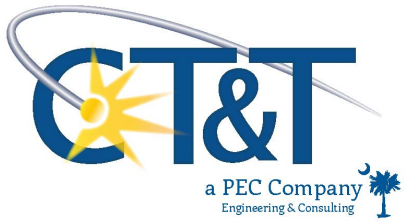
AR K-12 NETWORK STUDY SUMMARY

Arkansas Bureau of Legislative Research

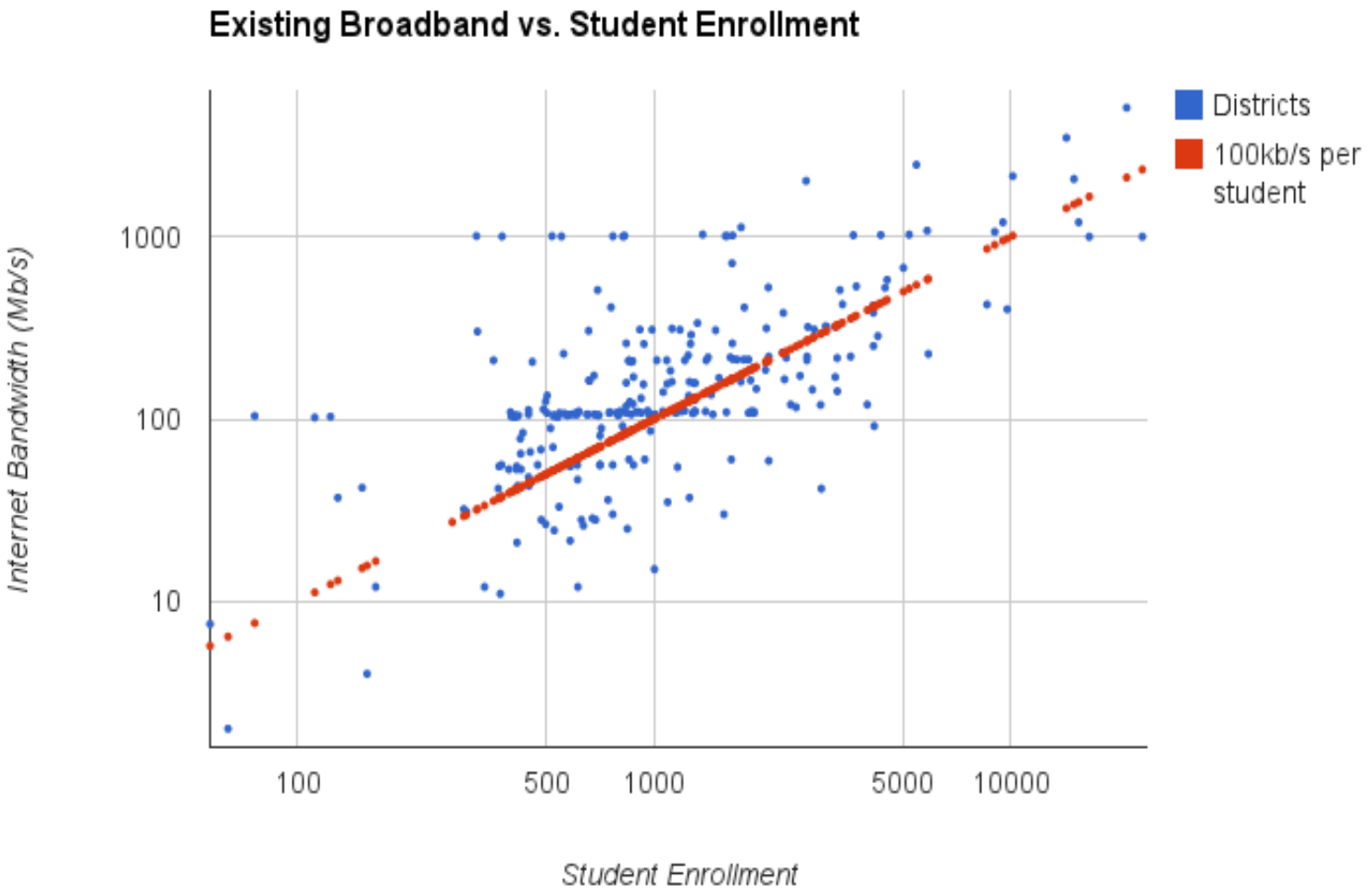
Compiled by: CT&T Inc.

