Rate.
  - Networkmaine acquires Internet access, local loop circuits, and other related services for its member schools and libraries that participate in MSLN. In 2012, Networkmaine received \$4.7 million in E-Rate commitments out of the \$8.4 million received by Maine. The remaining \$3.7 million included: \$2.9 million in telecommunications services, which are predominantly phone service, including cellular service; \$609,000 in Internet access; \$114,000 in basic maintenance of internal connections; and \$37,000 in internal connections.
  - MaineREN connects colleges and other research institutions across Maine. MaineREN is also organized as a “program” or “project” of Networkmaine. MSLN contributes about \$70,000 per year towards MaineREN’s expenses, paid for entirely by state funds (no E-rate) in order to avoid cost allocation issues. By comparison, MaineREN charges 2 levels of membership fee for its higher education members: \$12,000/year or \$24,000/year, depending on size. MaineREN connects to Cogent in Cambridge, MA and with Time Warner in Orono, ME. It maintains both connections in part to provide geographic route diversity to the public Internet.
- Maine Fiber Company is special purpose company created in 2009 to manage Maine’s BTOP-funded middle-mile fiber network and to offer access to the network on an equal basis to all qualified users. For E-Rate purposes, Maine Fiber Company acts as a service provider, selling services to Networkmaine.

### **School Connectivity Overview:**

- **District edge to Internet.**

- All Internet traffic for Networkmaine members, including MSLN participants, is aggregated onto MaineREN. Networkmaine is an Internet2 member. Networkmaine reduces its need for Internet access by using Internet 2's settlement-free peering service and with on-net caches from Google, Akamai, and NetFlix. Thanks to these resources, less than half of MSLN's Internet traffic ultimately goes through paid service.
- Networkmaine's paid Internet access is through 24 month contracts with Cogent and Time Warner Cable, renegotiated in 2013. Cogent provides a 4 Gbps (burstable to 10 Gbps) service at \$2,800/month (burst fee is \$0.95/Mbps) and Time Warner Cable provides a fixed 4 Gbps service at \$16,000/month. These prices are reduced from \$9000/month and \$56,000/month, respectively, in 2010. MSLN pays roughly half of the Networkmaine's total Internet, and receives E-Rate support for this purchase.
- Networkmaine lights all dark fiber at 1Gbps. Networkmaine reports that it is no cheaper to light the connections at slower speeds because the electronics are the same, while the costs of higher speed (e.g. 10 Gbps) electronics have not been justified by demand to date. All the 1 Gbps school/library connections in Maine are dark fiber connections.
- All circuits provided via FairPoint, Time Warner Cable, and Oxford Networks are based on 5 year pricing terms that started in July 2010. The dark fiber pricing from Maine Fiber Company is based on a three year term that started July 2012. All circuit contracts end in June 2015.
  - The per-Mb prices offered by the three commercial ISPs range from \$78/Mbps – Time Warner Cable's price for a 10 Mbps connection – to \$2.46/Mbps – Oxford's price for a 1 Gbps connection.
  - Maine Fiber Company charges per mile for its dark fiber connections. The mileage is measured from the school or district premise to one of Networkmaine's 26 POPs. Networkmaine estimates that, on average the cost of a 1 Gbps Maine Fiber Company circuit is \$500-\$750/month, including per-mile charges and the cost of electronics.
- A list of all prices on the Networkmaine contract is below. The non-recurring costs are one-time per-location costs.

**Costs per Networkmaine Contract  
(Commitment thru June 30, 2015 Required)  
(Fed and State USF fees already factored in)**

<b>Monthly Recurring Cost (transport to MaineREN interconnect)</b>			
<b>Bandwidth</b>	<b>Oxford Networks</b>	<b>Time Warner Cable</b>	<b>FairPoint</b>
10	\$ 263	\$ 777	\$ 525
20	\$ 368	\$ 850	\$ 814
50	\$ 447	\$ 1,066	\$ 1,339
100	\$ 578	\$ 1,413	\$ 1,785
200	\$ 788	\$ 2,127	\$ 1,822
300	\$ 998	\$ 2,463	\$ 1,902
400	\$ 1,208	\$ 2,715	\$ 1,958
500	\$ 1,418	\$ 3,114	\$ 1,988
600	\$ 1,628	\$ 3,219	\$ 2,170
700	\$ 1,838	\$ 3,323	\$ 2,246
800	\$ 2,048	\$ 3,429	\$ 2,275
900	\$ 2,258	\$ 3,534	\$ 2,624
1000	\$ 2,468	\$ 3,586	\$ 3,465
<b>Non Recurring Cost</b>			
	<b>Oxford Networks</b>	<b>Time Warner Cable</b>	<b>FairPoint</b>
<b>Install</b>	\$ 263	\$ 210	\$ -

<b>Distance</b>	<b>Maine Fiber Company</b>		
	<b>&lt; 1000 ft</b>	<b>1000 &lt;&gt;2500 Ft</b>	<b>&gt;2500 Ft</b>
	<b>Monthly Recurring Cost</b>		
	\$ 175 + \$13/mile	\$350 + \$13/mile	\$350 + \$13/mile + amortized amt > \$10K
	<b>Non Recurring Cost</b>		
<b>Install</b>	\$ 2,500	\$ 2,500	\$ 2,500

- **School edge to district edge.**
  - Maine has provided connectivity data for 680 K-12 schools that participate in MSLN. (NCES reports 621 public and 154 private schools statewide). 56% (378) of all school connections are known to be fiber, including all connections of 50Mbps or greater. The remaining 44% of connections (302) are of unknown type (either copper or fiber).

Speed	Percent of Schools
1 Gbps	11% (75 schools)
200 Mbps	11% (78 schools)
100 Mbps	19% (130 schools)
50 Mbps	14% (92 schools)
20 Mbps	8% (57 schools)
10 Mbps	36% (248 schools)

- All school and library connections are either: (i) provided by one of three commercial providers: FairPoint, Time Warner Cable, or Oxford Networks; (ii) dark fiber circuits provided by Maine Fiber Company and lit by Networkmaine; or (iii) dark fiber circuits owned by the school/library or Networkmaine and lit by Networkmaine.

Provider	Percent of Schools
Fairpoint	64% (436 schools)
Time Warner Cable	21% (145 schools)
School/Networkmaine owned	7% (50 schools)
Maine Fiber Company	4% (25 schools)
Oxford	4% (24 schools)

- The Maine Fiber Company dark fiber contract is based on a 2012 RFP for dark fiber local loops, a pilot by Networkmaine to be able to start running its own transport as other contracts come up for renewal in 2015. Networkmaine received one other bid on the RFP (they have not disclosed who the other bidder was).
- **Classroom edge to school edge.** State officials do not maintain a list of WiFi connectivity at schools, but they believe that virtually all schools have “some level” of WiFi available.

**Library Connectivity.** Of the approximately 250 libraries on MSLN, approximately 22 are connected via fiber. The remaining libraries typically have 10-20 Mbps connections. Networkmaine estimates that about half the 22 fiber-connected libraries have dark fiber that is either library-owned or provided by Maine Fiber Company, and the other half have some form of lit fiber service from one of the three traditional commercial providers.

