Illinois Connectivity Report

K-12 Broadband and Digital Learning Policy Academy

March 31, 2016

Education SUPERHIGHWAY

To upgrade the Internet access in every public school classroom in America so that all students can take advantage of the promise of digital learning.

Education
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Governor Bruce Rauner

" Technology plays an undeniable role in today's workforce. Being able to bring high-speed Internet to more schools in Illinois will help prepare our children to compete both in and out of the classroom. I am committed to providing an equal opportunity to all students in Illinois.

Education SUPERHIGHWAY

Illinois can close the K-12 connectivity gap statewide

- **69%** of districts in IL currently meet the 100 kbps per student target
  - **76%** of districts not meeting goals can get more bandwidth on their **current broadband infrastructure**. Outreach and awareness can help district leaders to prioritize this opportunity
  - **24%** of districts not meeting goals **need upgrades** to scalable technology. Over half of those connections are on copper

- Up to **18%** of IL schools are not connected through fiber, limiting their access
  - When including Chicago Public Schools, this percentage shifts to **12%**
  - The state can help by targeting support to these schools, and a **state matching fund** for fiber builds will get more schools on fiber before the E-rate window closes in 2018

- **95%** of students could meet goals with improved affordability
  - Districts can now leverage **data transparency** to get more bandwidth for their budget, and partners across the state can coordinate support to empower districts to take action

- **95%** of districts can still use E-rate **to upgrade Wi-Fi**
  - The state can support Wi-Fi procurement to make upgrades more affordable

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Illinois K-12 demographics

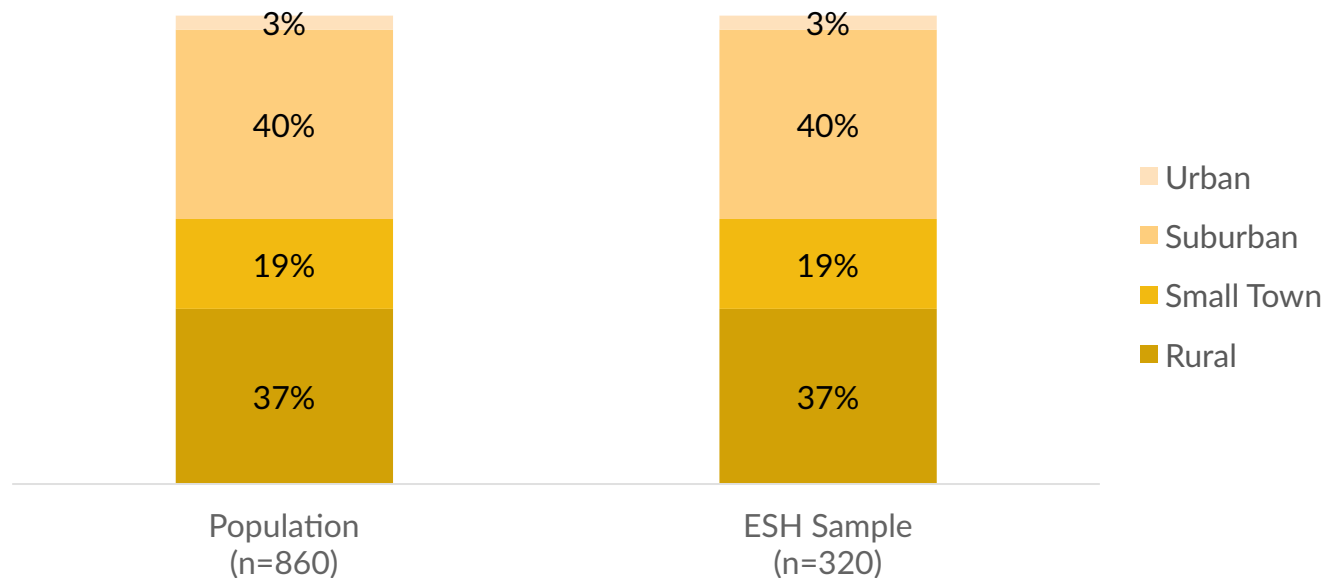**860** school districts

3,946 schools

1.9 million students

57% of Districts and **20%** of Students are in Rural or Small Town Locales

83% of Districts and **30%** of Students are Single-School or Small Districts

Sources: NCES 2012 Database

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Our sample represents 37% of school districts in Illinois

- Connectivity data based on E-rate funding requests for 2015-16
- Does not include charter, private, or Bureau of Indian Education (BIE) schools
- Does not include alternative, regional safe schools and special education centers
- Sample consists of 320 districts of varying locale and size
- Chicago Public Schools is excluded from the ESH sample

	Population (n=860)	ESH Sample (n=320)
Urban	3%	3%
Suburban	40%	40%
Small Town	19%	19%
Rural	37%	37%

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This analysis excludes Chicago Public Schools

- Chicago Public Schools (CPS) represents a significant number of schools and students
  - CPS accounts for ~15% of schools and ~17% students in the state
  - Statewide metrics would not accurately represent the needs of all IL districts

- State actions would target districts and schools beyond CPS
  - CPS operates independently from the other districts across the state
  - As an urban mega district, CPS has robust internal IT and procurement resources

- The state should still track progress in CPS to ensure that students have what they need
  - Upgrades are planned for Internet access, WAN and Wi-Fi/LAN

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Students in Illinois are benefitting from digital learning

Source: Twitter, @ccsd59

Source: Twitter, @gurneed56

But many districts face challenges in connecting schools

Increasing demand

Digital learning and growth in connected devices is driving significant demand for broadband

Diminishing funds for technology support

IL provided Internet service at negligible cost to districts through Illinois Century Network until 2015, but the state subsidy has been cut

Varying levels of awareness, expertise & resources

~860 districts individually plan, purchase and maintain broadband services, while the level of awareness, expertise, and resources can vary greatly from district to district

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National goals can guide action and promote equity

- FCC goals can be used as a benchmark

- The 2014 goal represents a **minimum threshold** for every school

- Once minimum thresholds are met, we suggest monitoring utilization and prepare to increase bandwidth as much as 50% per year

FCC Goals by Purpose

Purpose: Internet Access
Goal: 100 kbps per student/staff

Purpose: District Transport (WAN)
Goal: 1 Gbps per school*

More information: https://www.fcc.gov/page/summary-e-rate-modernization-order
*2014 WAN targets were recommended by SETDA, but schools with <100 students are ok with 100 Mbps transport.

Bandwidth needs to be scalable above 100 kbps/student to meet future demand

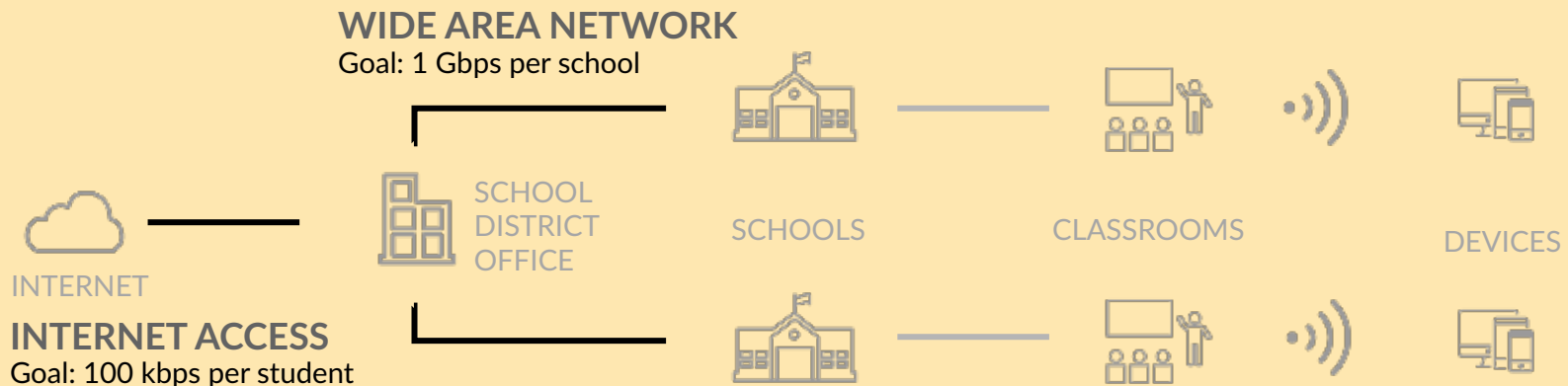| Individual Classroom Technology Use	Everyday 1:1 Technology Use	Everyday Media-rich 1:1 Technology Use
• Classroom technology use is variable and typically driven by individual teachers; devices are primarily in labs and on carts. • Basic network infrastructure for the school is in place to facilitate online assessments or classroom use, but not all classrooms at the same time.	• Technology is widely available; most students interact with a computing device most school days. • Digital curriculum, but not necessarily rich media, is a major part of one or more subject areas.	• Every student has a technology-enabled learning experience during the school day. • Video and other rich media are used as a central part of the everyday experience.
Moderate Bandwidth 100 kbps per student Internet bandwidth	**High Bandwidth** 1 Mbps per student Internet bandwidth	**Very High Bandwidth** 1+ Mbps per student Internet bandwidth

Source: "The Broadband Imperative", www.setda.org

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Goals

Are school districts meeting FCC connectivity goals?