17 December, 2014

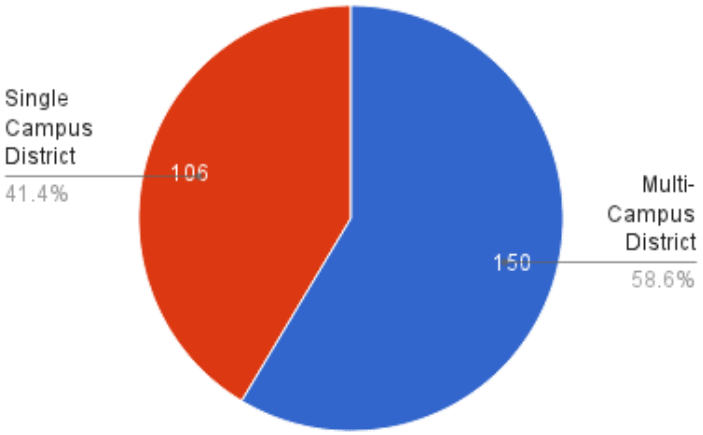


1280 COMPLIANCE

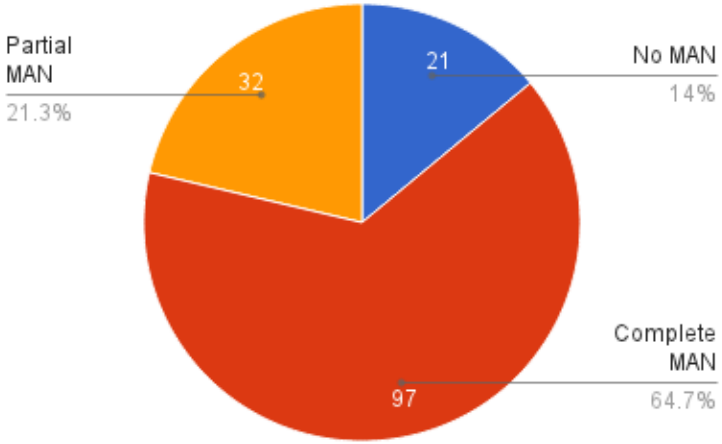
a PEC Company
Engineering & Consulting


Existing Broadband vs. Student Enrollment
Districts
100kb/s per student
Internet Bandwidth (Mb/s)
1000
100
10
100
500
1000
5000
10000
Student Enrollment

District Campus Facilities



MAN Capability in Multi-Campus Districts



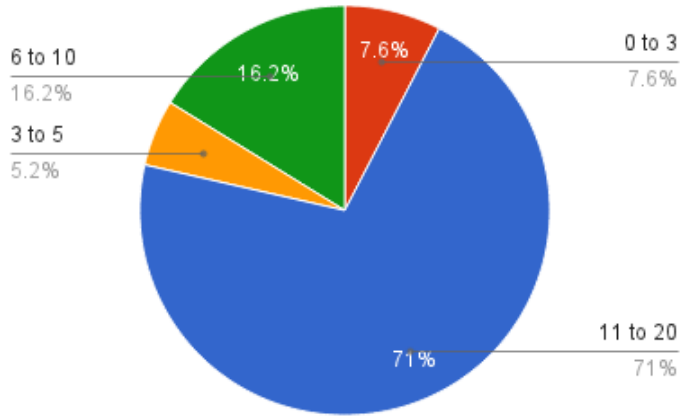
District MANs

- 150 of the 256 districts have multiple campuses that would require a MAN for communication within the school district
- Of the 150 districts with multiple campuses, there are 97 with complete MAN networks, 32 with partial MAN networks, and 21 that do not have MAN networks
- Estimated total cost to complete construction at all districts without fiber MAN today: $5.3M
- $1.1M post E-rate discounts