**Voice:** Schools districts and libraries typically purchase telephone service (VoIP or POTS) on their own. Networkmaine has considered providing VoIP to its members, but to date has chosen not to do so.

**Other Services:** MSLN also provides web hosting, email, and web filtering to all consortium members, but finds that most schools now use Google or other commercial providers for these services. Networkmaine does not apply for E-Rate for these services; it provides the web hosting and email in house, and has concluded that the complexity of determining whether its in-house costs are E-rate eligible and seeking support for these costs outweighs whatever relatively small amount of funding it might receive.

**Dedicated State Ed-Tech or Broadband Funding:** The Maine Telecommunications Education Access Fund (MTEAF) covers 100% of the non-E-Rate portion of broadband for schools and libraries. MTEAF does not cover phone service but does pay for other non-E-Rate eligible services, including: licensed database subscription services statewide, a number of Networkmaine operating expenses, and MSLN's \$70,000 annual contribution towards MaineREN. MTEAF is funded through an assessment on the intrastate portion of phone bills – essentially a state E-Rate.

Since MTEAF covers the full non-E-rate eligible cost of broadband circuits, Networkmaine runs a centralized, state-level process to determine what circuits to upgrade each year. Networkmaine monitors granular data on network utilization by individual schools and libraries, and watches for utilization to hit certain thresholds. At each E-rate funding cycle, Networkmaine decides how to prioritize upgrades based on these data and what schools tell them about their future IT plans. For example, if a school is planning a new 1:1 deployment they may get a higher priority than their current usage data would otherwise dictate.

**Large/Noteworthy Districts:** The two school districts that don't participate in MSLN are Hermon and Portland. Hermon is a small school district with one high school, one middle school, and one elementary school. The town of Hermon has partnered with a local wireless ISP to provide free or low cost Internet within the community, and the school participates in that deal.

In contrast, the City of Portland is the largest school district in Maine. It operates ten elementary schools, three middle schools, and four high schools, collectively serving 7500 students. The school district has free access to dark fiber through Time Warner Cable (TWC), negotiated as part of the city's original franchise agreement with TWC's predecessor. Localities retain local franchising authority in Maine, and TWC has been required to maintain the free dark fiber lease as part of its continuing franchise agreement.

**Sources:** Interviews with Maine and Networkmaine staff.

# Michigan

**Size:** 1,528,220 public school students (3,551 schools); 105,179 private school students (727 schools)

**E-Rate Commitments:** 2013: \$61.6 million P1; 2012: \$45.5 million P1, \$8.4 million P2; 2011: \$42.5 million P1, \$18.3 million P2

**BIP Infrastructure Awards:** Southwest Michigan Communications \$4.2 million; Chatham Telephone Company, \$8.6 million, Air Advantage \$31.9 million

**BTOP Infrastructure Awards:** Merit Network \$103 million; Bloomingdale Communications \$5.6 million

## REN and Statewide Structure

- The Michigan legislature has appropriated approximately \$50 million each of the last three years for the Technology Readiness Infrastructure Grant (TRIG).
  - TRIG funds are intended to improve district's technology readiness in preparation for 2014-2015 online assessments. Funds may be spent on infrastructure, software, or personnel. MDE created five regional consortiums to coordinate TRIG projects with a focus on leveraging existing resources and encouraging collaboration. Each of the five is taking the lead on one or more TRIG "Activity": (1) statewide E-rate coordination, (2) the Statewide Educational Network, (3) the Michigan Technology Readiness Assessment Tool, (4) classroom readiness, (5) device purchasing, and (6) assessment and curriculum.
  - One major component of TRIG is establishing a Statewide Educational Network (SEN) to provide increased bandwidth and data center resources for K-12 schools. The SEN will include a mix of owned and leased circuits, and will focus on leveraging the extensive fiber infrastructure already deployed in Michigan.
  - The SEN will be managed by a new non-profit corporation owned by K-12 schools and Intermediate School Districts (ISDs). The Board of Directors consists of ten ISD superintendents. The SEN will work closely with the Michigan Department of Education (MDE), which has an ex-officio seat on the Board. Staff from the Greater Michigan Educational Consortium and the Genesee ISD are leading formation of the SEN.
- Merit Network, Inc. is a non-profit, member-based organization that owns and operates a statewide fiber network. Merit may be one of the primary service providers serving the SEN. Merit connects to three Internet PoPs on its Chicago ring and a PoP in Cleveland through the Ohio Academic Research Network (OARNet). Merit received approximately \$103 million in grants and \$27 million in loans from BTOP to support its Rural, Education, Anchor, Community, and Healthcare – Michigan Middle Mile Community (REACH-3MC) proposal. REACH-3MC expanded Merit's fiber backbone primarily in rural areas in northern Michigan and the Upper Peninsula. REACH-3MC connected 141 community anchor institutions including 43 libraries, 58 K-12 schools, and 2 ISDs. REACH-3MC also extended fiber circuits to six districts that had previously leased last mile circuits to the Merit backbone.
- Michigan has 56 Intermediate School Districts (ISDs), regional education service agencies consisting of public school districts and non-public school organizations (e.g., Catholic Dioceses)

that were created to provide services that may be too expensive for individual districts, including technology, special education, early childhood education, and administrative functions, on a regional basis. ISDs leverage economies of scale to reduce costs for technology equipment and services. Individual school districts within each ISD administer their own WANs. In certain rural areas, Merit manages WANs on behalf of districts that do not have a traditional hub and spoke WAN infrastructure.

**School Connectivity Overview**

- **District edge to Internet.** ISDs purchase Internet access from service providers. Merit provides Internet access service to 32 of 56 ISDs and 46% of Library Cooperatives. Merit’s bundled service includes Internet access, maintenance, and transport from the ISD demarcation point to the Merit backbone at the rates below.
  - All Merit members pay a \$1,200 annual connection fee, plus an additional \$750 annual maintenance fee if Merit owns the member’s last mile fiber connection. If Merit leases the last mile circuit from a third party provider, the cost of leasing that circuit is passed through to the member.
  - Merit offers two service models for Internet access. The connection model provides a fixed connection at the prices in the first table below. Members can also purchase burstable service, which allows the member to receive capacity above their subscribed connection. Members that burst above their subscribed tier for more than 30 minutes on consecutive days will receive a burstable bill for the month at the per Mb rates in the second table below. These burstable charges are reviewed by Merit customer service and can be waived if the peak usage was an isolated occurrence. Merit is reviewing several options for burstable service going forward. The tables below contain Merit’s Internet access pricing for TRIG group participants as of January 2014.