Goals

69% of school districts meet the
100 kbps/student goal

65% of WAN circuits are 1 Gbps or greater

WIDE AREA NETWORK
Goal: 1 Gbps per school

INTERNET

INTERNET ACCESS
Goal: 100 kbps per student

SCHOOL
DISTRICT
OFFICE

SCHOOLS

CLASSROOMS

DEVICES

Sources: 2015 FCC Form 471 E-rate applications, data clarification calls to various districts

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69% of districts in IL are meeting the 2014 IA Goal

Percent of School Districts and Students
Meeting the 100 kbps/student Goal

Districts: National 77%, IL 69%
Students: National 53%, IL 63%

National   IL

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24% of districts NOT meeting goals need infrastructure upgrades

Goals

Highest-bandwidth Internet access connection,
districts not meeting goals

76%

These districts cannot meet future bandwidth
needs using existing infrastructure

			10%		
1%	8%	5%		0%	
Other/ Uncategorized	Cable	DSL	T1/T3	Fixed Wireless	Fiber

■ Non-scalable   ■ Scalable

Sources: 2015 FCC Form 471 E-rate applications, data clarification calls to various districts

Education SUPERHIGHWAY
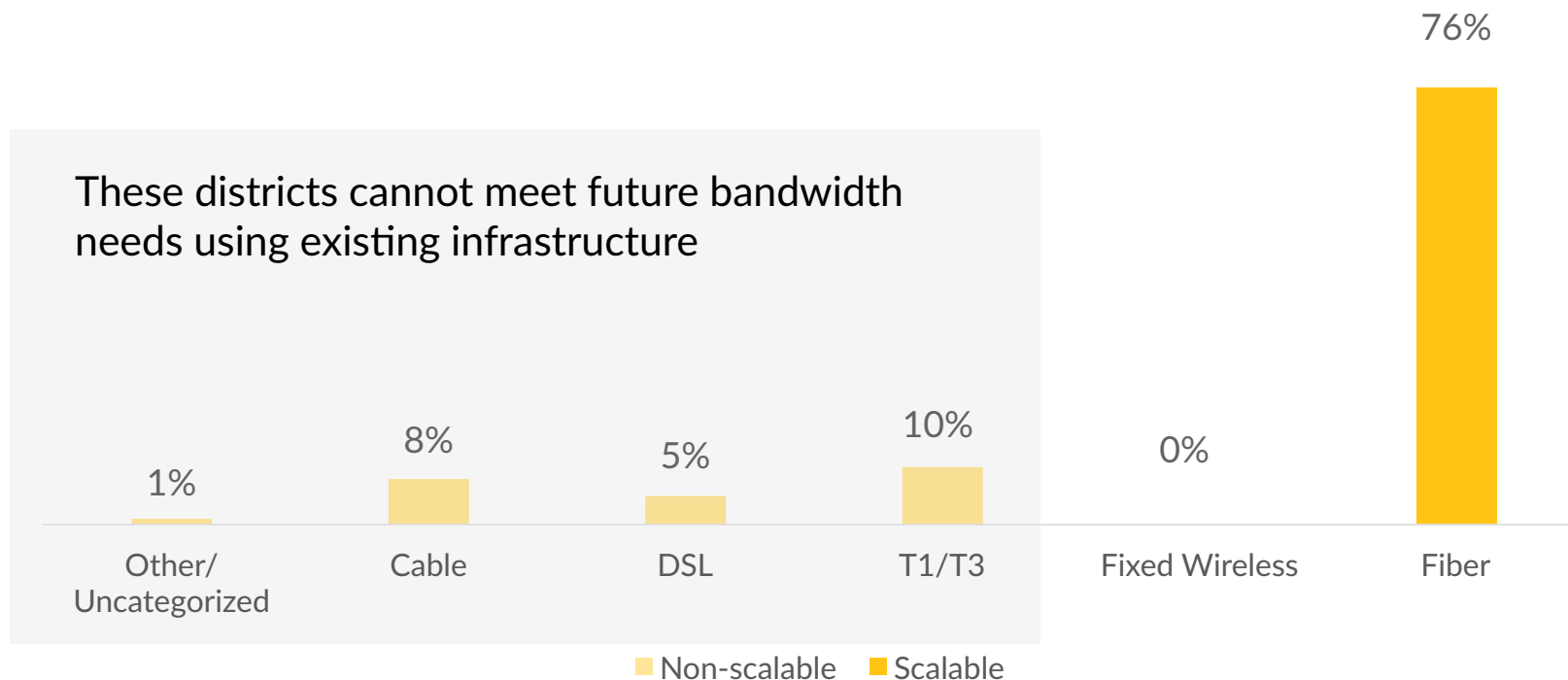
13% of districts meeting goals need infrastructure upgrades

Highest-bandwidth Internet access connection,
districts meeting goals

These districts cannot meet future bandwidth needs using existing infrastructure

Other/ Uncategorized	Cable	DSL	T1/T3	Fixed Wireless	Fiber
0%	8%	3%	0%	2%	87%

■ Non-scalable   ■ Scalable

Education
SUPERHIGHWAY
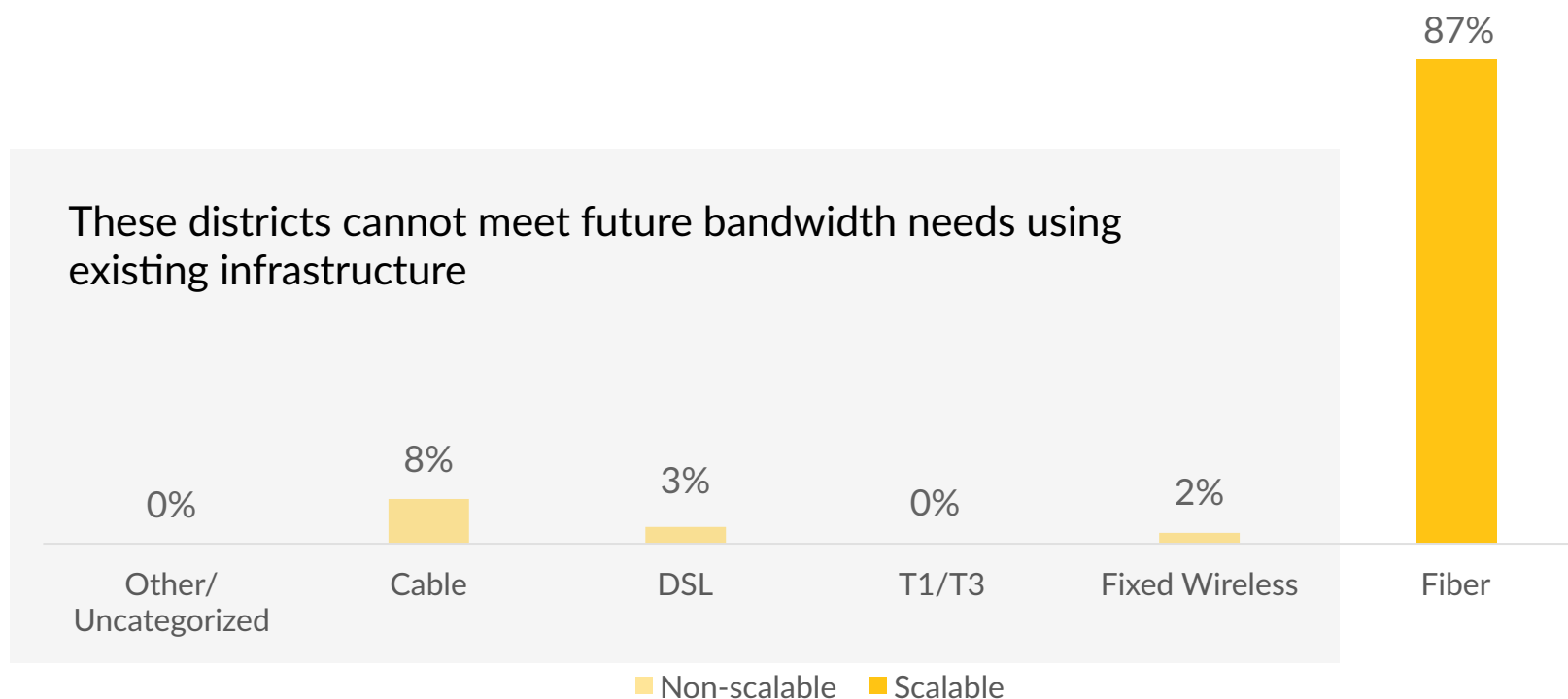
WAN upgrades will be required to meet future projected need

Goals

Current and projected WAN connections by speed

WILL need upgrades

MAY need upgrades

9%
3%

6%
18%

65%

97%

61% National Average >=1 Gbps

<100 Mbps

100 Mbps - <1 Gbps

>=1 Gbps

Projected Need for 1 Gbps

■ Not Fiber ■ Fiber

Sources: 2015 FCC Form 471 E-rate applications, data clarification calls to various districts

