

**E-RATE 2.0: CONNECTING EVERY CHILD TO THE  
TRANSFORMATIVE POWER OF TECHNOLOGY**

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**HEARING**

BEFORE THE

COMMITTEE ON COMMERCE,  
SCIENCE, AND TRANSPORTATION  
UNITED STATES SENATE

ONE HUNDRED THIRTEENTH CONGRESS

FIRST SESSION

—————  
JULY 17, 2013  
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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED THIRTEENTH CONGRESS

FIRST SESSION

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OF TECHNOLOGY**

WEDNESDAY, JULY 17, 2013

U.S. SENATE,  
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,  
*Washington, DC.*

The Committee met, pursuant to notice, at 2:50 p.m., in room SR-253, Russell Senate Office Building, Hon. John D. Rockefeller IV, Chairman of the Committee, presiding.

**OPENING STATEMENT OF HON. JOHN D. ROCKEFELLER IV,  
U.S. SENATOR FROM WEST VIRGINIA**

The CHAIRMAN. My apologies. The Senate works in mysterious ways. I was perched, 5 minutes ago, dutifully on the Senate floor, ready to do the first of two votes, for which I was told there was an agreement. And then the agreement dissipated. So, now I'm told it's at 3 o'clock, which is very shortly. So, let's just hope that they meant 5. And I do apologize to you, because you're all heroic.

In—and where's our—where are all our people? Where are our people? This is a big-deal hearing.

Senator PRYOR. I think they had the same idea you did, Mr. Chairman, go over, vote, and come back.

The CHAIRMAN. I didn't see a soul over there.

[Laughter.]

The CHAIRMAN. OK. Anyway, I apologize, particularly to the panelists, and to everyone.

In 1996, I brought a 16-year-old high school girl from McDowell County, West Virginia. She was a high school sophomore, Jessica Lambert. And I brought her up here to testify before the Commerce Committee about her success with something called “distance learning.” Now, this is 1996. John Thune was 12.

[Laughter.]

Senator THUNE. A little older.

The CHAIRMAN. A little older, OK.

And an amazing thing happened. Nobody really understood what “distance learning” meant, but she told us, because, from one of the poorest counties in the United States of America, she came up and spoke to us, and spoke to us, in part, in Japanese. Why? Because she had gone online, with University of Nebraska, to take a course. And she's kept on with that, has moved on through Chinese and goodness knows what else, and she's sort of the Shakespeare of Asian languages. That was stunning to me. That was stunning to

me. At the time, linking up classrooms via technology was an extraordinary idea or event, activity—not just the coalfields of southern West Virginia, but all across the country.

In 1996, this Committee saw the power that technology has to transform a person's life. Making sure that every child in America has that opportunity is a giant cliché underwritten by an even greater and more giant truth. And that is, we owe that—we owe making sure that every child in America has the opportunity to fulfill their dreams even before they know they have dreams. And if they've picked out a field, which is unlikely, this'll help them do it. And we glory in that.

And all of this was really the reason I worked so hard with a wonderful Republican by the—well, I mean, there are many wonderful Republicans, but this one was Olympia Snowe and then-Congressman, now-Senator, Ed Markey, who is actually sitting way down there. He's hard to see.

[Laughter.]

The CHAIRMAN. He has been in the House for 37 years, but this is his second day in the Senate, so he's sitting way down there.

And we got something called—on a very bipartisan basis—the E-Rate Program. The impact of the E-Rate's Program on our schools has been nothing short of revolutionary. Since its creation 17 years ago, E-Rate has provided more than \$30 billion to connect the overwhelming majority of schools to the Internet. Now, it doesn't give you a computer, it doesn't give you a trained teacher, it doesn't give you software, but it gives you the connectivity.

For example, in 1996, when the Telecommunications Act was signed into law, only 14 percent of all classrooms in this country were connected. And therefore—to the Internet—classrooms. Among the poor schools, only 5 percent of classrooms were connected. The most recent statistics for classroom connection are amazing. Over 92 percent of all classrooms are connected, and 95 percent of the poorest classrooms—previously 5 percent—95 percent are now connected.

As impressive as these statistics are, they're only part of a marvelous story. What's even more notable is the story of what schools have been able to do with this connectivity. Through their Internet connections, schools in the U.S. have been able to conduct virtual field trips to international places, at their will. And if people have home computers and connection, they can do it all day—to the Great Barrier Reef in Australia, where I've never been and have no immediate plans to go. And at least one school has taken a virtual field trip into outer space, when they visited the International Space Station.

I believe E-Rate has done more than just connect our schools; it has spurred a broadband revolution—insufficient, but, nevertheless, a broadband revolution—that has been a catalyst for widespread adoption of broadband technology.

E-Rate is also connecting our nation's libraries. Why libraries? Because we knew that, if we connected the schools, that would take care of a younger population, but what about adults? We count, too. And the best place to do that is from something called a library, which most small communities and large communities, obviously, have. And they remain the center of our communities, and hubs of

lifelong learning; now even more so. Our libraries remain on the forefront of public institutions that are adopting new technologies to meet the virtual demands of our communities.