**Fixed Bandwidth Connection Model – Commodity & Internet2 Access**

Capacity (Mbps)	Monthly		
	1 yr	3 yr	5 yr
100	\$2,015	\$1,915	\$1,820
500	\$8,750	\$8,310	\$7,900
750	\$10,320	\$9,805	\$9,315
1000	\$10,800	\$10,260	\$9,750
2000	\$19,200	\$18,240	\$17,300
3000	\$28,080	\$26,675	\$25,350
4000	\$36,480	\$34,660	\$32,925
5000	\$42,000	\$39,900	\$37,910
7000	\$55,800	\$53,025	\$50,370
10000	\$71,450	\$67,870	\$64,475
15000	\$92,100	\$87,500	\$84,000
20000	\$110,200	\$105,000	\$99,500

**Burstable Bandwidth Per Mb Per Month – Commodity & Internet2 Access**

Bandwidth Level (Mbps)	Monthly			Price Per Mb Per Month		
	1 yr	3 yr	5 yr	1 yr	3 yr	5 yr
<b>1.5-100</b>	\$2,100	\$2,000	\$1,900	\$21.00	\$20.00	\$19.00
<b>Up to 250</b>	\$4,750	\$4,438	\$4,200	\$19.00	\$17.75	\$16.80
<b>Up to 300</b>	\$5,475	\$5,190	\$4,950	\$18.25	\$17.30	\$16.50
<b>Up to 400</b>	\$7,140	\$6,800	\$6,460	\$17.85	\$17.00	\$16.15
<b>Up to 500</b>	\$8,750	\$8,325	\$7,900	\$17.50	\$16.65	\$15.80
<b>Up to 750</b>	\$11,813	\$11,250	\$10,688	\$15.75	\$15.00	\$14.25

- The table below breaks down current ISD bandwidth purchases for Merit members. Nearly all ISDs that are Merit Members are connected via 1 Gpbs-capable fiber, and some have 10 Gpbs-capable fiber connections.

Bandwidth (Mbps)	% of ISDs
1.5-100	22.2%
101-250	25.9%
251-500	14.8%
501-1000	33.3%
1000+	3.7%

- Another component of TRIG, led by the Intra-Michigan Technology Readiness Leadership Consortium, was organizing a statewide Internet access contract on behalf of all ISDs. This is a single bid for Internet connectivity that was submitted as a single E-rate application, which K-12 e-rate applicants could use as their Form 470 e-rate submission.
- **School edge to district edge.** Individual school districts pay the recurring costs for their WANs. Though there is no statewide data on WAN or Internet access prices or capacity for ISDs, districts, or schools other than Merit Members, this data is being gathered as part of the SEN project. The Intra-Michigan Technology Readiness Leadership Consortium is leading the effort to organize a statewide contract for WAN connectivity.
- **Classroom edge to school edge.** No statewide data available.

**Library Connectivity.** Libraries in Michigan are organized into 11 Library Cooperatives that allow them to share administrative services, technical knowledge and equipment, and optimize efficiency when purchasing goods and services. Five of Michigan’s 11 Library Cooperatives purchase connectivity from Merit. The primary reason that Library Cooperatives do not connect to Merit is that they do not coordinate connectivity purchasing among their members. Many Michigan libraries purchase connectivity on their own. Merit connects 162 libraries. 38% of those connections are by fiber. Many

libraries are connected by wireless Internet providers because they negotiate low rates in exchange for the wireless provider placing a tower on the library building.

**Voice:** No statewide data available.

**Other Services:** No statewide data available.

**Dedicated State Ed-Tech or Broadband Funding:** None, other than TRIG.

**Sources:** Interviews with Genesee ISD and Merit Network staff; TRIG website (<http://22itrig.org/>); TRIG overview presentation ([http://www.connectmi.org/sites/default/files/connected-nation/Michigan/files/tim\\_hall\\_and\\_bruce\\_umpstead\\_-\\_presentation.pdf](http://www.connectmi.org/sites/default/files/connected-nation/Michigan/files/tim_hall_and_bruce_umpstead_-_presentation.pdf)); materials submitted by The Quilt.

# Mississippi

**Size:** 490,526 public school students (1072 schools); 39,053 private school students (197 schools)

**E-Rate Commitments:** 2013: \$40.6 million P1; 2012: \$38.9 million P1, \$8.9 million P2; 2011: \$38.7 million P1, \$11.2 million P2

**BIP Infrastructure Awards:** Bay Springs Telephone Company \$4.1 million

**BTOP Infrastructure Awards:** Contact Network \$33.1 million

## REN and Statewide Structure:

- The Mississippi Department of Information Technology Services (ITS) has a state master contract (SMC) for Internet access and telecommunications services with AT&T, the largest provider in the state. The Mississippi Department of Education (MS DOE) pays for Internet access for each school district that chooses to use the SMC. MS DOE pays AT&T directly, with funds that include E-rate support, to serve districts that purchase service through the SMC. ITS, as the contract holder, revisits the SMC every two years to negotiate lower pricing. The rates listed below are postalized across the state and were available to districts as of January 1, 2014.
- Districts that opt to seek bids on their own establish their own contracts and apply independently for E-rate support. Several districts in areas served by multiple providers pay rates below the state master contract rate for Internet access and telecommunications.
- K-12 schools do not participate in the Mississippi Optical Network (MissiON), a network connecting universities that are members of the Mississippi Research Consortium.

## School Connectivity Overview:

- **District edge to Internet:** All 152 school districts now have fiber connections. Districts are migrating toward a centralized network model under which the district data center connects to the Internet and all schools on the WAN connect to a Managed Internet Service (see below). Previously, most Mississippi schools connected directly to an MPLS cloud service that connected to the public Internet. MS DOE pays for districts' Internet access costs at the rates below. The new MIS has a monthly Internet access charge but no transport cost.

**SMC MIS Prices for Districts as of 1/1/14**

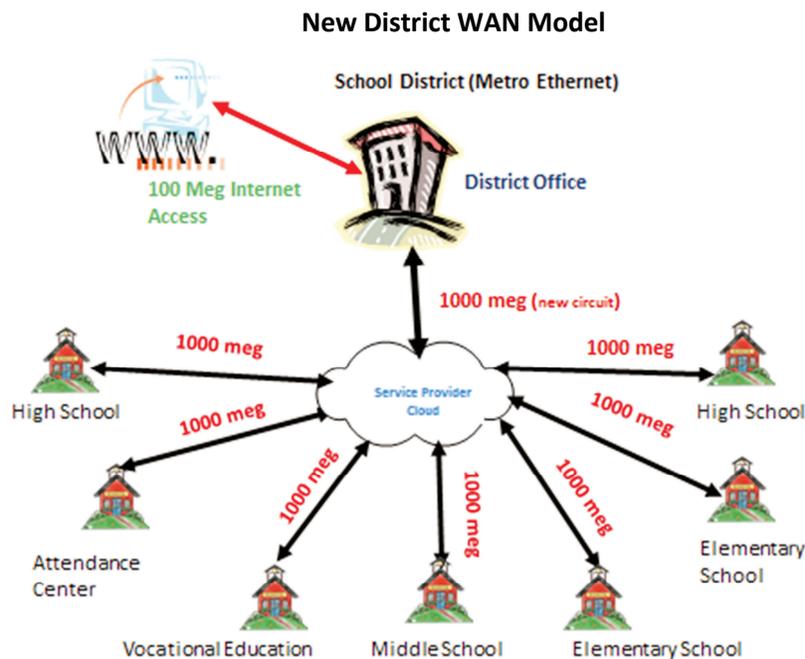
Bandwidth (Mbps)	Price
50	\$970
100	\$1,021
250	\$1,773
500	\$3,817
1000	\$5,874

A recent survey conducted by a group of Technology Coordinators found that the 14 Mississippi school districts that have bid their own Internet access service since January 2013 have lowered costs to an average of \$5.97/mb.