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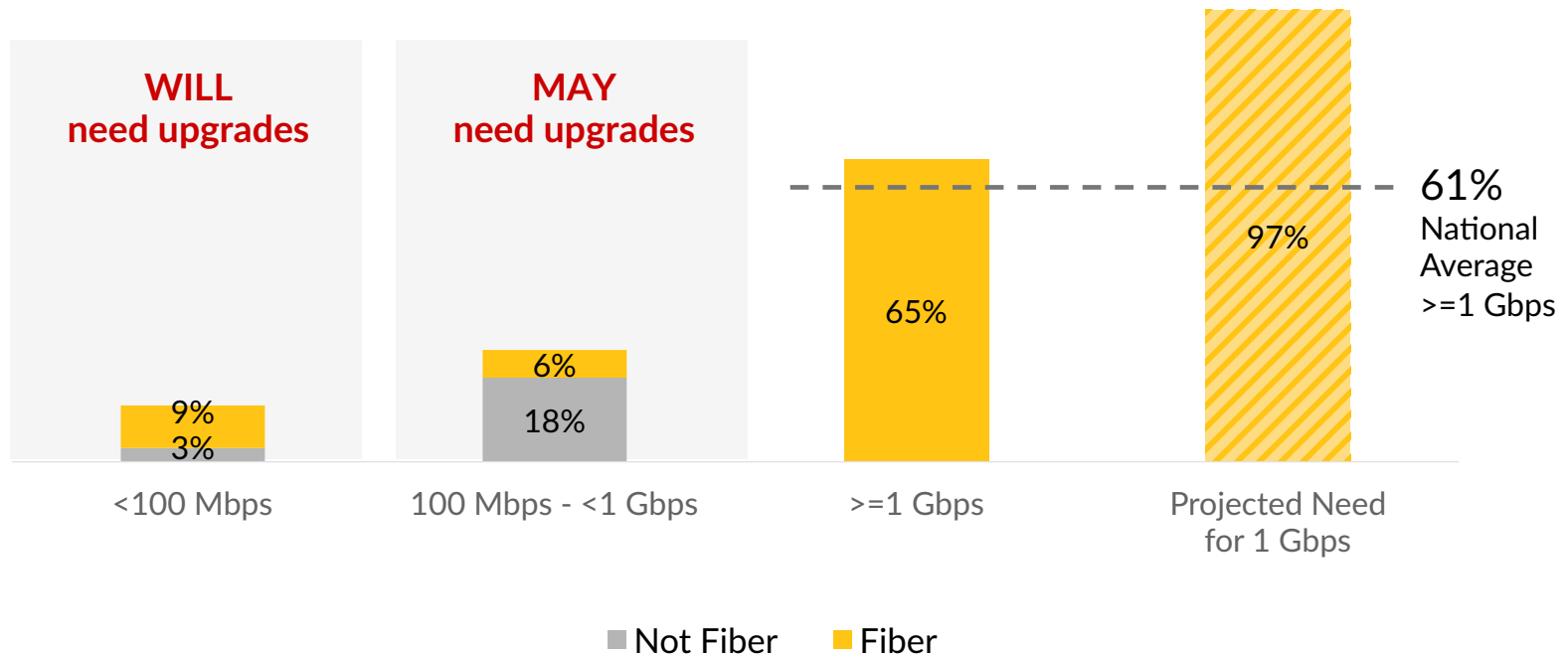
Fiber

Are schools connected on scalable technologies?

Fiber

Up to **18%** of schools are connected on a non-scalable connection, which could limit their ability to support digital learning today and tomorrow
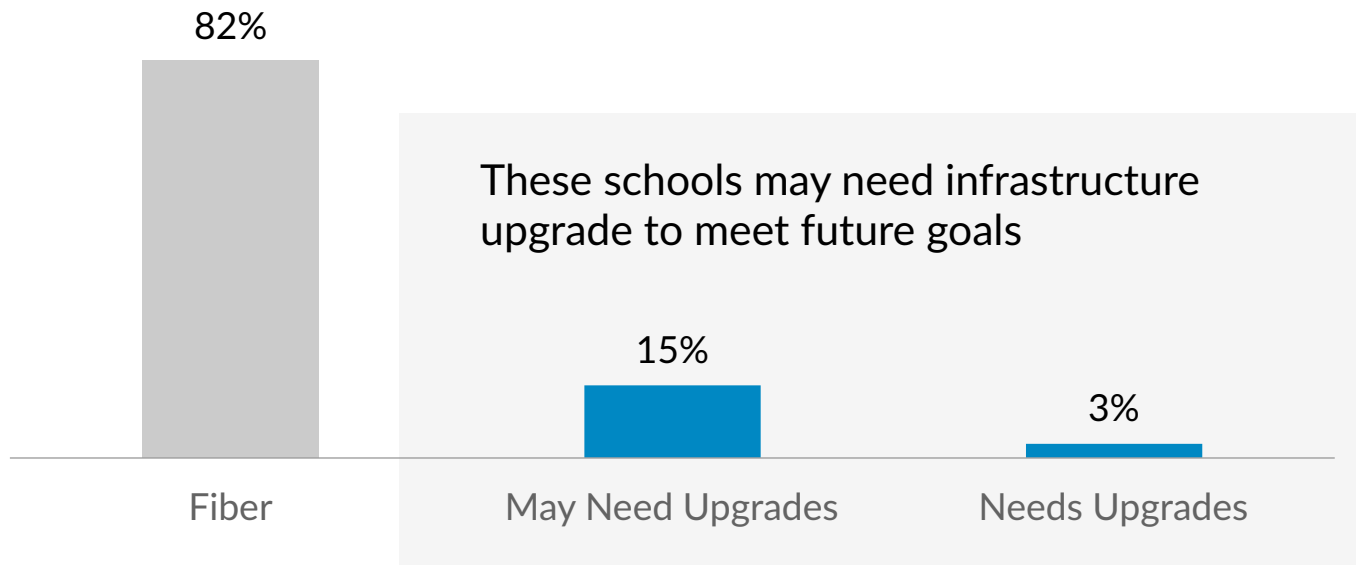
Connections lacking fiber need to be upgraded to meet future bandwidth demand

WIDE AREA NETWORK
Goal: 1 Gbps per school

SCHOOL DISTRICT OFFICE

SCHOOLS

CLASSROOMS

DEVICES

INTERNET

INTERNET ACCESS
Goal: 100 kbps per student

Sources: 2015 FCC Form 471 E-rate applications, data clarification calls to various districts

Education SUPERHIGHWAY
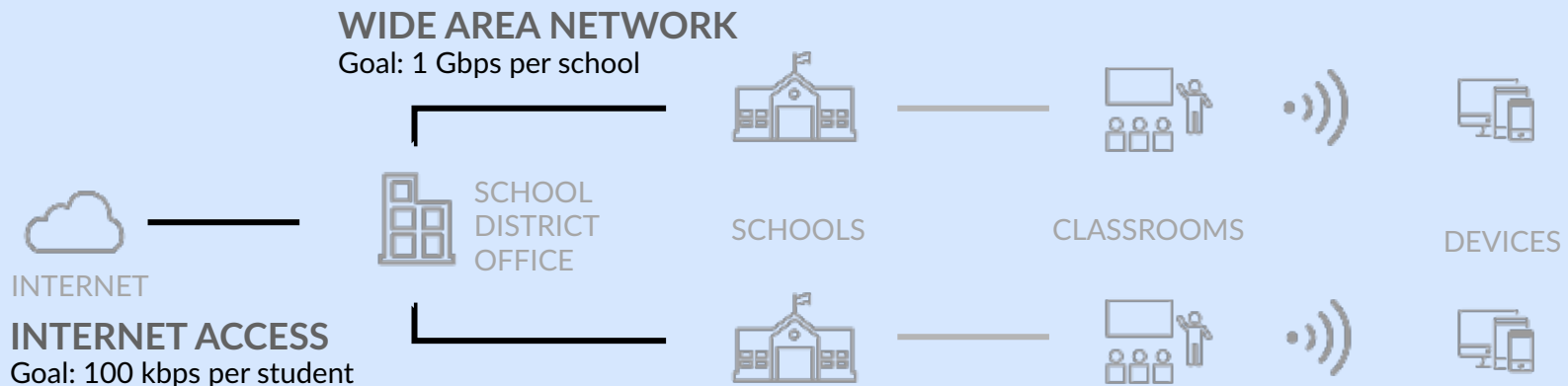
Up to 18% of Illinois schools may need infrastructure upgrades

Fiber

Distribution of schools by infrastructure type

82%

These schools may need infrastructure upgrade to meet future goals

15%

3%

Fiber

May Need Upgrades

Needs Upgrades

n = 1,250

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Schools that may have fiber needs are spread across the state
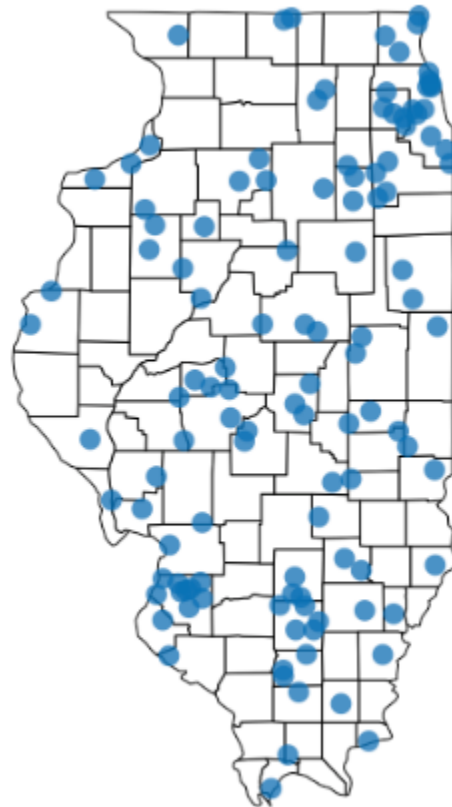
Fiber

- Districts with at least one non scalable school

— County boundaries

Sources: 2015 FCC Form 471 E-rate applications, data clarification calls to various districts

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Districts are constrained by geography and funds

Fiber

" There is NO fiber in our area. I did not receive any bids for my fiber Form 470 request.

I got one bid, but they retracted when they realized we are in the middle of nowhere.

We looked into building fiber and it was $180k and we don't have the funds.