Long lines. You go down to McDowell County, in a little, tiny library, and you will see long lines. Libraries with connectivity give children and adults an opportunity to access computers and the Internet so that they are not at a disadvantage when they're doing their homework and their research. For those seeking work, at the library they can access job postings, many of which are posted only online. And those in need of government services can use their community library to complete applications online.

All of this is possible because of the critical funding that the E-Rate provides to libraries. E-Rate is transformational. It's not all good—the Internet, that is—because it has brought us cybersecurity. So, in the mid-1990s, we took off. Let's just hope that we can do this cybersecurity thing, which the Ranking Member and I are determined to do.

But, we cannot sit back and simply enjoy this extraordinary success. Just as technology continues to evolve, so must the E-Rate Program. Several months ago, I called on the FCC to begin a process for creating E-Rate 2. I want to commend the FCC for moving quickly on this. A program designed nearly 17 years ago needs to reflect the connectivity and technology needs of our schools and libraries today and, indeed, into the future. And the bipartisan LEAD Commission, whose guide force, Jim Coulter, is in my eyes right now—he's one of the panelists—is here today, has made it clear that, without significant investment in high-capacity Internet connectivity, the wireless networks in schools will fail our children.

I know that we will hear from some who say that we cannot afford to do this. Skeptics will ask, Where will the money come from? It's a fair question. What should we be asking is, I think, Can we afford not to do this?

Cost comes from two directions. Can we afford to let our kids fall further and further behind their global peers in math and science? It's embarrassing now, and will get worse. Can we afford to deny our teachers the tools they need to educate the next generation? That's a complicated business, of teaching all of this. Can we afford not to give every child the abilities to succeed in a global economy? That's often used as a throwaway line, but think about it. We are a global community. Our global economy demands an increasingly educated workforce with higher skills and strong backgrounds in science and math and technology and engineering. Technology continues to offer new tools for raising the quality of education for all students, if we will give it a chance.

For so many of our schools, an Internet connection gives them access to an unparalleled amount of information they could otherwise not afford to have, and did not have. Technology has been the great equalizer in our society—the sociological statement—and every child deserves to be connected to the promise that this technology holds, no matter of income, location in our country, topography, or anything else.

With the right investment in high-capacity, high-speed Internet connections, we can expand E-Rate so that it will be available to provide future generations of children the opportunity to compete

in an increasingly interconnected and data-driven world. There's no doubt in my mind that E-Rate is the program that is giving more students a brighter future, and one that we absolutely know that is the future is within their reach.

I am very passionate about this. And I'm very proud to have, as my Ranking Member, Senator John Thune.

**STATEMENT OF HON. JOHN THUNE,  
U.S. SENATOR FROM SOUTH DAKOTA**

Senator THUNE. Thank you, Mr. Chairman. And thank you for holding this hearing.

And I want to thank our witnesses, our panelists who are here today, for being with us and sharing your perspectives and insights with us.

And, Chairman Rockefeller, I want to start by complimenting you in your success, nearly 20 years, to include language in the 1996 Act that laid the groundwork for E-Rate. While we might disagree on some of the particulars on how to modernize the program today, your commitment and determination, then and now, to deliver the promise of technology to our nation's schools and libraries is a very laudable one, and you deserve a lot of credit for your great work and vision, way back at that time.

The goal of the E-Rate Program is to connect America's classrooms. And, by and large today, they are connected. E-Rate has played a role in this development, and I agree with champions of the program, like our new colleague, Senator Markey, who note that the original goals of E-Rate have largely been met.

I also agree that the program needs to be reformed. E-Rate is nearly two decades old, and, like many of our communications laws, it could better reflect today's digital reality. Like you, I am pleased that the FCC plans to move forward on Friday with a rule-making to begin the modernization of E-Rate. Online activity in schools will no doubt continue to increase, as it will throughout our society. But, I hope E-Rate will avoid prioritizing reaching debatable speed goals for some schools at the expense of necessary connectivity in others. As we consider ultrafast broadband in American classrooms, we must not lose sight of those schools and students that still need more basic communication services.

The President's ConnectED initiative includes the goal of connecting 99 percent of America's primary and secondary students with high-speed broadband and wireless within 5 years. We should keep in mind, however, that the unreached 1 percent in this case amounts to over half a million students. And that assumes the goal is met. So, the real number could be much higher.

As a Senator from a very rural state with just 147,000 school-children, the parents, teachers, and students that I represent would like to know where they stand as a priority for this Federal program, moving ahead.

The fact is, schools in remote areas are simply more expensive to reach with service than their counterparts in more populated areas, which are typically located much closer to network infrastructure. This has always been the underlying issue at hand with universal service, and I look forward to seeing how the FCC addresses this reality through E-Rate reform.

I also want to draw particular attention to FCC Commissioner Pai's speech, delivered yesterday, in which he outlined several reform ideas for the Commission to consider. I am intrigued by many of Commissioner Pai's proposals, such as providing more simplicity, transparency, and accountability for the E-Rate Program and its beneficiaries. I am also pleased by his focus on local decision-making and flexibility, allowing schools to meet their own needs, which may not always be what Washington assumes.