- School edge to district edge:** Nearly all schools within Mississippi that have requested fiber services are now connected to fiber. Exceptions are found in a few Independent Telephone Company areas. Though schools are moving to the Metro Ethernet WAN model illustrated above, 470 of Mississippi's 1,071 public K-12 schools were still connected directly to MPLS attached Internet as of February 2014. Those schools still on MPLS pay \$582 for 1.5 Mbps and \$1,325 for 3 Mbps. MPLS attached Internet is \$5 per Mb.
- Network Diagram:** Below is a diagram of a typical WAN design for districts that use AT&T as their provider. Most schools are opting for a 1000 Mbps connection to the Service Provider Node, and then the District connects to the Node with a 1 Gbps circuit. The district then connects to the Internet with a minimum of a 100 Mbps connection, scalable as demand requires it.

**SMC Metro Ethernet WAN Circuit Prices**

Bandwidth (Mbps)	Price
10	\$408
100	\$500
1000	\$750



- Classroom edge to school edge:** Mississippi does not collect any statewide data on WiFi coverage or LAN costs.

**Voice:** No statewide data available.

**Dedicated State Ed-Tech or Broadband Funding:** none

**Sources:** Interviews with and documents provided by state staff.

# Missouri

**Size:** 911,928 public school students (2408 schools); 93,087 private school students (579 schools)

**E-rate Commitments:** 2013: \$33 million P1; 2012: \$35.9 million P1, \$12.9 million P2; 2011: \$35.9 million P1, \$4.6 million P2

**BTOP Infrastructure Awards:** Bluebird Media LLC (\$45.1 million); Show-Me Technologies (\$26.6 million)

**BIP Infrastructure Awards:** Northeast Missouri Rural Telephone (\$5.1 million)

## **REN and Statewide Structure:**

- The Missouri Research and Education Network (MOREnet) is a member-based non-profit organization that operates as a separate business unit within the University of Missouri System. MOREnet operates a statewide fiber backbone capable of supporting 8.8 Gbps bandwidth and offers a range of connectivity, educational, and technology services to K-12 schools, libraries, higher education institutions, health care facilities and other affiliated organizations.
  - MOREnet connects to Internet service providers and peering partners in Kansas City and St. Louis with an aggregate capacity of 36 Gbps. MOREnet is a member of Internet2 and connects to the national Internet2 research network through the Great Plains Network (GPN) in Kansas City.
  - MOREnet purchases Internet access and transport from private carriers directly, files multiple consortium E-rate applications for those services (grouped by member district discount level), and passes through the post-E-rate portion to member school districts and libraries as part of their service package.
  - MOREnet's member service charges to schools are not E-rate eligible, with the exception of pass through charges to transition traffic to the public Internet. MOREnet is funded by member service fees, which are published on its website (<http://www.more.net/content/membership-options>).
  - Nearly all educational institutions and libraries purchase transport and Internet access through MOREnet, including 86% of the 520 public K-12 school districts, 90% of the 146 public library systems, and 3% of the 540 private and parochial schools.

## **School Connectivity Overview:**

- MOREnet's January 2014 School Readiness Assessment Project Report performed under contract for the Missouri Office of Administration estimated the cost of meeting the Smarter Balanced testing requirements (45 Kbps per active test) and SETDA external connectivity recommendations for a subset of Missouri's public K-12 schools. Based on previous surveys conducted by the Missouri Department of Elementary and Secondary Education, 1,416 schools were prepared, 681 schools did not meet the recommendations, and 294 schools were not estimated. MOREnet concluded that 87 percent of the connections, serving 354 school districts, are unprepared to meet the 2014-15 SETDA recommendations and will require an upgrade, while 97 percent of the connections are unprepared to meet the 2017-18 SETDA bandwidth

recommendations and will require an upgrade. The majority of districts included in the study are prepared to meet Smarter Balanced testing requirements.

- **District edge to Internet.**

- MOREnet members pay an annual network connectivity fee that covers the costs of both Internet access and transport on the MOREnet backbone.

**MOREnet Annual Network Fee**

<b>Bandwidth (Mbps)</b>	<b>FY15 Fee</b>
1.5	\$1,317
5	\$2,390
10	\$3,580
20	\$5,157
50	\$9,822
100	\$16,324
150	\$20,924
250	\$29,002
500	\$42,472
750	\$52,472
1,000	\$62,472

- The MOREnet study estimates that 335 of the 399 external connections (district demarc to the Internet) surveyed will need upgrades to meet the 2014 SETDA recommendations (100 Mbs/1000 users) at an estimated cost of \$4.8-\$6.5 million. MOREnet estimates that 389 of the 399 external connections will need upgrades to meet the 2017-2018 SETDA recommendations (1 Gbps/1000 users) at a cost of \$36.2-\$48.5 million.

**Per Student Internet Access, 2013-2014**

<b>Students</b>	<b>0-1,000</b>	<b>1,001-5,000</b>	<b>5,001-10,000</b>	<b>&gt;10,000</b>
<b># K-12 Districts</b>	306	122	17	17
<b>Total Students</b>	119,329	285,183	106,798	282,358
<b>Avg. Kbps/Student</b>	30.5	25.3	35.4	24.8

**External District Connections by Circuit Technology**

<b>Circuit Technology</b>	<b>% of Buildings</b>
Ethernet	68.4%
DSL	11.3%
IMA	9.8%
Cable Internet	5.5%
T1	3.3%
Other	2.0%

**Current District Internet Access Connections**

<b>Bandwidth (Mbps)</b>	<b>Districts</b>
<b>&lt;10</b>	197
<b>10-49</b>	202
<b>50-99</b>	37
<b>100</b>	31
<b>150-300</b>	17
<b>500</b>	4
<b>1000</b>	3

- School edge to district edge.** The MOREnet study reviewed WAN connections but did not collect costs associated with WAN infrastructure. 306 of the 354 districts provided WAN data. Of those respondents, 176 had a WAN, 123 had only one building in the district, and 7 have external Internet access connections at each building instead of a WAN. The tables below show the number of districts with WANs capable of meeting the SETDA internal WAN recommendations.