District in Southern Illinois

Source: ESH survey to districts, March 2016

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E-rate provides an opportunity to upgrade all schools to fiber

Fiber

E-rate modernization has created an unprecedented opportunity for states to assist schools that need fiber construction

- **Additional 10% E-rate discount if state has a matching fund**
- $500 K cap has been suspended on construction costs
- More flexibility to pay non-discounted portion of construction costs
- Could help service providers build out their networks

This opportunity is only guaranteed until the 2018 E-rate cycle

Source: www.fcc.gov/general/summary-second-e-rate-modernization-order

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Fiber matching fund can connect 42% of schools at no cost to districts

Fiber

A 10% state match will bring fiber to these schools at **zero cost to districts**

2% — 20%
3% — 40%
1% — 50%
18% — 60%
24% — 70%
32% — 80%
10% — 90%

Distribution of schools by E-rate discount rate

Education SUPERHIGHWAY
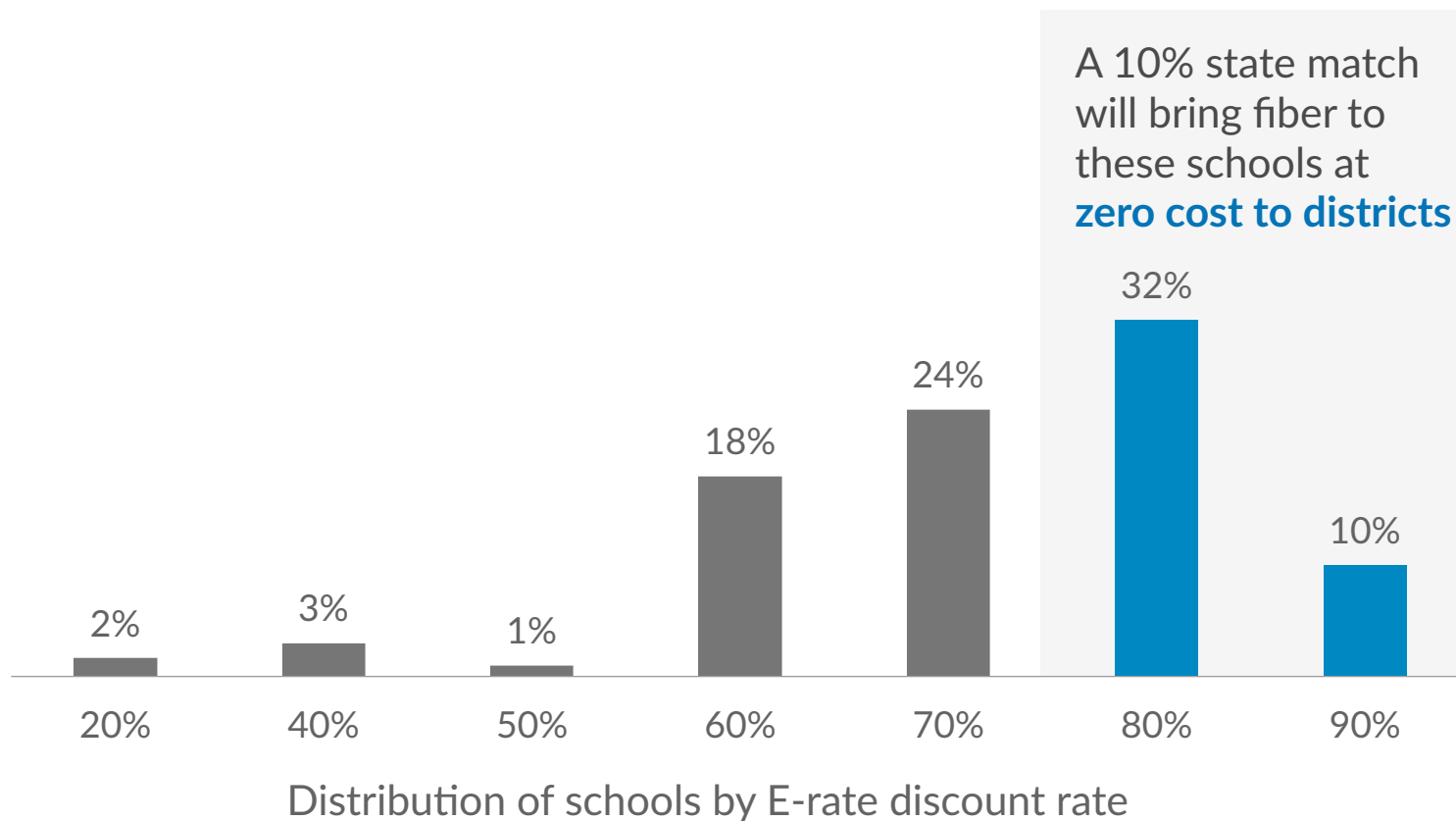
States are leveraging E-rate to make fiber a reality

Fiber

New Mexico estimates it can help ~40 schools access fiber for less than $1M

District	# of schools	Build cost	E-rate %	State match	District match
Bernalillo Public Schools	9	$2,500,000	90%	$125,000	$0
Central Consolidated Schools	11	$3,100,000	90%	$155,000	$0
Cobre Consolidated Schools	1	$675,000	90%	$33,750	$0
Deming Public Schools	1	$1,325,000	90%	$66,250	$0
Farmington Municipal Schools	8	$700,000	80%	$70,000	$0
Gadsden Independent Schools	1	$450,000	90%	$22,500	$0
Gallup-McKinley County Schools	4	$5,975,000	90%	$298,750	$0
Hondo Valley Public Schools	2	$115,350	90%	$5,768	$0
TOTAL	**37**	**$14,840,350**		**$777,018**	**$0**

20x
leverage on investment

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With a 10% state match, even districts in remote areas could be connected to fiber
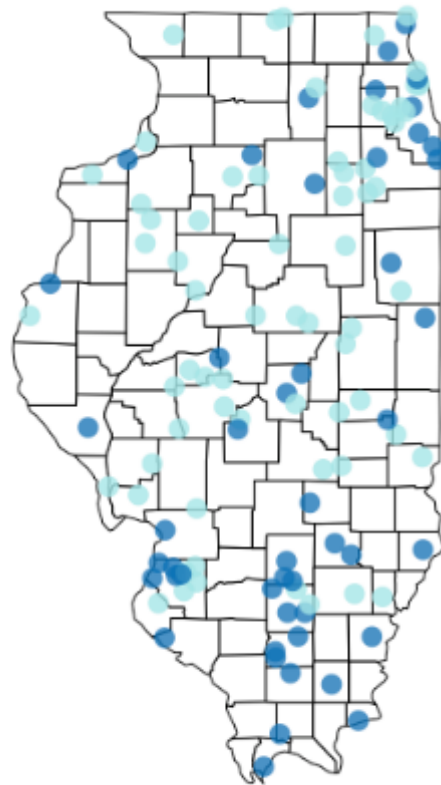
Fiber

● Upgrade at no cost for district

● Upgrade at partial cost to district

— County boundaries

Sources: 2015 FCC Form 471 E-rate applications, data clarification calls to various districts

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Districts can do more when they understand their options

Case Study: Central CSD in New Mexico plans to upgrade to fiber

PROBLEM	SOLUTION	OUTCOME
Multiple providers, unreliable connectivity, high prices	Research options and release RFP	Competitive bids, unlimited bandwidth at ~10% of cost

PROBLEM

- 6,000 students, 17 schools in the remote Four Corners area of New Mexico
- Best effort network of 5 providers cobbled together, many schools not on fiber
- Current $17,500 / mo for poorly performing, inadequate network

SOLUTION

- Researched options for lit, leased dark and self-construction fiber
- Recommended RFP to increase competition and drive range of bids
- RFP for fiber was released for 2016 E-rate cycle
- District tech director empowered "*this is the best call I've been on in my 20 year career here*"

OUTCOME

- 3 complete bids from different fiber providers, 2 for lit service, 1 for self-construction
- Likely self-construction with MRC of $1,300, 93% less cost with unlimited bandwidth scalability for the future (and <10 year breakeven for TCO compared to lit service)
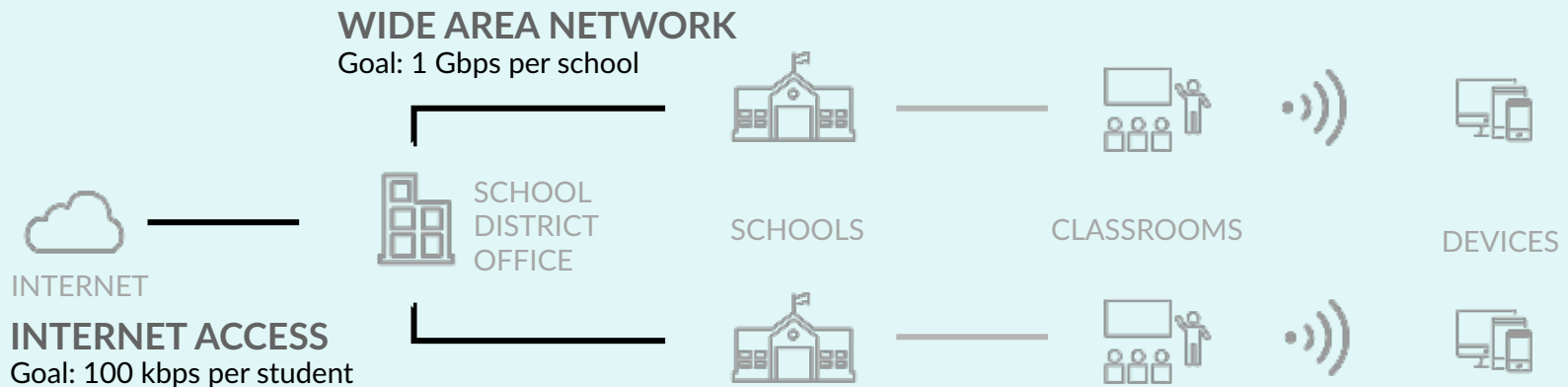
Education SUPERHIGHWAY

Affordability

Is K-12 broadband affordable for all districts?