Finally, I want to applaud his suggestion that reform be achieved within the current resources available to the Universal Service Fund. The President, in rolling out his ConnectED initiative, also directed the Federal Government to make better use of existing funds to get Internet connectivity and educational technology into classrooms. I agree with Commissioner Pai and the President, because it is very important for all government programs to stay within their means in this difficult fiscal and economic environment.

Again, Mr. Chairman, thank you for holding today's hearing. I look forward to working with you to continue our committee's oversight of the FCC and its E-Rate rulemaking.

And I—as we have votes later today, I also have an Ag Committee oversight hearing with the CFTC, and it is an issue that is important in my state, so I will probably be trying to bounce back and forth.

But, I appreciate us having the hearing and, again, the panelists who are with us today, and I look forward to what you have to say. Thank you.

The CHAIRMAN. Thank you, Senator Thune.

Let's go directly to Dr. Sheryl Abshire. And she's the Chief Technology Officer—and I have to pause here to get this right—at the Calcasieu Parish School System, which is the fifth-largest system in the State of Louisiana. And she's a real expert on this. And I—we all look forward to your testimony.

**STATEMENT OF SHERYL R. ABSHIRE, CHIEF TECHNOLOGY OFFICER, CALCASIEU PARISH SCHOOL SYSTEM**

Dr. ABSHIRE. Thank you so much, Mr. Chairman and members of the Committee.

It's my great privilege to testify before this committee once again about the importance of the E-Rate Program, not only to my school district, but to my state and the entire Nation. I want to personally thank the Chairman for having the foresight to found this now 15-year-old program and the wisdom to advocate for needed changes.

My name is Sheryl Abshire, and I've been the Chief Technology Officer for the Calcasieu Parish Schools in Lake Charles, Louisiana, for the past 15 years, and a public educator in that system for over 40 years. Currently, I work with the Consortium for School Networking and the International Society for Technology and Education, as a member of those organizations. I've just completed a 4-year term as the K–12 representative on the Schools and Libraries Committee of USAC.

This hearing today comes at a pivotal point for the program. The E-Rate has achieved its interim goals of providing at least basic connections to the Internet for all of our nation's schools and librar-

ies, regardless of where they're located and the socioeconomic status of the communities that they serve. E-Rate supported networks that have facilitated educational attainment, personalized in virtual learning courses, and online professional development for millions of students and teachers. However, unless significant steps are taken to bolster the E-Rate, and they're not taken promptly, I fear that the sun will set on this incredibly successful program.

Today, I join with the voices of Chairman Rockefeller and FCC Commissioner Jessica Rosenworcel in declaring a need for E-Rate 2.0. Any serious effort to change the program will start, I believe, with increasing the E-Rate's annual support for the long term. For years, my colleagues and I have shouted from the rooftops that E-Rate was in danger of evaporating because of the escalating need for its support, with no significant funding increase to match. Now, we stand on the threshold of internal connection support becoming extinct and telephone and Internet access support facing cutbacks. We cannot let this happen.

My district is the fifth largest district in Louisiana, and we have nearly 5,000 employees and more than 33,000 students, covering more than 75 buildings. Six months after I testified before this committee in 2005, my parish, our public school system, and all of our schools were wiped out by Hurricane Rita. But, thanks to 14 dollars—\$14 million in E-Rate support, we were able to rebuild our network and expand it to meet the district's growing need for bandwidth. Today, our district's wired network infrastructure supports 35,000 network devices over a wide-area network. Our wireless infrastructure supports a network of 3,000 wireless access points; and, on any given day, peak usage of our network's infrastructure reaches 95 percent of its capacity, with over 9,000 users accessing the network at any single time. Even more, in excess of 250,000 e-mails are exchanged on our network each day.

And all of this has made a huge difference to our students. Between 1999 and 2011, proficiency levels on state exams for Louisiana students with special needs, low-income students, and African-American students have grown between 26 and 31 percent—percentage points. E-Rate truly has helped some of our most impoverished schools.

Example: At Nelson Elementary School, an urban Title I school with in excess of 50 percent of their students on free and reduced lunch, and 17 percent of their students having English as a second language, every classroom is equipped with at least 10 iPads, a Promethean Board, and a variety of cutting-edge technology school—tools. Parents check grades online, they view student assignments, and students work online 24/7 via our Online Learning Portal. Between 2008 and 2012, Nelson's average state school performance score increased by 16 percent. Nelson is now designated as a school of recognized academic achievement.

However, our work is not complete. Calcasieu needs more bandwidth to support forthcoming online assessments to ensure reliable connectivity for our video security systems and our door-entry systems that we are beginning to install in the wake of the Newtown crisis. We need to make sure our students and our teachers gain access to the very best educational online content, services, and tool available.

Unfortunately, our and the Nation's need for more E-Rate support is colliding with the reality of E-Rate's inadequate funding today. The program's \$2.25 billion cap was set, back in 1998, well before tablets and smartphones existed. It is simply insufficient to meet school and library demands, some 15 years later. Indeed, this year's estimate of program demand, about \$5 billion, is more than double the available funds. And alarming is the fact that the growth in Priority 1 services demand, a 10-percent increase in this year alone, is truly leading to de facto elimination of Priority 2. And if the trend of increasing demand for priority one holds true next year, even priority-one applicants may have to receive reduced discounts.