<b>2014-2015 SETDA</b>		
	<b>No. of Districts</b>	<b>% of Districts</b>
<b>WAN Ready</b>	201	65.7%
<b>WAN Not Ready</b>	105	34.3%

<b>2017-2018 SETDA</b>		
	<b>No. of Districts</b>	<b>% of Districts</b>
<b>WAN Ready</b>	134	43.8%
<b>WAN Not Ready</b>	172	56.2%

- Classroom edge to school edge.** No statewide data currently available, though MOREnet is collecting data for select school districts on behalf of the Missouri Office of Administration. MOREnet also offers on-site wireless assessments to assist its members with their WiFi network layout. Members pay \$500/day plus travel expenses for a wireless assessment and can purchase a custom findings report for an additional \$500. Additional details on the wireless assessments is available at <http://www.more.net/services/wireless-assessment-surveys>.

**Library Connectivity.** MOREnet provided the following summary for public library members.

<b>Bandwidth</b>	<b>No. of Libraries</b>
<b>&lt; 5 Mbps</b>	171
<b>5 Mbps</b>	41
<b>6-10 Mbps</b>	16
<b>20-50 Mbps</b>	6
<b>50 Mbps</b>	4
<b>100 Mbps</b>	2

**Voice:** No statewide data available

**Other Services:** No statewide data available

**Dedicated State Ed-Tech or Broadband Funding:** None

**Sources:** Interviews with MOREnet and MO DESE staff; MO DESE 2014 School Readiness Assessment Project Report; documents provided through The Quilt.

# New Mexico

**Size:** 335,526 public school students (866 schools); 17,140 private school students (158 schools)

**E-Rate Commitments:** 2013: \$33.6 million P1; 2012: \$28.7 million P1, \$7.2 million P2; 2011: \$31.3 million P1, \$12.2 million P2

**BIP Infrastructure Grants:** Baca Valley Telephone Company, Inc. (\$1.6 million); Western New Mexico Telephone Co. (\$11.5 million); Penasco Valley Telephone Cooperative, Inc. (\$4.8 million), Kit Carson Rural Electric Coop (\$63.7 million)

**BTOP Infrastructure Grants:** ENMR Plateau Telephone Cooperative, Inc. (\$27.8 million); Navajo Tribal Utility Authority (\$32.3 million for AZ, UT, NM); NM Department of Information Technology (\$38.7 million); North Central New Mexico Economic Development District (\$10.6 million)

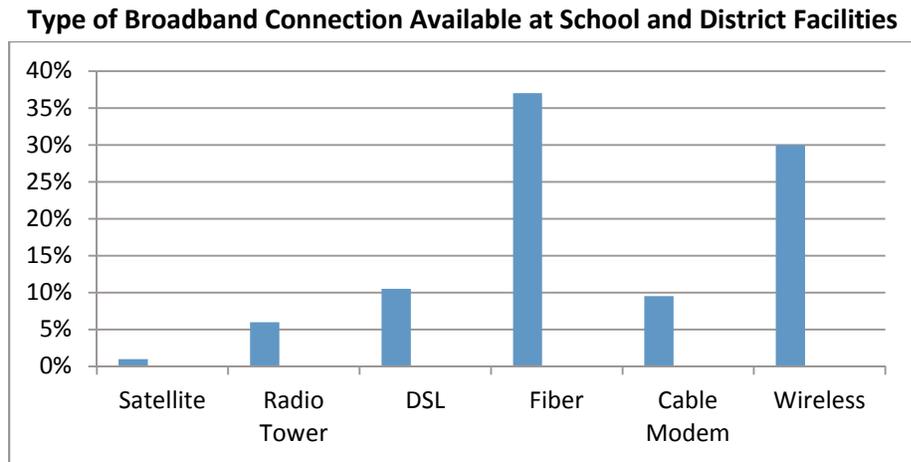
## REN and Statewide Structure:

- There are no state master contracts for telecommunications or Internet access services. Districts purchase both transport and Internet access directly from providers. Schools do have the option to purchase internal connections equipment off the New Mexico General Service Department's purchasing agreements.
- The independent, non-profit New Mexico Council for Higher Education Computing/Communication Services (CHECS) operates CHECS-Net, a higher education research and education network that connects over 30 institutions. K-12 schools are eligible to connect to CHECS-Net, though few have to date.
- The Department of Information Technology (DoIT) is developing the New Mexico Digital Microwave System (NMDMW), a network that will offer broadband to public entities via microwave wireless service. The NMDMW has been incrementally going live for the last year and will reach maximum capability in November 2015 with a network currently pushing 4,800 miles. Each of the 105 NMDMW sites will have a range of 50 to 65 (assuming line of sight) and be capable of providing 300 Mbps that is scalable to 600 Mbps. Each tower will be connected to a fiber backbone that is a combination of state-owned and leased fiber. DoIT anticipates collaborating with rural providers to serve those small school districts that have limited resources

## School Connectivity Overview:

- **District edge to Internet.** There is no statewide survey data on school district or individual school Internet access connectivity. The DoIT, New Mexico Public Education Department (PED), and the Public Schools Facility Authority (PSFA) have just completed a pilot of 30 schools to identify whether Internet access performance issues are within or outside the school district. Preliminary results are promising and the test was expanded to 300 schools in August 2014.
- **School edge to district edge.** DoIT recently conducted a speed test in order to assess readiness for online assessments. The test measures download and upload speed of the Internet connection to each student device. 26 schools reported less than 5 kbps/student, 226 reported

5-55 kbps/student, 441 reported 55-770 kbps/student, and 15 reported 770+ kbps/student. The DoIT New Mexico Broadband Program published a report “Broadband Assessment and Recommendations: Education, Healthcare, and Economic Development” (November 2013) that included the following table on connections. Respondents were not broken down between schools and districts.



- **Classroom edge to school edge.** No statewide data available. However, the State will drill down into the facility architecture and identify deficiencies following the completion of the “District Edge to Internet” testing.

**Voice:** No statewide data available.

**Other Services:** No statewide data available.

**Dedicated State Ed-Tech or Broadband Funding:** The Public Schools Facility Authority (PSFA) assists schools with the planning, construction, and maintenance of facilities. The PSFA’s work on technology infrastructure has to date been limited to ensuring that schools have the necessary power outlets and reliable electrical wiring to support new broadband networks. The PSFA has not expanded its work into technology assistance in part because there were no state adequacy standards to serve as a starting point. The state’s new Educational Technology Plan includes such standards as of August 2013. PSFA has also received funding to implement solutions to the broadband connectivity deficiencies identified by the assessments discussed above. In addition, the PED has acquired funds that will compliment PSFA in improving connectivity deficiencies outside the school districts.

The DoIT New Mexico Broadband Program (NMBBP) funded by the NTIA State Broadband Initiative has been instrumental in providing availability data and metrics to target deficiencies and identify solutions. The NMBBP recently conducted a survey of three industry sectors (Education, Healthcare, and Economic Development) and released a report on current broadband availability and usage, emerging technologies and future broadband demand, and barriers to meeting that demand. The report opens

with 23 detailed policy recommendations, including several new sources of dedicated funding and/or support such as centralized management of backbone connectivity for all K-12 schools, state-funded technical support for districts, and funding for long-term infrastructure investments. The state legislature provided initial funding for these efforts in January 2014.