Districts not meeting goals pay over **2x** more per Mbps than those meeting goals

Districts need **more bandwidth for their budget**

WIDE AREA NETWORK
Goal: 1 Gbps per school

SCHOOL DISTRICT OFFICE

INTERNET

INTERNET ACCESS
Goal: 100 kbps per student

SCHOOLS

CLASSROOMS

DEVICES

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The median cost for Internet access in IL is $9 per Mbps

Monthly Internet access cost per Mbps
(all technologies and speeds)

$5	$9	$17
25th Percentile	Median	75th Percentile

Target: $3

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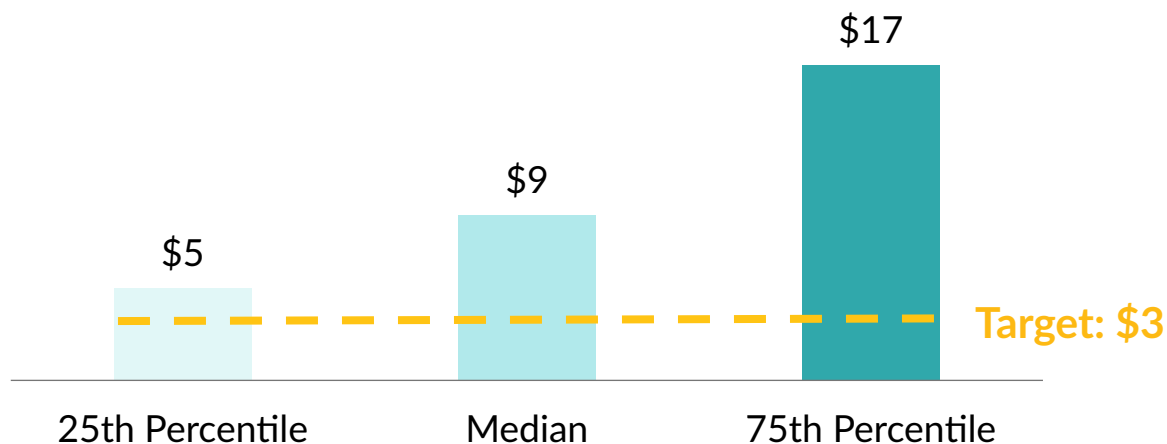
Districts not meeting goals pay over 2x more than those meeting goals for Internet access

$

Affordability

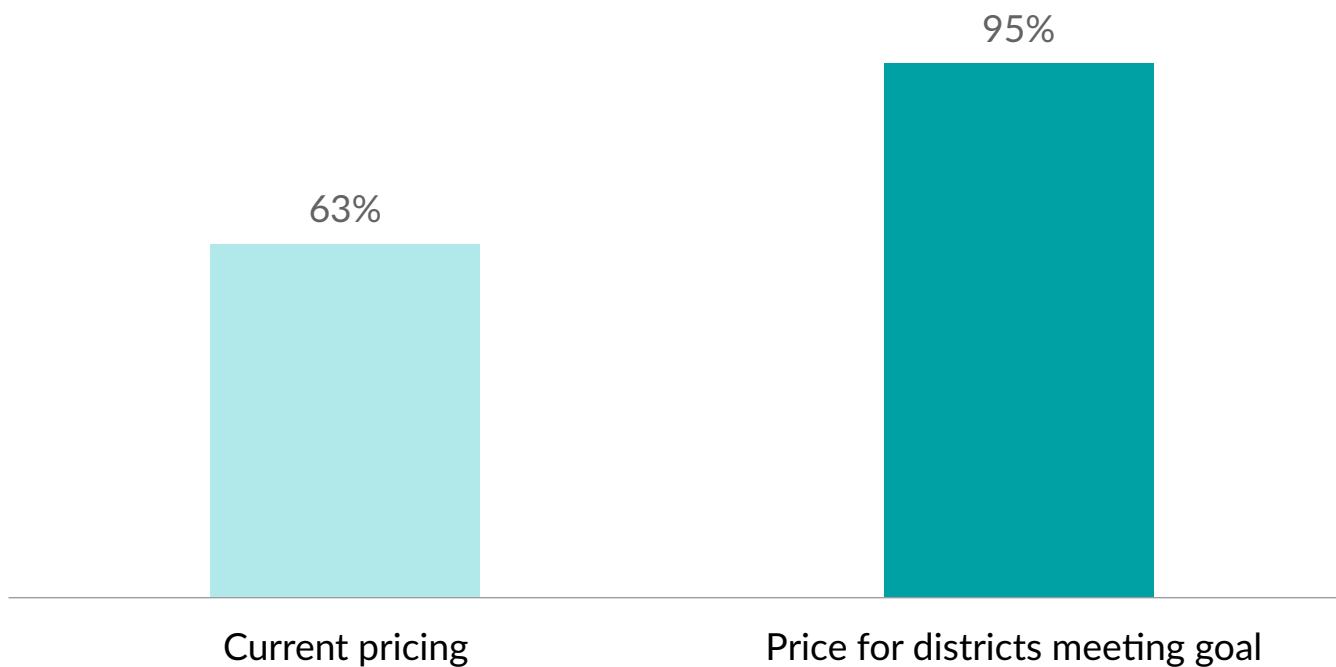Aggregate Internet access cost per Mbps for districts not meeting and meeting the 2014 goal

$15

~2x difference

$7

Not Meeting 2014 Goal
(n=100)

Meeting 2014 Goal
(n=220)

Education SUPERHIGHWAY
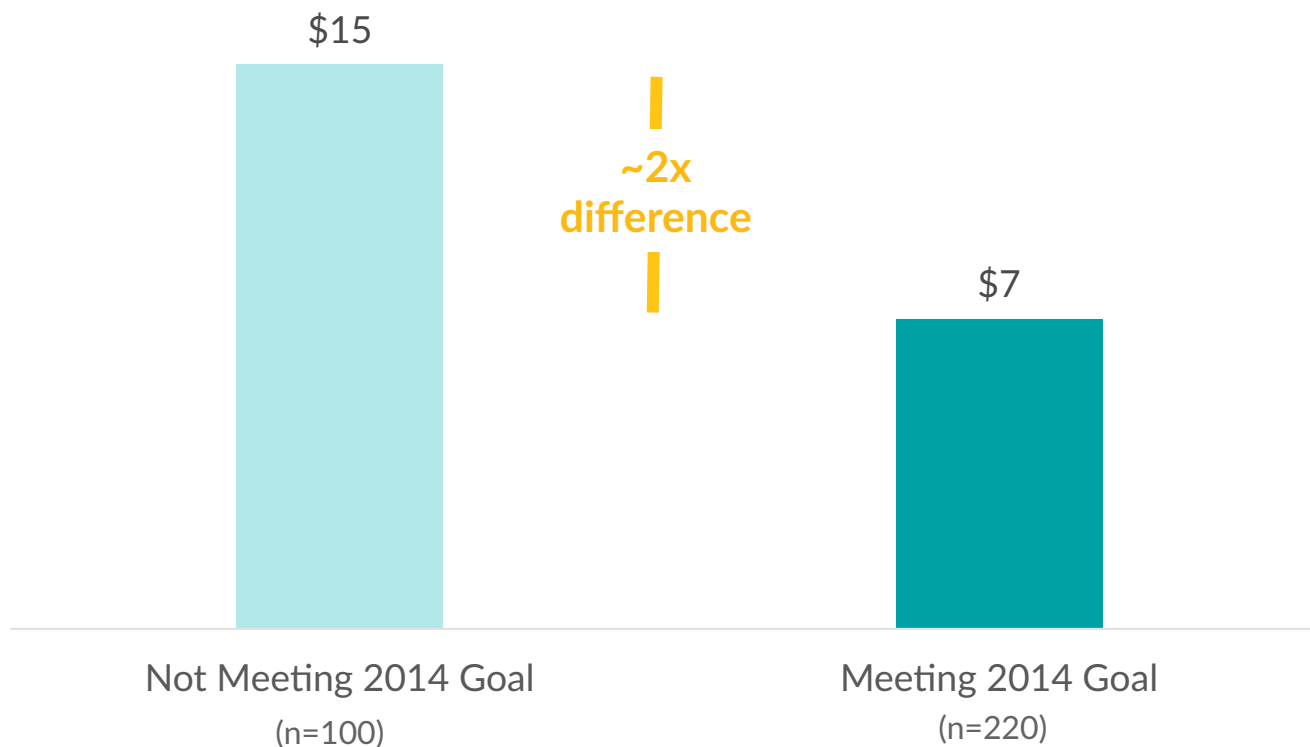
With more affordable pricing, 95% of students could meet goals

Affordability
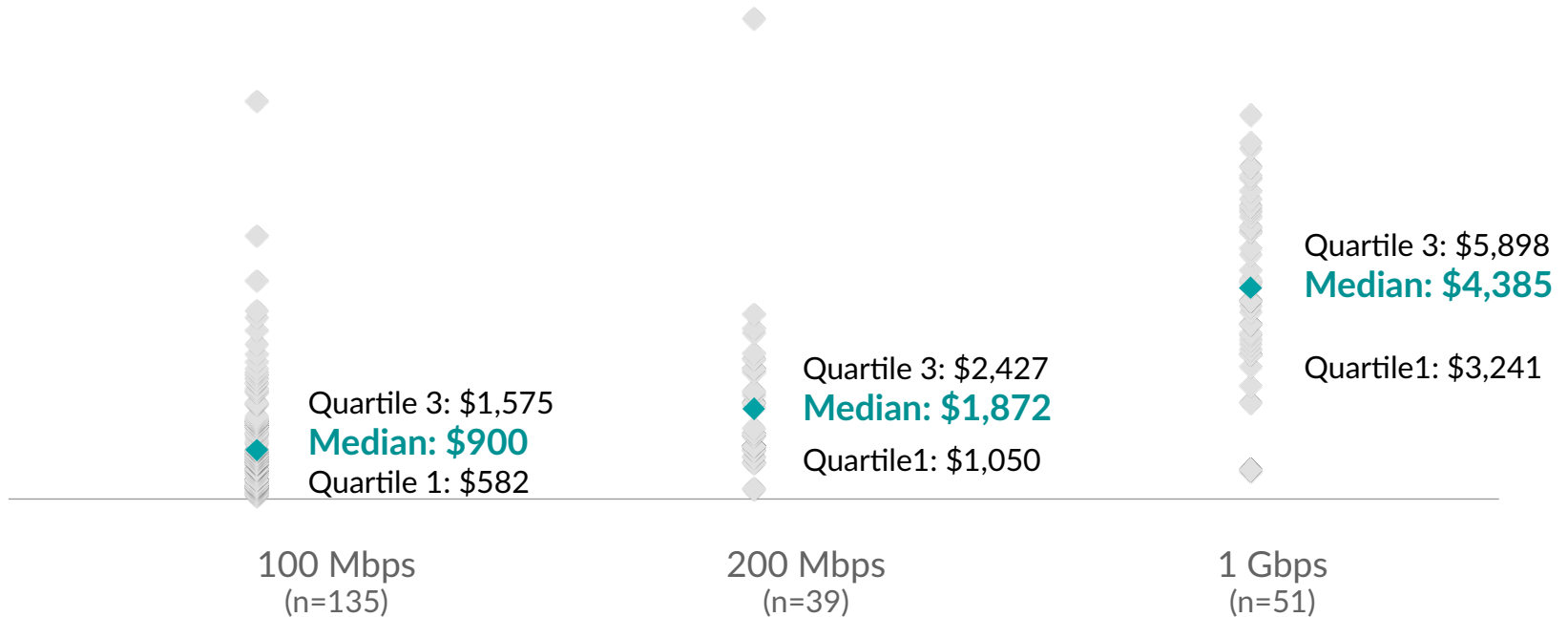
Percent of students meeting 100 kbps per student goal