I submit to you, this afternoon, that we cannot allow E-Rate to slowly expire. I strongly agree with Chairman Rockefeller and FCC Commissioner Jessica Rosenworcel and the President that we need a plan to put E-Rate back on track—an E-Rate 2.0, if you will. For me, that plan starts with more funding. In my opinion, we need a permanent increase in E-Rate's annual cap that, at a minimum, meets current demand. Additionally, I believe the FCC should consider establishing a rather lookback period—a formal lookback period, regularly—every 5 years, perhaps, to assess whether the program's funding levels adequately meet demand.

Additionally, I agree with Commissioner Rosenworcel that bandwidth targets are an important part of E-Rate 2.0. When the program began in 1998, we only measured the fact that classroom and library connections were there, and we were thrilled when virtually all schools and libraries achieved some kind of Internet connection. However, a low bandwidth connection 15 years ago does not meet the immense bandwidth needs entailed by this explosion of online content, assessments tools, services, and communications in our classrooms.

I believe we need to set well recent achievable goals for classrooms and device connectivity that reflect the needs of modern education. I think it's vital these goals be based on demand and data, and that they take into account the different needs and demands of rural, urban, and suburban schools and libraries. Like E-Rate's funding level, I support these periodic reappraisals and adjustments of these bandwidth goals.

I want to thank the Chairman for holding this hearing on this very important subject, and I look forward to supporting his and the FCC's efforts to protect and preserve the E-Rate Program. And I will entertain questions, if it's appropriate, later.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Abshire follows:]

PREPARED STATEMENT OF SHERYL ABSHIRE, CHIEF TECHNOLOGY OFFICER AND DISTRICT ADMINISTRATIVE COORDINATOR OF TECHNOLOGY, CALCASIEU PARISH PUBLIC SCHOOLS

Thank you, Mr. Chairman and members of the Committee. It is my great privilege to testify before this Committee once again about the importance of the E-Rate program to my school district, my state and the entire nation. For me, this is a particularly special honor as it affords me the opportunity to personally thank the Chairman for having the foresight to found this now 15-year-old program and the wisdom to advocate for changes that will modernize it and secure its long-term future.

My name is Sheryl Abshire and I have been the Chief Technology Officer (CTO) for Calcasieu Parish Public Schools in Lake Charles, Louisiana for the past 15 years. I have been an educator for more than 40 years, starting as a second grade teacher in 1973, working as a Librarian/Media Specialist during the 1980s, and serving as a Principal for two elementary schools during the 1990s. In 1998, I moved into my current role as my district's CTO, where I created and implemented my district's technology program and coordinate its annual E-Rate applications process.

This hearing today comes at a pivotal moment for the program. E-Rate has achieved its interim goals of providing at least basic connections to the Internet for all of our Nation's schools and libraries, regardless of where they are located and the socioeconomic status of the communities that they serve. E-Rate supported networks have facilitated educational achievement, personalized and virtual learning courses, and online professional development for millions of students and teachers. And E-Rate supported networks have allowed library patrons to gain access to employment opportunities and government services. However, unless significant steps to bolster the E-Rate are not taken promptly, I fear that the sun will set on this incredibly successful program.

I am here today to join my voice with the voices of Chairman Rockefeller and FCC Commissioner Jessica Rosenworcel in declaring the need for an E-Rate 2.0. In my view, any serious effort to change the program must start with increasing E-Rate's annual support for the long term. For years, my colleagues and I have shouted from the rooftops that E-Rate was in danger of evaporating because of escalating need for its support with no significant funding increase to match. Now, we stand on the threshold of internal connections support becoming extinct and telephone and Internet access support facing cutbacks. We cannot let this happen.

Just as important as more funding are new goals for the program. E-Rate needs to move beyond assessing whether a classroom or library has an Internet connection to determining whether that connection's speed meets the needs of users who seek to access and use the most up-to-date digital content, courses, resources, services and tools. Clear goals that do not meet that standard will not effectively chart E-Rate's into the future.

My recommendations on E-rate 2.0 arise from my long history with the program as well as in state and national education policy. Currently, I serve as a Board Member of the Consortium for School Networking, a non-profit organization that was instrumental in securing the E-Rate's passage. I have also participated in the refresh of the National Education Technology Standards as a member of the International Society for Technology in Education, a large ed tech non-profit that was also deeply involved with the launch of the E-Rate. Finally, I just completed a four-year term as one of the K-12 education association representatives on the Schools and Libraries Committee of the Universal Service Administrative Company (USAC), which administers E-Rate and the other Universal Service programs.

Please allow me to give you a little background on my district and its network, why technology infrastructure matters to our district, how we paid for this all, and where we need to go from here.