**Sources:** Interviews with and documents provided by NM DoIT and Dept. of Pub. Ed. staff; New Mexico Broadband Program Report

([http://www.doit.state.nm.us/broadband/reports/NMBBP\\_Report\\_Assess\\_Recommendations.pdf](http://www.doit.state.nm.us/broadband/reports/NMBBP_Report_Assess_Recommendations.pdf)).

# North Carolina

**Size:** 1,486,681 public school students (2,577 schools); 94,596 private school students (583 schools)

**E-Rate Commitments:** 2013: \$119.2 million P1; 2012: \$58.8 million P1, \$20.4 million P2; 2011: \$58.8 million P1, \$20.2 million P2

**BIP Infrastructure Awards:** None

**BTOP Infrastructure Awards:** MCNC (\$103 million)

## REN and Statewide Structure:

- MCNC is a non-profit entity that owns and operates a fiber backbone that serves research, education, non-profit healthcare, and community institutions in North Carolina. The North Carolina Research and Education Network (NCREN) is the name of the MCNC network that connects 115 school districts and 76 charter schools.
- MCNC and the North Carolina Office of Information Technology Services collaborate to provide Internet connectivity, firewall, web security, and domain name services (DNS) to North Carolina public K-12. These services are currently funded by a consortium E-Rate application filed by the Department of Public Instruction (DPI) and state funds available through the North Carolina School Connectivity Initiative (SCI).
- The SCI was established in 2007 to expand the number of public schools with broadband Internet access, further develop networks for rural and underperforming schools, aid in professional development for staff, and develop a scalable model to maintain and enhance network services to all schools in North Carolina. The SCI, which is funded by a recurring \$20 million state appropriation, helps fund the complete MCNC connectivity bundle and consulting services for all school districts. The SCI also pays for E-rate consulting services offered by the DPI and the portion of every district's WAN costs that are not covered by E-rate support. School districts therefore do not have to fund any portion of their broadband connectivity.

## School Connectivity Overview:

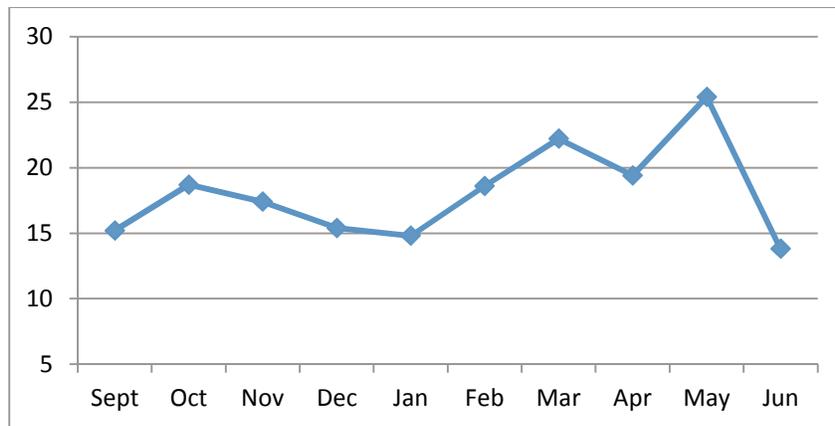
- **District edge to Internet.** 100% of North Carolina school districts are connected to NCREN by MCNC-owned fiber or last mile lit fiber services procured by MCNC from local service providers.
  - DPI is the billed entity for all K-12 Internet access service.
  - The SCI's monthly ISP service bundle prices vary by school district due to differing prices for circuits from the district demarcation point to MCNC. In 2013, school districts contracted with MCNC for an average bandwidth of 500 Mbps and 44 Kbps/student. MCNC monitors school district bandwidth utilization in order to increase capacity as demand increases. Total ISP service prices for the 2013-2014 school year will not be finalized until the end of the year because school districts may increase their bandwidth purchase during the year. For the 2012-2013 school year, the total monthly Internet access cost for all 115 school districts was \$11,732,975. The E-rate Program paid \$6,994,918 of that total. Average pricing as of July, 2014 for each bandwidth tier is below.

**SCI Monthly Bundled ISP Service\*, July, 2014**

<b>Bandwidth (Mbps)</b>	<b>Avg. Monthly Price</b>	<b># of Districts</b>
100	\$2,431	15
250	\$4,185	49
500	\$7,171	24
1000	\$11,147	16
2000	\$21,004	8
3000	\$26,676	2
4000	\$32,905	1
10000	\$69,409	-

*\*Excludes firewall service*

**2013-2014 Average Statewide Per Student Bandwidth Utilization (Kbps)**



- School edge to district edge.** 95% of schools are connected to their district WAN by fiber, which is typically lit fiber leased from service providers. Many of the 123 schools not connected to fiber currently purchase point-to-point microwave wireless services on long term contracts that will soon expire. At least two districts, encompassing about 50 of the 123 schools not served by fiber connections are in the process of deploying fiber to many of these remaining schools. Total monthly WAN expenses for all 115 school districts for the 2013-2014 school year are \$3,322,955 (before E-rate discount).

**Average School District WAN Speeds, 2013-2014**

High Schools	1.26 Gbps
Middle Schools	884 Mbps
Elementary Schools	846 Mbps

- Classroom edge to school edge.** For planning purposes, MCNC recommends one wireless access point (WAP) per classroom. However, MCNC emphasizes that this planning metric should not replace proper WLAN design processes which include defining requirements, design, and validation. Of the 2,331 schools that responded to an April 2013 DPI survey, 515 have one WAP per classroom, 928 have one WAP for every two classrooms, and 818 have one WAP for every three or more classrooms. 371 schools currently have a 1:1 student to device ratio.

- MCNC estimates that deploying comprehensive WiFi to all schools will cost approximately \$90 million, based on an average cost of \$2,300 per classroom. The costs detailed below include 3-year maintenance and support and the cost of WiFi to common areas.

Per-Classroom WiFi Estimate	
Description	Cost
Installation (cable pulls, mounting)	\$250
Configuration (switch ports, WAPs, etc)	\$50
Wireless site survey	\$100
802.11ac WAP	\$950
Wireless controller (redundant)	\$350
POE + switch port	\$250
Other network/security upgrades	\$200
Misc.	\$150

**Voice:** No statewide data.

**Other Services:** The MCNC standard service includes Internet connectivity, firewall, web security, and manages domain name services (DNS) for use in mapping host names to IP addresses.

**Dedicated State Ed-Tech or Broadband Funding:** NCREN’s Client Network Engineering (CNE) service is a consulting service that offers network design and operational support to school districts. CNE offers analysis of network functionality, performance, and security. CNE also offers network design services, general technical guidance, training, and assistance resolving complex network problems. CNE staff compiles technical papers and recommended practices. The CNE services are funded solely by the SCI. CNE is vendor neutral and does not recommend specific vendor products or services. Although CNE will help districts gather and document WiFi requirements, they encourage districts to use the design services of their selected WiFi vendor or reseller so that those vendors and resellers will offer solution support beyond basic equipment warranties.

In 2013 the North Carolina General Assembly passed a law requiring all public K-12 schools to transition to all digital content by the 2017-2018 school year.