95%

63%

Current pricing

Price for districts meeting goal

Sources: 2015 FCC Form 471 E-rate applications, data clarification calls to various districts

Education SUPERHIGHWAY

Districts pay a wide range for identical services

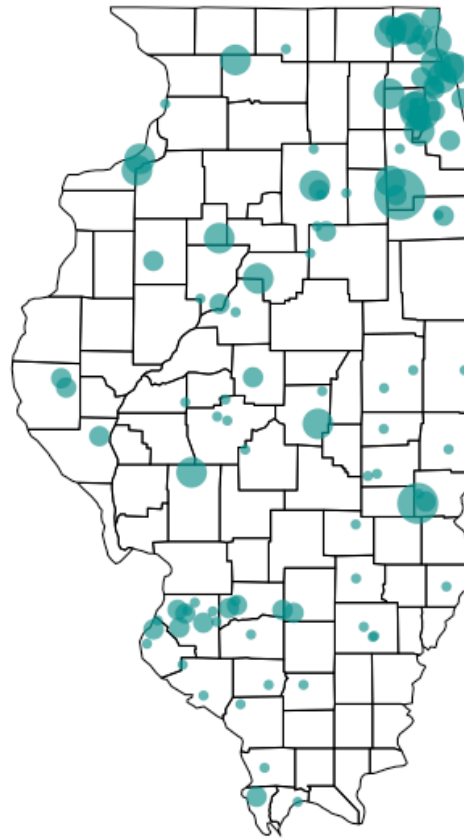Monthly cost per circuit for lit fiber
at 100 Mbps, 200 Mbps and 1 Gbps

Affordability

Quartile 3: $5,898
Median: $4,385

Quartile1: $3,241

Quartile 3: $2,427
Median: $1,872
Quartile1: $1,050

Quartile 3: $1,575
Median: $900
Quartile 1: $582

100 Mbps
(n=135)

200 Mbps
(n=39)

1 Gbps
(n=51)

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These trends can be explored on a regional level

Monthly cost per circuit for lit fiber
Internet circuits at 100 Mbps

- less than $1000
- $1000 – less than $2000
- $2000 – less than $4000
- $4000 – less than $8000
- more than $8000

Sources: 2015 FCC Form 471 E-rate applications, data clarification calls to various districts

Education
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IL districts pay nearly 1.5x target price for WAN

Monthly WAN cost per 1 Gbps lit fiber circuit

$848 — 25th Percentile

$1,178 — Median

$1,876 — 75th Percentile

Target: $750

n (line items) = 75

Sources: 2015 FCC Form 471 E-rate applications, data clarification calls to various districts

Education SUPERHIGHWAY
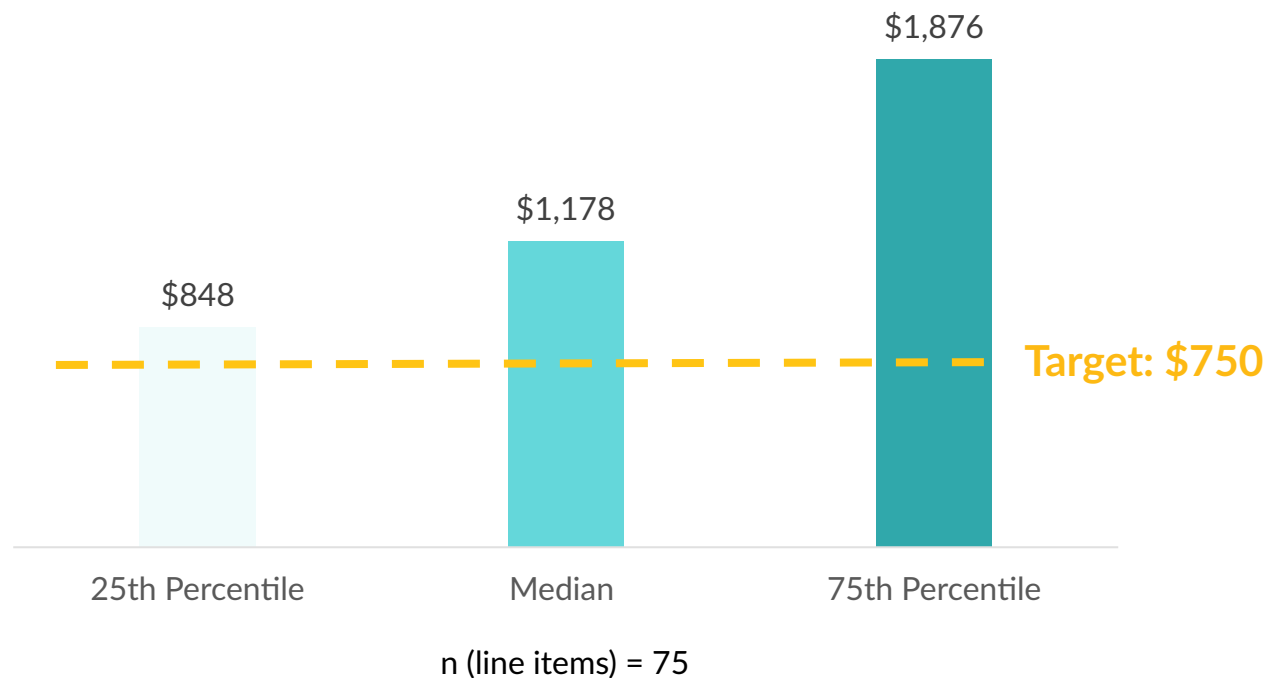
WAN circuit costs are higher than nearby states

$

Affordability

Median WAN cost for 1 Gbps lit fiber circuits
in IL and nearby states

OH	MN	IA	WI	KY	MO	IL	IN	MI	AR
$551	$750	$769	$950	$1,059	$1,104	$1,178	$1,229	$1,257	$1,500

Education SUPERHIGHWAY
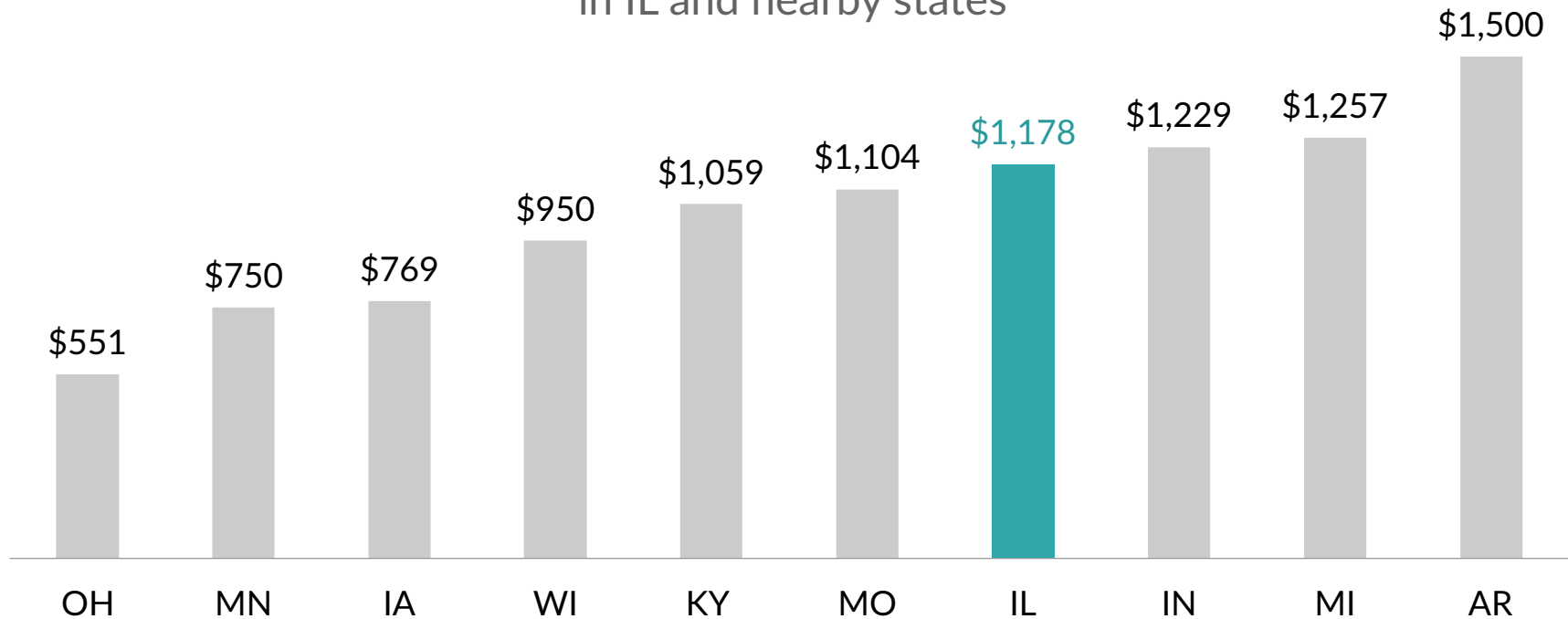
Data transparency helps to uncover and further explore these differences

Open data can inform and empower buyers. Districts do not always know if they are getting the best deal or what their neighbors are receiving

Transparency can help to **explore** regional dynamics and engage service providers

Komarek SD 94
- 100 Mbps lit fiber
- $1,500 per month
- Comcast

Salt Creek SD 48
- 100 Mbps lit fiber
- $3,212 per month
- Comcast

Sources: 2015 FCC Form 471 E-rate applications, data clarification calls to various districts

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In Virginia, 5x bandwidth for marginal increase in cost

VA piloted a program with 15 districts to leverage data transparency

By openly sharing bandwidth and cost data, 5/15 districts worked with providers to negotiate more bandwidth for little to no extra cost.