#### **Calcasieu and the Network**

Today, Calcasieu is the fifth largest district in Louisiana, where nearly 5,000 employees educate more than 33,000 students, working out of 59 schools and 17 district office sites. Our district's wired network infrastructure supports 35,000 network devices over a Wide Area Network (WAN) connection that delivers broadband Internet access at 100 mbps. Our network is supported by a fiber optic backbone to all sites that is interconnected by over 1200 network switches and 65 virtual servers and 53 physical servers. The services that Calcasieu's network provides include:

- Internet resources
- Network storage
- Wireless access
- Student information systems
- Virtual learning platforms
- Voice Over IP (VoIP)
- Environmental controls
- Online testing
- Video security systems
- Access control systems (door entry)
- E-mail

Aside from our wired connections, Calcasieu's robust wireless infrastructure supports a network of 3,000 wireless access points. As the number of mobile devices increases with the implementation of Bring Your Own Device and 1-to-1 initiatives, this wireless connectivity is becoming a resource that is required for student learning devices.

### **Why Technology Infrastructure Matters to Calcasieu**

*Why must Calcasieu have such a robust network?* The answer is simple: unbelievable demand for online educational resources and the need to communicate. Overall, on any given day, peak usage of our network's infrastructure reaches 90–95 percent of its capacity with over 9,000 users accessing the network at the same time.

*What do Calcasieu's users access?* For one thing, they use Calcasieu virtual learning system, which offers a rich learning environment conducive and supportive of today's students and educators. Beyond accessing content, today's students—and their teachers!—are also uber communicators and they make heavy use of the network for e-mail. At Calcasieu, all staff and students having access to e-mail accounts and a total number of 35,000 e-mail accounts exist on our network. Even more staggering, 250,000 e-mails are exchanged on Calcasieu's network each day.

*Where is the proof that this network matters educationally?* If testing is any measure, student test scores have improved dramatically with the advent of technology in Calcasieu and across the entire state. Between 1999, the year after the E-Rate began, and 2011, student subgroups that traditionally struggle on exams—students with special needs, low-income students and African-American students—saw their academic proficiency on state exams grow, respectively, by 31 percentage points, 26 percentage points and 26 percentage points. In Calcasieu, over the past five years, we have seen measurable progress in proficiency as well;

- English/Language Arts improved 6 percentage points—71 percent in 2009 to 77 percent in 2013;
- Math improved 4 percentage points—70 percent in 2009 to 74 percent in 2013;
- Science improved 4 percentage points—68 percent in 2009 to 72 percent in 2013;
- Social Studies improved 4 percentage points—71 percent in 2009 to 75 percent in 2013.

While all of these gains are not directly attributable to our network and the E-Rate, there is no question in my mind that technology and broadband access have played a significant role. Two examples from Calcasieu make this case well:

1. *Frasch Elementary in Sulphur*, a rural Title 1 school with over 50 percent of its students on the Federal Free and Reduced Price Lunch Program, immerses its students in a high-tech environment. Teachers and students have robust Internet access and unlimited access to technology tools, hardware, and software. Perhaps most importantly, Frasch staff make ample use of just in time/job embedded staff development in the strategic use of technology to improve student achievement. As a result of this strong technology implementation, the school has experienced huge gains in student achievement over the past six years, with its School Performance Score growing from 108.4 to 121.8 points. Indeed, Frasch has grown to be recognized as an "A" school in the Louisiana accountability system.
2. *Nelson Elementary School* is an urban Title 1 school with in excess of 50 percent of their students on free and reduced lunch. In addition to its high poverty challenges, 17 percent of Nelson's students have English as their second language. Like Frasch, Nelson has sought to improve its academics with a strong technology program. Thus, every classroom is equipped with at least 10 iPads, a Promethean Board and a variety of other cutting edge technology and interactive tools. The school also has five ACTIVtables, two Laptop Labs and one Successmaker Desktop Lab. Parents are able to check grades online and view student assignments and student work via its online learning portal. The school library has a rich resource of e-books available online. Also like Frasch, this high tech model has yielded significant results: its 2012 state School Performance Score of 118.4 represents a 16 percent increase since 2008; it received a state designation as a school of Recognized Academic Achievement and a High Gains Award; and it has now been designated as a Model Inclusion school.

### **How Calcasieu built the network**

Eight years ago, I testified before this Committee about how vital the E-Rate program had been in transforming Calcasieu from a technology backwater into a na-

tionally recognized digital district. At that time, Calcasieu had received \$4 million in E-Rate support to establish 100 mgps connections for the 11,000 desktop computers that we had then (about a third of what we have today). Back then, I indicated that the vast majority of these funds had been used to support plain old telephone service, cellular phone service, the installation and upgrade of a high-speed network to all of our 59 schools, and the bandwidth used by our compressed video services. Mobile wireless devices like tablet computers, which are proliferating in schools nationwide, did not exist then, nor did online assessments. I concluded my statement in 2005 by calling E-Rate “a blessing for my district” and stating: “Our students, teachers, library/media specialists and administrators have all benefited greatly from the distance learning courses, online professional development, and the wealth of Web-based material that the E-Rate has put at their fingertips. We continue to make significant progress academically in our schools, which, in no small measure, is helped by the E-Rate.” Given all that has happened in Calcasieu since then, truer words I have never spoken.