**Sources:** Interviews with and documents provided by MCNC staff; documents provided through The Quilt.

# Ohio

**Size:** 1,726,715 public school students (3,724 schools), 174,577 private school students (836 schools)

**E-Rate Commitments:** 2013: \$106.7 million P1; 2012: \$71.9 million P1, \$13 million P2; 2011: \$73.8 million P1, \$18.9 million P2

**BIP Infrastructure Awards:** Wabash Mutual Telephone (\$2.2 million); Consolidated Electric Cooperative (\$1 million); Benton Ridge Telephone Co. (\$1.5 million)

**BTOP Infrastructure Awards:** Com Net, Inc. (\$30 million); Horizon Telcom, Inc. (\$66.4 million); OneCommunity/Ohio Middle Mile Consortium (\$44.8 million); Zito Media Communications II (\$6.1 million)

## **REN and Statewide Structure:**

- With the exception of seven large urban districts and a small number of independent districts, all Ohio school districts are members of one of 22 Information Technology Centers (ITCs).
  - ITCs are quasi-governmental entities created by state law but owned and operated by member districts. ITCs also receive approximately \$5.6 million in annual state funding.
  - ITCs provide IT support and assistance with LAN and WiFi services that smaller districts might not otherwise have the ability to staff.
  - School districts may join any ITC; they are not determined by geography.
- The Ohio Academic Resources Network (OARnet), a division of the Ohio Board of Regents, leases a fiber backbone that provides Internet access services for higher education, K-12 schools, local and state governments, healthcare facilities, and public broadcast stations throughout Ohio.
  - OARnet used BTOP support to expand its middle mile network in partnership with three regional providers. All middle mile fiber connections between the OARnet backbone and ITCs and large urban districts are being upgraded for a ten-year term from 1 Gbps to 10 Gbps. The state recently provided \$13 million to upgrade the full OARnet backbone to 100 Gbps. Ohio continues to invest in broadband to support the future of education and workforce development.
  - OARnet purchases commodity Internet access from several providers and has peering arrangements with several states as well as a transit peering arrangement with Internet2. OARnet's average costs are approximately \$2.50/Mb, with some bulk purchasing arrangements as low as \$1/Mb. OARnet connects to Internet2 PoPs in Cleveland and Cincinnati.
- The Ohio Department of Education (ODE) pays for the recurring costs of connections between OARnet and ITCs and large urban districts.

## **School Connectivity Overview:**

- **District edge to Internet.** Most Ohio school districts connect to the public Internet through their ITC, which resells Internet service. Currently, OARnet charges the ITCS and urban districts \$3.00/Mbps. Seven large urban districts connect directly to OARnet on circuits funded by ODE. Not all school districts purchase Internet connectivity through their ITC. A small number of

districts prefer to procure service independently or get free Internet access service from a local cable company.

- School edge to district edge.** OARnet partners with commercial service providers under a state master contract to provide WAN circuits to schools and libraries. ODE has adopted a statewide goal of 100 Mbps Internet access bandwidth for all K-12 school buildings. As of October 2013, 90% (3,089) of school buildings in Ohio had the capability to connect at 100 Mbps or greater, 9% (298) had 10-99 Mbps, and 1% (52) had less than 10 Mbps. ODE has requested funding from the state legislature to build fiber to the remaining schools. ODE provides \$1,800 per educational building per year to assist with connectivity costs. The tables below summarize connectivity data provided by OARnet.

Purchase WAN Connectivity	% School Buildings
1 Gbps Ethernet	31%
100 Mbps Ethernet	15%
10 Mbps Ethernet	13%
Other Fiber	28%
155 Mbps OC3	1%
45 Mbps DS3	2%
T1s/Cable Modems/DSL	10%

Available WAN Connectivity	School Buildings
1 Gbps+	2,136
100 Mbps	747
11-99 Mbps	83
10 Mbps	350
<10 Mbps	113

- Classroom edge to school edge.** ITCs provide IT support and assistance with LAN and WiFi services that smaller districts might not otherwise have. Districts that are not part of an ITC generally manage their own LANs. No statewide data on WiFi is available.

**Voice:** As of 2013, through an RFP process, a statewide VoIP contract has been established with Cincinnati Bell Technology Solutions (CBTS). CBTS uses OARnet network to deploy these services. All state and local government, K-12 and higher education institutions are eligible to purchase using this contract.

**Other Services:** OARnet negotiates volume purchase prices for software, hardware, and/or network services on behalf of members. ODE also provides planning, support, and information to E-rate applicants and recipients.

**Library Connectivity.** Ohio libraries purchase Internet access (library edge to Internet) through the Ohio Public Library Information Network, which provides libraries with a bundled service that includes Internet access, firewall, and filtering services. The state recently began buying the connectivity portion of that service from OARnet for approximately \$3/Mbps. Libraries will pay \$3/Mbps or the state service bundle. Through a Memorandum of Understanding, all state agencies and libraries are required to connect to the OARnet backbone beginning July 1, 2014.

**Dedicated State Ed-Tech or Broadband Funding:** None

**Sources:** Interview with and documents provided by OARnet staff, Ohio Board of Regents staff and staff from three ITCs; documents provided through The Quilt.

# Wisconsin

**Size:** 872,436 public school students (2,213 schools); 119,801 private school students (722 schools)

**E-Rate Commitments:** 2013: \$38.7 million P1; 2012: \$35 million P1, \$1.9 million P2; 2011: \$42.9 million P1, \$1.8 million P2

**BIP Infrastructure Awards:** None

**BTOP Infrastructure Awards:** Board of Regents of the University of Wisconsin System (\$5.1 million); University of Wisconsin – Extension Service (\$29.9 million)

## REN and Statewide Structure:

- Wisconsin K-12 schools and libraries purchase connectivity through a two-tiered structure.
  - The BadgerNet Converged Network provides transport to school districts and libraries. BadgerNet is a public sector statewide transport network that leases lit fiber on behalf of schools and libraries and also provides broadband circuits to state government agencies and other public sector facilities. School districts connect to BadgerNet circuits at district head ends, which are most often at high schools. Districts are then responsible for purchasing or leasing WAN connectivity from commercial carriers, installing their own circuits, or a combination of both to connect other schools in the district to the head end location.
  - WiscNet is a non-profit, member-based service provider for research and educational institutions. It was founded by the University of Wisconsin – Madison but it is now a separate non-profit entity with no legal connection to the university.
    - WiscNet provides Internet access to approximately 73% of school districts and 98% of libraries. Private ISPs serve the remaining districts and libraries.
    - With just a few exceptions, WiscNet does not provide transport circuits from districts to Internet PoPs. Schools and libraries connect to WiscNet by purchasing transport either from BadgerNet or a private provider.
    - WiscNet minimizes its rates for schools and libraries by utilizing extensive peering arrangements, participating in several regional and national networks, and maintaining two 10 Gbps backbone circuits to POPs in Chicago and Kansas City. WiscNet also provides caching services for all network users.