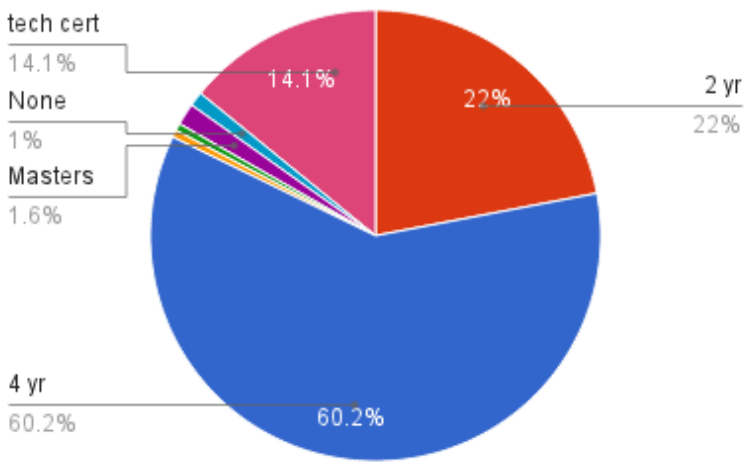
District IT Personnel

- Significant experience across the state
- Wealth of knowledge at the local level
- IT personnel typically coordinate with neighboring districts in their region or Co-op to manage needs and planning
- Co-Op technology coordinators meet online weekly and in-person on a monthly basis.
- Many IT directors participate in vendor led specialty training and industry recognized certification programs

Experience



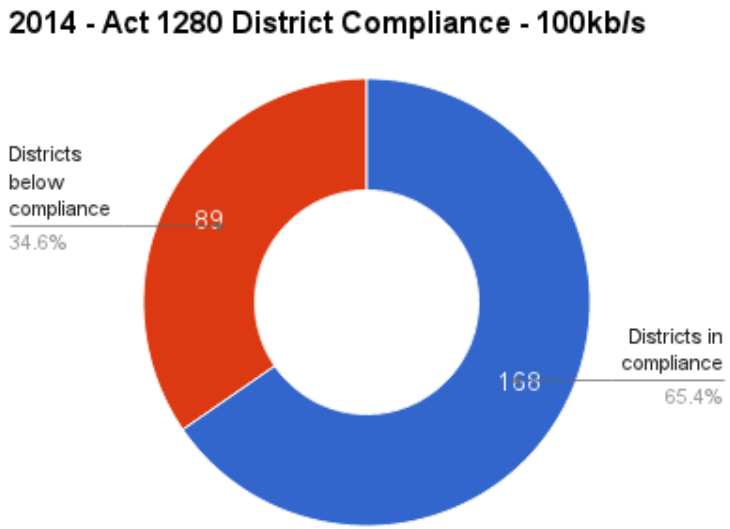
Qualifications



1280 Compliance

- 65% of districts comply with ACT 1280
- 100% compliance achievable within 12 months (no negative budget impacts)
- Collaboration and formal governance is key to sustain 1280 compliance
- Communications gap between ADE, DIS, Co-Ops, and districts
- Limited oversight of platform and application standardization

Act 1280 compliance - Currently



Act 1280 compliance - 2018

School District	Kb/s per student
LEE COUNTY *	1,223
BARTON-LEXA*	1,228
PALESTINE-WHEATLEY*	1,312
ARK SCHOOL FOR THE BLIND	1,368
CLARENDON*	1,826
BRINKLEY*	1,946
MARVELL-ELAINE*	2,679
HUGHES*	3,173

*Great Rivers Co-Op

Recommendations

- Establish adequate Internet access connectivity to the remaining 86 schools that do not meet the targets for 1280 compliance.
- Appoint a technical project coordinator at the state level to ensure goals are met in the 2015-16 school year
- Take immediate action to cancel the redundant APSCN connections to the districts.
- Conduct statewide RFP to procure the additional capacities required by the districts for compliance
- Seek model where the schools can procure broadband transport connectivity to the provider network, and participate in an aggregated Internet access pricing from provider
- DIS should complete the upgrade of the Financial Management System in order to reduce the dependency on a private APSCN connection
- DIS should also establish lightweight VPN access such as SSL or site-to-site IPSEC VPNs.

Needed Capacities

Total current Internet capacity:	69.527 Gb/s
Additional capacity needed:	13.122 Gb/S
Total capacity for 2014 compliance:	82.647 Gb/s

2014 Budgetary Guidance

		Post E-rate
Annual APSCN saving	$11.9M	$10.6M
Annual projected Internet access costs (100kb/s)	$10.4M	
Projected E-rate discount	$8.32M	
Annual total post E-rate discount	$2.08M	$2.08M
	Effective savings:	$8.52 M