In 2005, six months after I testified here, Hurricane Rita ravaged Calcasieu Parish and its public schools and tore apart much of the infrastructure that Calcasieu had spent eight years building. E-Rate supported infrastructure played a significant role in helping the district react quickly to the disaster, allowing the district’s still operational internal networks and e-mail system to make payroll for its more than 4,000 employees just days after the hurricane and facilitating communication and online learning amongst students, parents and educators that Rita had scattered. However, the damage to the network we built was substantial.

Fortunately, the E-Rate was there to come to our rescue. Over the past seven and a half years, we relied on E-Rate support to rebuild our network and expand its reach. Using \$14 million in E-Rate support received since 2006, we upgraded our network to serve more than three times as many devices as we were serving before Hurricane Rita and established a robust wireless network to support the burgeoning number of mobile wireless devices in our schools today. Specifically, E-Rate helped us defray the network costs for over 1,200 network switches and over 3,000 wireless access points. It allowed us to upgrade our wired infrastructure to broadband levels. Additionally, E-Rate support proved critical as we converted the district’s telephone system to Voice Over IP (VOIP), which now includes over 1,300 VOIP phones and network storage for voice-mails associated with all telephone extensions. Without E-Rate, we might never have recovered from Rita and could not have expanded our network to serve the district’s learning and technology needs.

#### **Where Calcasieu and E-Rate go from here**

Even with E-Rate’s incredible support and the high quality network in Calcasieu that it helped build and maintain, my job—and E-Rate’s—in Calcasieu is far from completed. Calcasieu’s need for still more bandwidth far into the future is readily apparent. Right now, we are preparing for online academic assessments, requiring even greater levels of bandwidth, which will be arriving as soon as next year in Calcasieu and Louisiana. Moreover, in the wake of the tragedy at New Town in Connecticut, we are stepping up our technology security measures, installing video security systems and door entry systems, both of which require reliable network connectivity. Finally, our students and teachers are interacting with new and valuable online educational content, services and tools each day, all of which place still greater bandwidth demands on our network. Thus, our need for E-Rate goes on.

Unfortunately, Calcasieu’s need—as well as the Nation’s need—for more E-Rate support is colliding with the reality of E-Rate’s inadequate funding. The program’s \$2.25 billion annual cap was set back in 1998, well before tablets and smart phones existed, and is simply insufficient to meet school and library demand some 15 years later. Indeed, this year’s estimate of program demand—\$4.986 billion—is more than double available funds. Based on my experience, that demand is actually lower than actual need as many districts forego applying for Priority 2 services as they know they have almost no chance of receiving support. Even more alarming is the fact that the growth in Priority 1 services demand—a 10 percent increase this year alone—is leading to de facto elimination of Priority 2. Experts expect that the increased demand for Priority 1 services this year, \$260 million more than last year for a total of approximately \$2.7 billion, will likely lead to no available funding for Priority 2 internal connections services. And if the trend of increasing demand for Priority 1 holds true next year, even Priority 1 applicants may have to receive reduced discounts.

We cannot allow E-Rate to slowly expire. I agree with Chairman Rockefeller, FCC Commissioner Jessica Rosenworcel and the President that we need a plan to put E-Rate back on track—an E-Rate 2.0, if you will. For me, that plan starts with more funding. And when I recommend more funding, I am not talking about a one-time

surge that, when it ends, returns E-Rate to current funding levels. In my opinion, we need a permanent increase in the E-Rate's annual cap that, at a minimum, meets current demand. Additionally, I believe that the FCC should consider establishing a regular look-back period, perhaps every five years, to assess whether the program's funding levels adequately meet demand.

Aside from more funding, I agree with Commissioner Rosenworcel that bandwidth targets are an important piece of E-Rate 2.0. When the program began in 1998, we only measured the fact of classroom and library connections and were thrilled when virtually all schools and libraries achieved some sort of Internet connection. However, a low-bandwidth connection 15 years ago does not begin to meet the immense bandwidth needs entailed by the explosion of online content, assessments, tools, services and communications present in today's classroom. For E-Rate 2.0, I believe we need to set well-reasoned, achievable bandwidth goals for classroom and device connectivity that reflect the needs of modern education. I think it vital that these goals be based on data and that they take into account the different needs and demands of rural, urban and suburban schools and libraries. Like E-Rate's funding level, I support periodic reappraisals and adjustments of these bandwidth goals.

#### **Conclusion**

I thank the Chairman for holding this hearing on this most important subject and look forward to supporting his and the FCC's efforts to protect and preserve the E-Rate program. Calcasieu, Louisiana and the Nation are fully behind the E-Rate.

The CHAIRMAN. No, thank you very, very much, Ms.—Dr. Abshire. I apologize.

Next is Ms. Linda Lord, State librarian, Maine State Library. And, obviously, you've got to think immediately of Olympia Snowe. But, also, Ms. Lord is the current chair of the American Library Association's E-Rate Task Force and as the E-Rate liaison for the Association of State Library Directors.

We're happy that you're here, Ms. Lord. And please proceed.

#### **STATEMENT OF LINDA H. LORD, MAINE STATE LIBRARIAN**

Ms. LORD. Thank you. Good afternoon. I am Linda Lord, the Maine State Librarian. I want to thank Chairman Rockefeller, Ranking Member Thune, and members of the Committee for this opportunity to testify on the success of the E-Rate Program and the needs of our 16,000-plus public libraries across the country who serve 30 million people each week.