## School Connectivity Overview:

- **District edge to Internet.** School districts pay WiscNet for Internet access service at fixed rates based on student population, as opposed to bandwidth usage or speeds.
  - Approximately 90% of Wisconsin’s 426 public school districts have fiber connections to at least one location and 70-80% of districts have fiber connections to each school building.
  - Below are the rates that schools and libraries pay for unlimited Internet access. These rates are eligible for E-rate support. WiscNet members also pay a mandatory \$1,000 annual membership fee that is not E-rate eligible.

Organization Type	Student Enrollment or Equity Factor*	Annual Network Participation Fee
<b>K-12 Education</b>	1-199	\$5,000
	200-399	\$5,500
	400-599	\$6,000
	600-799	\$6,500
	800-999	\$7,000
	1,000-1,199	\$7,500
	1,200-1,399	\$8,000
	1,400-1,599	\$8,500
	1,600-1,799	\$9,000
	1,800-1,999	\$9,500
	2,000-2,499	\$10,500
	2,500-2,999	\$11,500
	3,000-3,999	\$13,000
	4,000-4,999	\$14,500
	5,000-5,999	\$16,000
	6,000-9,999	\$18,000
	10,000-19,999	\$22,000
20,000-49,999	\$35,600	
50,000+	\$96,400	
<b>Library</b>	Library System: 4% to 5%	\$7,500
	Library System: 5.1% to 9.9%	\$8,300
	Library System: 10% to 11%	\$8,700
	Library System: 12%+	\$12,900
	SWITCH System	\$5,000
	Individual Libraries	\$5,000

*\*Library system fees are based on the level of state aid that the library receives for operations and maintenance. The aid determination is based on population and geographical area served.*

- Below is a breakdown of the bandwidth usage at the district head-end location for each of the 308 school districts on WiscNet. Based on recent utilization data, WiscNet estimates that 19% of districts have adequate capacity (<40% utilization), 18% are approaching maximum capacity (40%-60%), 21% are nearing capacity (60%-80%), and 42% are at maximum capacity (>80%).

Broadband Speed	Number of Districts
1 Gpbs	5
500-999 Mbps	3
101-499 Mbps	4
100 Mbps	58
51-99 Mbps	87
50 Mbps	16
25-49 Mbps	89
<25 Mbps	46

- Wisconsin’s TEACH (Technology for Educational Achievement) program subsidizes transport on BadgerNet for public school district head-end circuits, private K-12 schools and public libraries. TEACH subsidizes a single circuit per district that connects the district to BadgerNet (see below for rates). TEACH is funded through the state universal service fund and E-rate.
- In 2011, TEACH paid carriers approximately \$26 million in subsidies for BadgerNet connections at 992 sites. TEACH does not subsidize connections over 100 Mbps or non-BadgerNet circuits. Districts and cooperatives that require connections of more than 100 Mbps purchase from private providers. The chart below provides a per-site breakdown of TEACH subsidies.

<b>Bandwidth</b>	<b>Monthly Cost for TEACH</b>	<b>Monthly Cost for Customer</b>	<b>Monthly Savings for Customer</b>
256 Kbps	\$299.20	\$100.00	\$199.20
384 to 512 Kbps	\$345.40	\$100.00	\$245.40
768 Kbps	\$414.70	\$100.00	\$314.70
1.5 Mbps	\$460.90	\$100.00	\$360.90
3 Mbps	\$829.40	\$100.00	\$729.40
5 Mbps	\$1,105.50	\$100.00	\$1005.50
10 Mbps	\$1,600.50	\$100.00	\$1500.50
15 Mbps	\$1,831.50	\$250.00	\$1,581.50
20 Mbps	\$2,073.50	\$250.00	\$1,823.50
30 Mbps	\$2,134.00	\$250.00	\$1,884.00
40 Mbps	\$2,227.50	\$250.00	\$1,977.50
50 Mbps	\$2,321.00	\$250.00	\$2,071.00
60 Mbps	\$2,352.90	\$250.00	\$2,102.90
70 Mbps	\$2,384.80	\$250.00	\$2,134.80
80 Mbps	\$2,416.70	\$250.00	\$2,166.70
90 Mbps	\$2,448.60	\$250.00	\$2,198.60
100 Mbps	\$2,480.50	\$250.00	\$2,230.50

- According to Department of Public Instruction (DPI) staff, the rates that carriers charge BadgerNet for transport are often higher than rates available to districts and cooperatives that purchase directly from other broadband providers. For example, BadgerNet’s cost for a 100 Mbps circuit is \$2,480/month and its cost for 500 Mbps is \$5,610/month (not reflected in the table above because support is capped at 100 Mbps). DPI staff reports that Charter recently quoted an educational cooperative \$800/month for 100 Mbps and \$980/month for 500 Mbps.
- The DPI, the Department of Administration, and the carriers who provide the BadgerNet circuits, are currently working with a select group of school districts to implement higher speed bandwidths up to 1 Gbps.

- The Department of Administration began a new state network procurement process in September 2013. One of the primary goals of the procurement will be to significantly lower BadgerNet's current rates for transport.
- **School edge to district edge.** There is no available statewide data on K-12 purchases of transport, WAN services, or connection speeds to individual school buildings, although the DPI is currently working with the EducationSuperHighway to collect some of these data.
- **Classroom edge to school edge.** No statewide data available

**Library Connectivity.** Approximately 10% of the state's 384 public libraries currently have fiber connections. However, the DPI, in cooperation with the state Department of Administration and the carriers who provide BadgerNet circuits, is currently involved in a major library fiber build-out project. It is expected that by November 2014 ninety five percent of the state's public libraries will have fiber at minimum speeds of 10 Mbps.

**Voice:** No statewide data available.

**Other Services:** Some Wisconsin communities have formed community area networks (CANs) that provide the WAN connections for schools, higher education institutions, libraries, health care facilities and municipal government agencies. CAN members pay annual maintenance and membership fees in exchange for access to and transport on the WAN and then purchase Internet access through WiscNet or another provider.

Wisconsin also has 12 regional Cooperative Educational Service Agencies (CESAs) that provide special education, instructional, and technology resources to member school districts. For example, CESA 10 includes 29 school districts in western Wisconsin with approximately 35,000 students. CESAs join together to purchase technology, supplies, services, and staffing. All member schools pay only for annual maintenance costs on the CESA's WAN and pay WiscNet directly for Internet access service, based on their student population.

**Dedicated State Ed-Tech or Broadband Funding:** In addition to the TEACH program, the state's Public Service Commission has a Broadband Expansion Grant Program that started in 2013. The program provides reimbursement for equipment and construction expenses incurred to extend or improve broadband telecommunications service in underserved areas of the state. Grant funds cannot be used to pay for ongoing operating expenses. A total of \$500,000 was awarded to seven grant recipients in May 2014.

**Sources:** Interviews with and documents provided by DPI staff; Wisconsin TEACH website (<http://teach.wisconsin.gov/category.asp?linkcatid=2603&linkid=619&locid=85>); WiscNet website (<https://www.wiscnet.net/services/wiscnet-network-services>).