DIS – APSCN AND E-RATE

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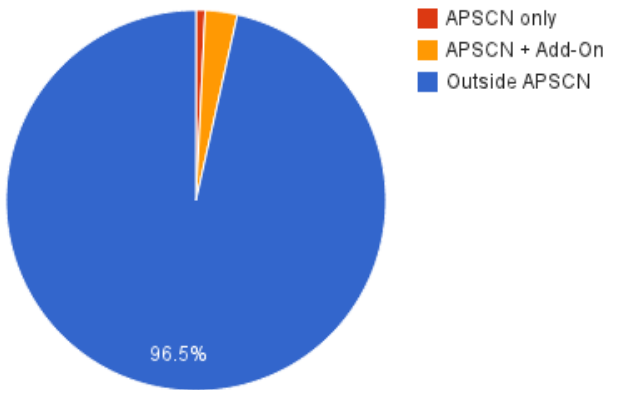
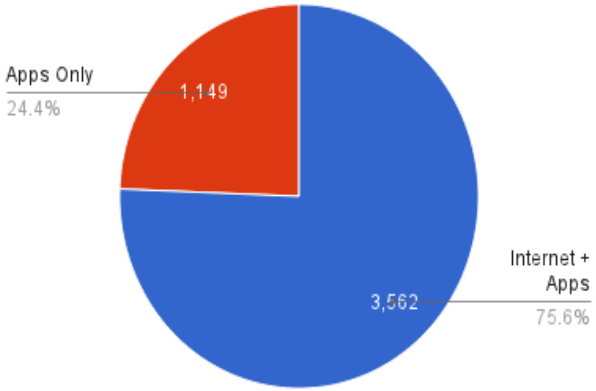
District APSCN Reliance by Procurement Source



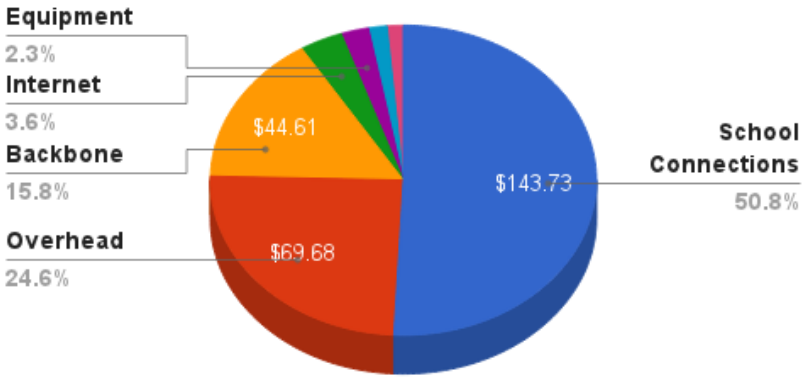
APSCN Bandwidth Capacity (Mb/s)