The E-Rate Program has transformed libraries and the technology resources we offer our communities. In 1996, only 28 percent of our public libraries provided public Internet access, compared with nearly 100 percent today. E-Rate has been fundamental to ensuring equity of service to online educational, workforce, and government resources for all of our citizens.

Frankly, we're at a turning point where we can continue to watch demand overwhelm the E-Rate Program or we can step boldly forward with a proactive vision for meeting the educational and learning needs of our communities for the next 15 years and beyond.

How information is delivered and shared is changing at an incredible rate. Learning in libraries and schools increasingly relies on interactive online experiences, and capacity needs are also growing as job training, continuing education, and Government agencies use streaming media and Web-delivered videos to reach our communities.

When the Maine School and Library Network was formed, in 1996–1997, we were thrilled to connect our schools and libraries with 56-kilobit-per-second connectivity and FRADs, frame relay ac-

cess devices. And when people from Cisco said, "You need to think ahead to routers," we said, "Oh, no we don't. We're so thrilled with this connectivity we have." We didn't have the vision to begin to see how quickly things would move.

A single patron watching a high-definition video today will consume nearly all of a T-1 connection, leaving other patrons limited access to the Web. Inadequate bandwidth stifles a library's ability to provide new services, such as interactive online homework help or digital learning labs. I'm old enough to remember when it took 20 minutes to achieve a dial-up connection. In fact, while I'm confessing, I'm old enough to remember telephones mounted on the wall, where you cranked to reach the operator, and, if the person wasn't home, you said to the operator, "Where are they?"—and they told you. It was—

[Laughter.]

Ms. LORD. Things have certainly changed since my youth.

In 1998, I could not have envisioned the program libraries offer today. For instance, in Maine we are using interactive videoconferencing technology to connect rural Mainers with volunteer attorneys who offer clinics to library patrons on topics like filing taxes or debt counseling. So, a lawyer comes into the Maine State Library, does an hour-long presentation, answers questions from videoconferencing centers from around the state. And then, on May 1, we had a day when every county in Maine had at least two libraries with lawyers in them, where people could meet with the lawyers and get free legal help. I think that's probably one of the original things that's happened in the country. I can't guarantee that, but I don't know of other states who have done it.

Libraries provide technology-rich programs for young people. And an example of this comes from the Cherryfield Public Library. And, frankly, in Maine terms, with all due respect to Cherryfield, it's in the willy wacks. There are 1,200 citizens in Cherryfield, but that little library, through videoconferencing, brought in 28 elementary students to view a live program on flight from the Smithsonian Institution. This would not have been possible even 5 years ago.

Libraries are also keys to the success of nontraditional students, such as Maine's 5,000 homeschoolers. Learners of all ages use libraries to take online courses. They cover areas not available locally. And students use libraries and online data bases to prep for GED courses, the ASVAB tests, and other tests. We also help adults who need to improve and develop their job skills and take necessary courses to qualify for better jobs. Public libraries serve everyone from preliteracy to Medicare Part D. And I do mean that literally.

Chairman Rockefeller really gave my testimony, but I thought, since I'm here, I might as well keep going with it.

We had a young man in Holton who went to McDonald's to apply for a job. And I'm sure you all know, even though nobody here has applied for a job at McDonald's, that you have to apply online. Well, this young man didn't have a clue, but he did know, if he needed help, he should go to his library. They found the forms for him. They helped him apply online. And then, the last thing he read on the application was, "We will notify you of an interview, if you receive one, by e-mail." He didn't have an e-mail address. He

didn't know how to get an e-mail address. The library set him up. He went back to the library each day to check his e-mail to see if he had an interview. And that's happening all over the country. It's an incredibly wonderful service libraries offer.

Maine is the least-densely populated state east of the Mississippi, but our Maine School and Library Network reaches even the most remote citizens. The public library in Maine is the only place for free Internet access in 77 percent of our communities. We're not exactly studded with Starbucks.

Our libraries and schools would have not have connectivity and all that it brings to their communities if it were not for E-Rate. And I highlighted that sentence in my remark. I mean that most sincerely. We would not have connectivity and all that it brings to our schools and libraries if it were not for E-Rate. However, it's not enough to be connected; we need high-speed, reliable connections, like the one at the Omaha Public Library, for example, that ensured one patron could Skype into three interviews with Boeing before being offered a job. And we also need upload capacities that rival download speeds for small businesses to upload large packets of information into the Cloud.

In 2010, the FCC report on the E-Rate Program said that 80 percent of applicants reported their connectivity was inadequate. The current level of telecommunications and information services demands E-Rate 2.0. Today, through the ConnectED initiative and the upcoming E-Rate proceedings, we have an opportunity to address this shortfall and lay the groundwork to meet future needs.

In closing, libraries are vital community technology hubs, and we simply cannot allow inadequate bandwidth to be the limiting factor for what our students and our nations can achieve.