Total Mbps of Internet access

3,200

5x more bandwidth

650

Before (February 2015)   After (May 2015)
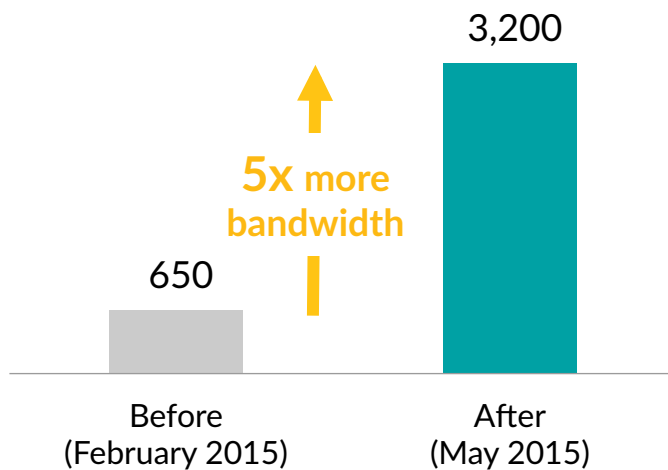
Total monthly cost of Internet access

15% more cost $18,070

$15,678

Before (February 2015)   After (May 2015)

Education SUPERHIGHWAY
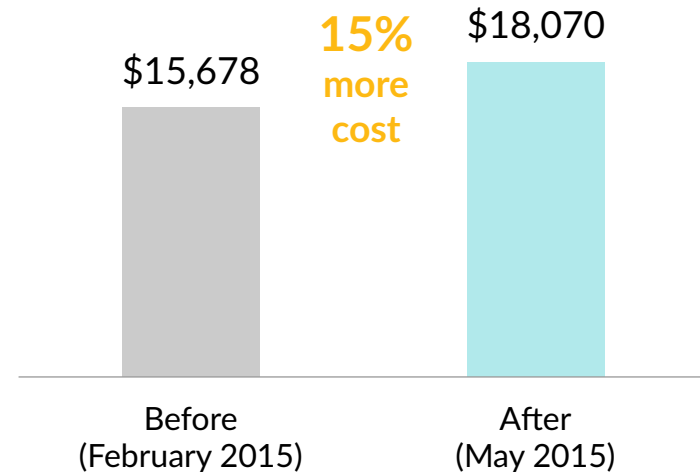
Wi-Fi

Are districts using E-rate funding to upgrade Wi-Fi and internal connections?

Wi-Fi

$101.8M in federal funding for wired and wireless internal network connections remains

Unlike Internet and WAN connections, Wi-Fi / LAN requires ongoing upgrades

WI-FI

INTERNET — SCHOOL DISTRICT OFFICE — SCHOOLS — CLASSROOMS — DEVICES

Education SUPERHIGHWAY
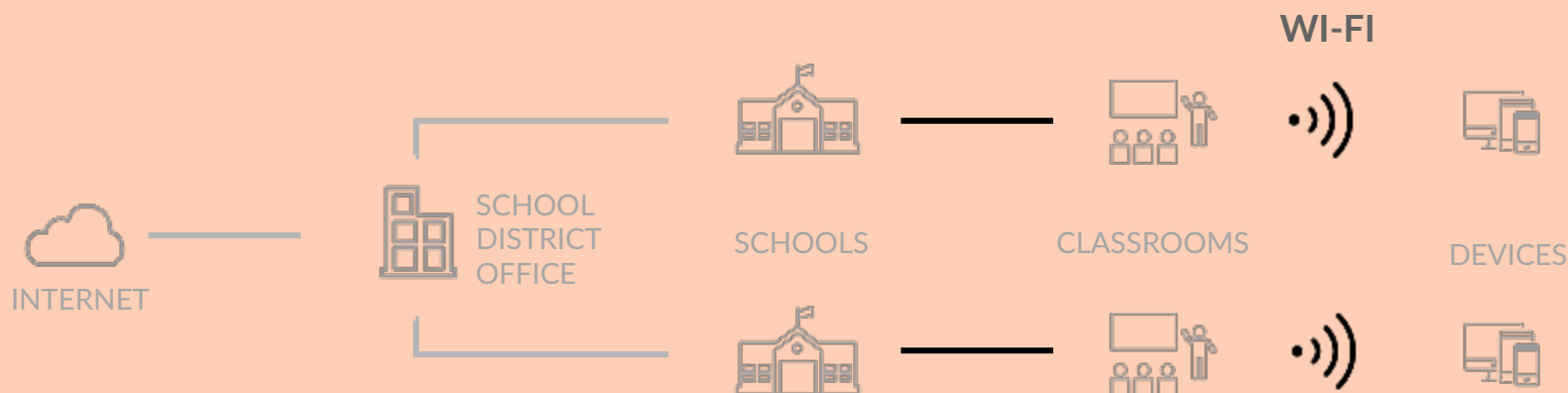
Over $100 M in Category 2 funding is available

Wi-Fi

Illinois by the numbers:

$101.8 million
of $186.2 million of the state's five year E-rate budget for wired and wireless networks in the building is still available

54%
of districts have received Category 2 funding

5%
of districts have utilized their full $150/student budget

- There are many districts in need of procurement and technical support

- ICN initiated a statewide Category 2 RFP to support districts for 2017

- There is an opportunity to learn more about how to meet these needs

Sources: 2015 FCC Form 471 E-rate applications

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Conclusion

Illinois Century Network may play a key role in upgrades
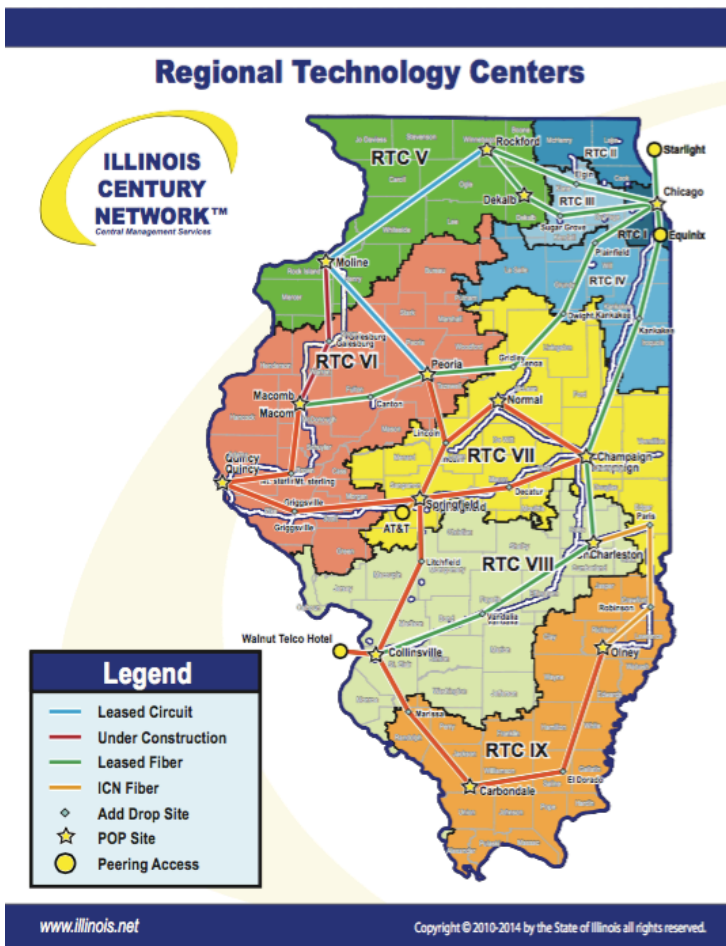
Statewide fiber backbone
ICN serves over 6,000 community anchor institutions over a high-speed fiber backbone with 15 Points of Presence and across the state over 2,000 miles across the state

Technology support
9 Regional Technology Centers provide technical support and service to schools within its customer base

Partnerships
ICN collaborates with various partners to serve K-12, including ISBE, Learning Technology Centers and regional fiber networks through federal BTOP grants

Source: http://www.illinois.gov/icn/

Partners are well positioned to coordinate efforts

Illinois can close the K-12 connectivity gap statewide

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  - **24%** of districts not meeting goals **need upgrades** to scalable technology. Over half of those connections are on copper

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  - Districts can now leverage **data transparency** to get more bandwidth for their budget, and partners across the state can coordinate support to empower districts to take action

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  - The state can support Wi-Fi procurement to make upgrades more affordable

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Cross-agency working group will drive action