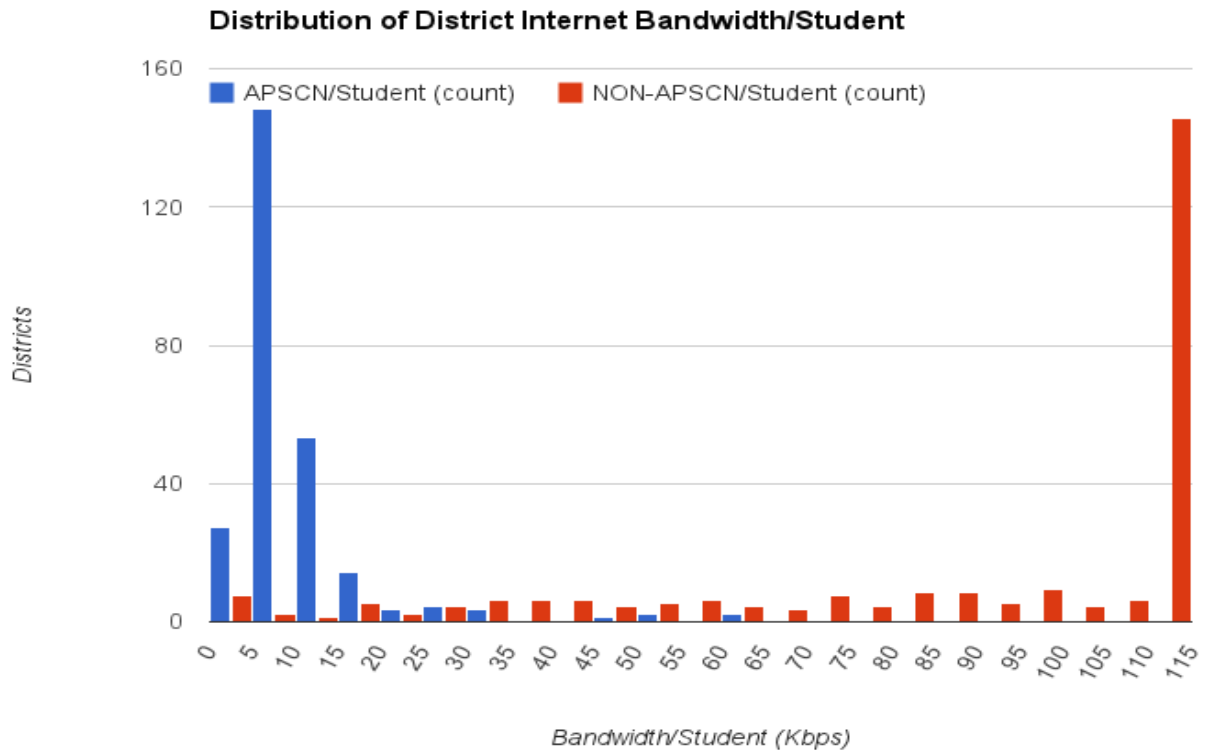


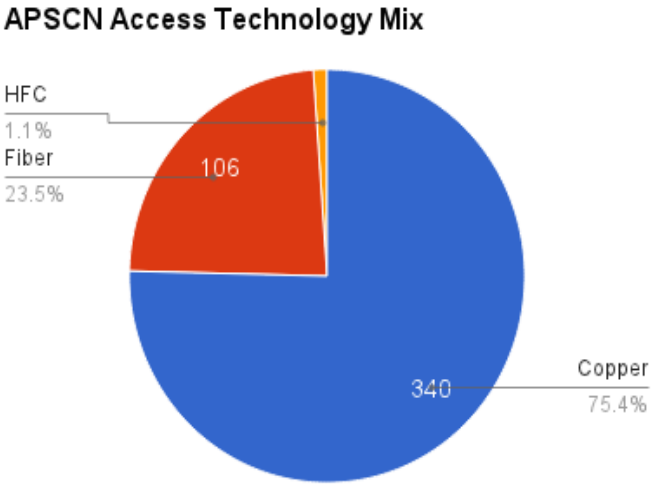
Districts served by APSCN only

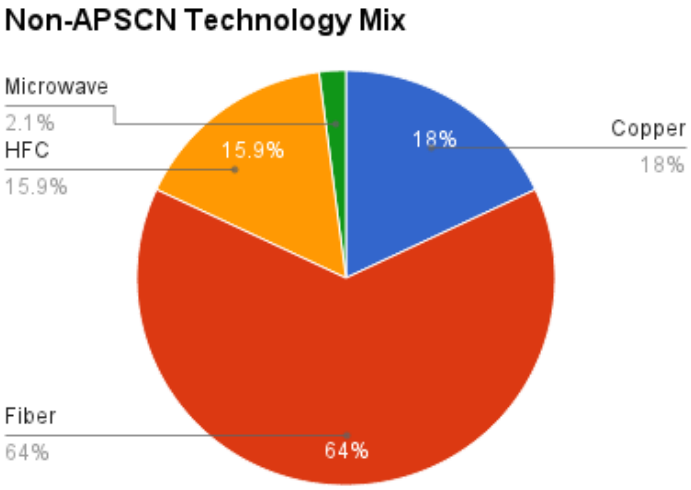
School District	APSCN Connection (in Mbps)
Covenant Keepers Charter	**4**
Imboden Charter	**13**

APSCN $283.02/Mb Internet Cost Breakdown



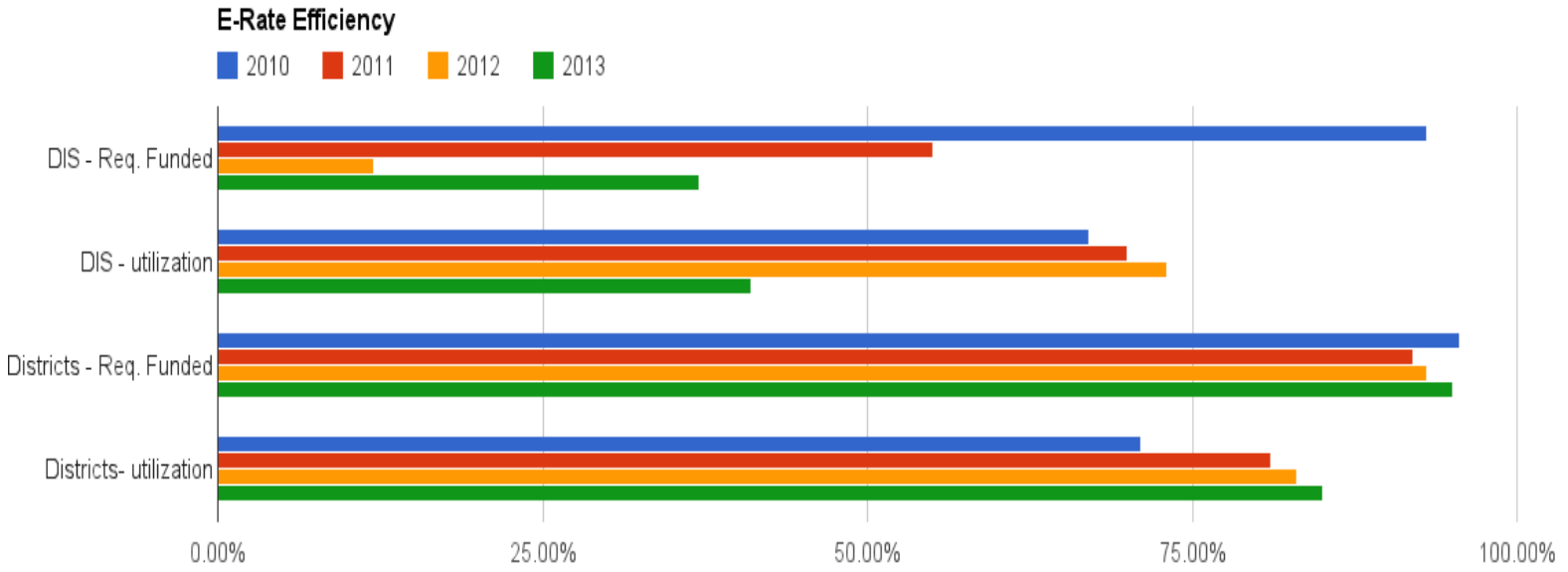

Distribution of District Internet Bandwidth/Student
APSCN/Student (count)
NON-APSCN/Student (count)
Districts
160
120
80
40
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115
Bandwidth/Student (Kbps)


APSCN Access Technology Mix
HFC
1.1%
Fiber
23.5%
106
340
Copper
75.4%


Non-APSCN Technology Mix
Microwave
2.1%
HFC
15.9%
15.9%
18%
Copper
18%
Fiber
64%
64%

Year	Applicants	Prediscount	Requested	Funded	Disbursed	% of Requests Funded	% Utilized of Funding
2010	All	$36,193,435.86	$28,761,018.37	$27,122,917.29	$18,750,413.19	94.3%	69.1%
2010	Minus DIS	$18,054,005.88	$14,585,982.41	$13,943,057.78	$9,923,633.01	95.6%	71.2%
2010	DIS	$18,139,429.98	$14,175,035.96	$13,179,859.51	$8,826,780.18	93.0%	67.0%
2011	All	$49,665,587.36	$39,404,897.13	$28,026,357.79	$21,416,459.64	71.1%	76.4%
2011	Minus DIS	$21,317,371.15	$17,016,693.93	$15,682,119.68	$12,731,882.78	92.2%	81.2%
2011	DIS	$28,348,216.21	$22,388,203.20	$12,344,238.11	$8,684,576.86	55.1%	70.4%
2012	All	$52,803,057.14	$41,984,461.96	$20,560,151.59	$16,781,450.30	49.0%	81.6%
2012	Minus DIS	$24,192,112.52	$19,291,419.90	$17,875,429.56	$14,825,507.41	92.7%	82.9%
2012	DIS	$28,610,944.62	$22,693,042.06	$2,684,722.03	$1,955,942.89	11.8%	72.9%
2013	All	$37,519,932.98	$29,910,820.14	$22,693,691.01	$17,969,609.11	75.9%	79.2%
2013	Minus DIS	$25,812,162.23	$20,573,225.90	$19,555,708.00	$16,685,826.45	95.1%	85.3%
2013	DIS	$11,707,770.75	$9,337,594.24	$3,137,983.01	$1,283,782.66	33.6%	40.9%
2014	All	$47,413,159.32	$37,821,437.06	$26,557,820.86	$2,700,713.53	70.2%	0%
2014	Minus DIS	$34,160,025.05	$27,256,373.30				
2014	DIS	$13,253,134.27	$10,565,063.76				