Team Member	Organization
Jamey Baiter, Principal Consultant	Illinois State Board of Education
Essam El-Beik, Consultant	Illinois Century Network
Mindy Fiscus, Director	Learning Technology Center 6
Tim McIlvain, Director	Learning Technology Center 4
Beth Purvis, Secretary of Education	Governor's Office
Mary Reynolds, Director	Illinois State Board of Education
Sara Shaw, K-12 Project Manager	Office of the Secretary of Education
Lori Sorenson, Chief Operating Officer	Central Management Services
Robin Woodsome, Director	Illinois Century Network

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From Assessment to Action:

A Framework for Leveraging the Connectivity Report

From Assessment to Action: Close the Fiber Gap

FIBER	EDUCATIONSUPERHIGHWAY OFFERINGS
1 Identify all schools in the state without fiber using existing information or data collection efforts	**Fiber Program** dedicated 4-person consulting teams help connect schools through technical and procurement support
2 Assess available funding for state match	
3 Reach out to school districts to verify their data and help them understand the need for fiber	
4 Develop and present options for districts to upgrade to fiber	**Fiber Toolkit** online tool that provides guidance to districts on upgrading their network, funding, purchasing, and implementation
5 Support procurement of fiber	
6 Monitor implementation of the new fiber solution	

Education SUPERHIGHWAY

From Assessment to Action: Ensure Wi-Fi in Classrooms

WI-FI		EDUCATIONSUPERHIGHWAY OFFERINGS
1	Identify and define what districts need related to internal connections	**Surveys** tools to collect data on Category 2 needs from a tech lead and teacher perspective
2	Assess available resources and capabilities at the state and district level	
3	Decide the optimal level of state support (aggregate or support districts), and develop a plan to execute	**School Wi-Fi Buyer's Guide** vendor-neutral Wi-Fi guide that helps school districts maximize their E-rate budgets
4	Support procurement of Wi-Fi and LAN equipment for each school	**Wi-Fi Training and Support** webinars to help technology directors with procurement decisions
5	Provide ongoing support	

Education SUPERHIGHWAY

From Assessment to Action: Improve Affordability

AFFORDABILITY	EDUCATIONSUPERHIGHWAY OFFERINGS
1 Identify school districts that are on scalable infrastructure and need to increase their bandwidth to meet goals	**Compare & Connect K-12** data transparency tool to help districts get more bandwidth
2 Build awareness around the need for more bandwidth	
3 Help districts to decide their best course of action by arming them with tools and pricing data	**Convenings** meetings to share data and support district action for upgrades
4 Support procurement to ensure districts are getting more bandwidth for their budgets	

Education SUPERHIGHWAY

Methods

Sampling methodology

UNIT OF ANALYSIS

All analyses were conducted using line item or district-level records as the primary unit. Only those districts whose line item records were verified through EducationSuperHighway's data management processes were determined to be fit for analysis.

- Each line item in the data sample represents one distinct service reported in a district's Form 471. School districts often submit multiple funding requests and each funding request may contain multiple line items. A single line item may also contain multiple circuits.
- Since cost and bandwidth data is at the line item level, and a large portion of our analysis involves understanding the relationships between thee variables and district connectivity, many analyses in this report required the aggregation of services to the school district level.

ESH CONVENIENCE SAMPLE OF DISTRICTS

Districts were considered fit for analysis if:
1) all of its line items were determined to be fit for analysis;
2) the district itself was cleared of data quality indicators; and
3) the district was considered to be a "regular school district" by NCES.

EducationSuperHighway chose not to analyze data relating to public charter schools, private schools, libraries, non-instructional facilities, and schools administered by the Bureau of Indian Education (BIE). The procurement patterns, as well as market dynamics, that impact broadband purchases for these entities may not be similar to those that affect traditional public school districts. These areas represent opportunities for future research.

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Goals calculations

PERCENT OF DISTRICTS / STUDENTS MEETING THE 2014 FCC INTERNET ACCESS GOAL (100 KBPS / STUDENT)

Each district's total bandwidth was compared to the 2014 FCC target of 100 kbps per student. Districts were classified as either "Meeting 2014 FCC goal" (greater than or equal to 100 kbps per student) or "Not meeting 2014 FCC goal" (less than 100 kbps per student).

Methods

Education
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Fiber calculations

PERCENT OF SCHOOLS ON SCALABLE CONNECTIONS

For each district, the total number of campuses (accounting for the sharing of services among schools) was compared to the number of scalable circuits received by schools in that district. Circuits received by Non-instructional facilities or charter schools were not included. Percent of schools on scalable connections is calculated by dividing the number of scalable circuits/campuses by the total number of campuses.

Assumptions:
- All circuits go directly to campuses, unless they have been identified as backbone or middle mile
- Medium, large and mega districts without reported WAN have dark fiber WAN
- Tiny and small districts with more campuses than circuits received have potentially non-scalable circuits

Scalable technologies are defined as:
- Scalable: lit fiber, dark fiber, OCN, Ethernet >100 Mbps for WAN and >150 Mbps for Internet, broadband over power lines, standalone internet access, etc.
- Potentially scalable: fixed wireless, cable
- Non-scalable: Copper (T1/T3), DSL

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Affordability calculations

INTERNET ACCESS COST PER MBPS

Unless otherwise indicated, cost per Mbps was calculated as a weighted average, agnostic of connection speed and connection type.

CIRCUIT PLANNING

Unless otherwise indicated, circuit pricing is calculated at the line item level, agnostic of connection speed and connect type.
- Internet access circuit pricing includes all bundled Internet line items received by districts.
- WAN circuit pricing includes all WAN line items received by districts.

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Category 2 (C2) calculations

|	
STATE CATEGORY 2 FUNDING STILL AVAILABLE	The theoretical maximum amount of funding was calculated by multiplying the number of students in the sample by $150, the 5-year Category 2 cap. The cost of all Category 2 services applied for during the present funding cycle was later subtracted and the remainder multiplied by the statewide average discount rate (across all applicants) to determine the remaining available funding.
PERCENT OF DISTRICTS IN A STATE THAT STILL HAVE THE OPPORTUNITY TO USE THEIR $150/ STUDENT BUDGET	The number of districts that are listed to receive funding for any Category 2 services within the funding year, divided by the total number of districts in the state.
PERCENT OF DISTRICTS IN A STATE THAT HAVE RECEIVED C2 FUNDING	The percent of districts in a state that are listed to receive funding for any Category 2 services within the funding year which accumulate to be equal to or greater than $150 per student. Note that the C2 total costs included in this calculation are only for those going to district recipients.

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Appendix

District population vs. sample comparison

- All school districts
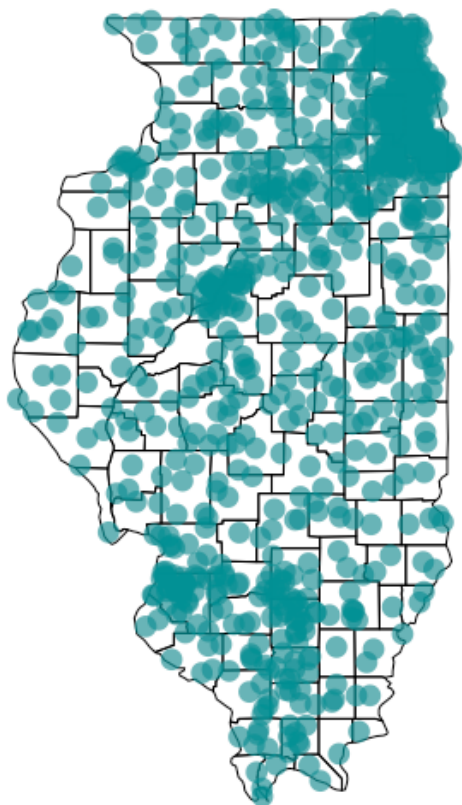
- School districts in ESH sample
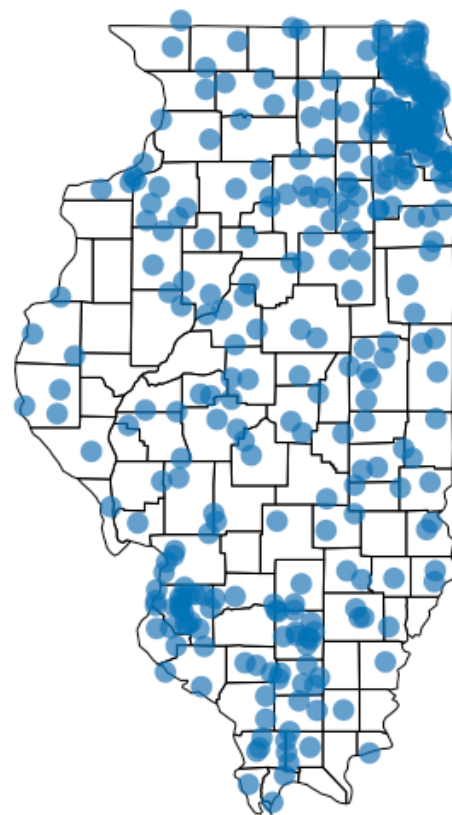
About Us

EducationSuperHighway

EducationSuperHighway is the leading non-profit focused on upgrading the Internet access in every public school classroom in America. We believe that digital learning has the potential to provide all students with equal access to educational opportunity and that every school requires high-speed broadband to make that opportunity a reality.

EducationSuperHighway's data-driven programs accelerate upgrades in America's schools. We help school districts and state leaders develop strategies to upgrade their K-12 networks, get fiber to schools that need it, provide guidance for effective Wi-Fi purchases, and make broadband more affordable. Our work served as a catalyst for the modernization of the Federal Communications Commission's $3.9 billion E-rate program, earning our CEO the 2015 Visionary of the Year award from the San Francisco Chronicle. To learn more about our programs and services for governors, state partners, and school districts, visit our website at www.educationsuperhighway.org.