Pre-discount: Amount intended to spend by applicant
Requested: Amount requested to be off-set by E-rate
Funded: Amount actually funded by E-rate
Disbursed: Amount of approved E-rate funding utilized



App Number	Form ID	Status	Amount
2012			
825296	Backbone 12/13	Held for further review and other verification	$1,357,436
851598	Windstream 12/13	Held for further review and other verification	$1,007,606
851631	AT&T 12/13	Held for further review and other verification	$3,304,336
2013			
901293	WINDSTREAM-1314	Held for further review and other verification	$1,215,994
901935	SmallTelco1314	Held for further review and other verification	$455,652
901903	Backbone1314	Held for further review and other verification	$1,196,162
901906	ATT1314	Held for further review and other verification	$337,847
		Total on-hold:	**$8,875.033**

- Immediate intervention in the DIS E-rate program
- Someone appointed by the state to act as the point of contact regarding the $8.9M of reimbursements that are currently on hold
- ADE has outsourced go forward E-rate planning to Funds for Learning and hired a state E-rate coordinator to manage the program going forward
- DIS remains responsible for the 2 years of reimbursements that are on hold with the FCC.

ARE-ON CONNECTIVITY

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Primary Connectivity Components – Model 1/1a

- ADE owned routers/switches at datacenter and ARE-ON hubs
- ADE leased 1G and 10G wavelengths to connect ADE "Points of Presence" (POP) and form K-12 Backbone
- ADE POPs serve as aggregation points to purchase Internet connectivity from service providers to include ARE-ON
- Internet traffic exits/enters the K-12 Backbone at the regional POP level, and on-net traffic traverses the private ARE-ON wavelength connectivity until it reaches destination POP
- **ADE owned fiber connectivity between ADE POP and school districts**

Cost components of model

	Annual Expense	Capital
Option 1 (new construction)	$3,430,250	$227,579,597
Option 1A (10 Year Fiber IRU)	$3,430,250	$109,925,000

Benefits

- ADE maintains a private network that is purpose built to the meet the needs of K-12 public schools in Arkansas
- Traffic aggregated to regional hubs allows greatest Internet access purchasing flexibility for ADE
- Ease of scaling backbone capacity needs by adding capacity in 1G and 10G increments
- Capacity increases only require incremental capital for interfaces
- Owned fiber access infrastructure to support all future bandwidth demands

Challenges

- Centralized operational complexity increases sharply; platform expertise will be required
- Platform will require 24X7 Network Operations personnel (outsourcing estimates are included in costs analysis)
- Platform will also require greater centralized planning and coordination with Co-Ops and Districts when implementing network policy
- Does not address broadband access needs of districts

Primary Connectivity Components – Model 2

- "Virtual router" presence on existing ARE-ON IP network
- ARE-ON provides fully managed backbone and Internet access
- **Service providers aggregate school traffic and transport to specified ARE-ON huts**

Cost Components of Model

	Annual Expense	Capital
Option 2	$6,282,896	$1,393,410

Benefits

- ADE maintains a private backbone that is purpose built to the needs of K-12 public schools
- Traffic aggregated to regional hubs allows greatest Internet access purchasing flexibility for ADE
- Ease of scaling backbone capacity needs by adding capacity in 1G and 10G increments
- Replaces APSCN annual backbone costs of $2,413,632.36
- Leased transport for traffic aggregation reduces capital outlay to operationalize model

Challenges

- Will require a function to coordinate and manage interconnection program
- Does not address broadband access needs of districts

Drivers

- No special performance requirements
- Security can be addressed at a individual session or site level
- Cost savings of ~$1.9M per annum in backbone costs
- Internet access unit costs decrease rapidly with volume
- Service Provider independence
- We question the accuracy of all public transport cost estimates; will require RFP to get to actual transport figures

The backboneless POP

- Service Providers Aggregate Internet traffic normally
- Service Providers Peer in-State
- School traffic exchanged within 1 or 2 hops
- DIS-hosted traffic exchanged within 1 or 2 hops

Internet Vs. Transport bandwidth costs

- Direct Internet Access
    - Local Loop
    - Internet Access
- Transport:
    - Local Loop
    - Transport Cost
    - Backbone Cost
    - Internet Access

End