And, in conclusion, I do want to acknowledge the bipartisan effort and support for the E-Rate Program by Chairman Rockefeller and Maine's original E-Rate champion, Olympia Snowe, as well as to others who have supported this critical program over the years.

Thank you for this opportunity to share the library experience at this very formative time in the E-Rate Program.

Thank you, Chairman.

[The prepared statement of Ms. Lord follows:]

PREPARED STATEMENT OF LINDA H. LORD, MAINE STATE LIBRARIAN

Good afternoon. Thank you Chairman Rockefeller, Ranking Member Thune, and members of the Committee for inviting me here today to testify about how the E-Rate program has enabled libraries to connect our communities and how we might further strengthen the program to better support digital learning.

My name is Linda Lord, and I am the Maine State Librarian. Before joining the state library 14 years ago, I spent 16 years as a school librarian at the Mount View Junior/Senior High School in Thorndike, Maine. Today I am honored to speak on behalf of Maine's libraries, part of the more than 16,000 public libraries in the U.S., about the role of the E-Rate program in helping libraries ensure that no one is excluded from digital opportunity.

This hearing is focused on the role of E-Rate in maximizing access and use of technology to benefit every child in America. I am proud of the role that both our libraries and schools play in giving our young people the opportunity to develop the critical thinking and technological skills they need to succeed in today's economy and prepare them for tomorrow's economy too.

I would be remiss if I did not pause here to acknowledge the bipartisan support for the E-Rate program by Chairman Rockefeller and Maine's original E-Rate champion, former Senator Olympia Snowe, that led to the establishment of the E-Rate

program. The citizens of Maine are deeply indebted to the foresight and commitment of these two leaders as well as to others who have supported the program over the years.

It has been my pleasure to work with students and their parents in rural Maine (Thorndike, population 890) and now, as State Librarian, to serve the 1.3 million residents across our state. Our libraries serve everyone, from the remote areas in western Maine, to Downeast Washington County (which is a county the size of Delaware and Rhode Island combined but with a population of just 32,000), to Portland, our most populous City of 66,000.

Though Maine is the least densely populated state east of the Mississippi, our library system reaches citizens in the most far-flung parts of the state. In the summer months, our libraries allow visitors to stay longer, relying on the Internet at the local library so they do not have to completely “unplug” from work. Speaking as someone very familiar with the phone-as-an-appendage for all teenagers, we know that while parents are responding to work e-mails, their kids are staying in touch with friends and often using the library Wi-Fi to read the latest thread on Tumblr. I actually heard a story that a teen was on the library porch reading a Stephen King book on her iPhone using the library’s Wi-Fi connection instead of reading the print book from the library. How people use our libraries and our internet-enabled services continues to change every year.

I’ve been involved with the E-Rate program since the beginning, and I have witnessed the tremendous positive impact it has had throughout Maine and indeed nationwide. As State Librarian, I am also a member of the Chief Officers of State Library Agencies (COSLA) and regularly hear from my colleagues about the role E-Rate has in their own states. In Nebraska, for instance, a resident of the Dundee neighborhood has been coming into the Sorensen Branch of the Omaha Public Library with her laptop to Skype into job interviews. I’m thrilled to report she ultimately received a job offer from Boeing. Web and videoconferencing are amazing—and bandwidth-intensive—tools for closing distances across our vast nation.

I have also served as Chair of the American Library Association’s E-Rate Task Force for the last four years and thus have a deep appreciation for the intricacies of the program, the issues that most concern library applicants, and how the program has only become more vital to libraries in a more complex technology landscape. I will be sharing some E-Rate successes with you today.

I’m old enough to remember the days of dial-up when you had to listen to that annoying modem sound and hope that you could get a connection. Clearly, we are in a different place today. So are our libraries. In 1996, only 28 percent of public libraries provided public Internet access, compared with over 99 percent who report this is the case today.

The E-Rate program has transformed libraries and the technology resources we offer our communities since 1998. According to a 2013 Pew Internet Project report the availability of computers and Internet access now rivals book lending and reference expertise as vital library services. Seventy-seven percent of Americans say free access to computers and the Internet is a “very important” service of libraries, compared with 80 percent who say borrowing books and access to reference librarians are “very important” services.<sup>1</sup>

The most recent downturn in the economy has further established the critical importance of the E-Rate program. The downturn hit Maine hard, as it did so many communities across the country. We see the lingering effects in our libraries. In 2012, 60 percent of public libraries reported an increase in use of their public access computers from the previous year (on top of the 69.8 percent increase reported in 2010–2011 and the 75.7 percent reported in 2009–2010). Librarians consider the provision of public Internet services to job seekers the most important service to their communities, followed by access to government services and providing educational resources for K12 students. Ninety-two percent of all libraries report they provide access to jobs databases and other job opportunity resources.<sup>2</sup>

Many of our residents struggle with inadequate resources to meet basic necessities and depend on the library to stay connected. Families come to the library so that their kids can work on homework assignments, some bringing their own laptops to use the library’s Wi-Fi. More people use our computers and Internet access to look for and apply for jobs or to recertify for a new position. In Maine the public library is the only place people can go for free Internet access in 77 percent of our communities. Nationwide, 62 percent of libraries report this is the case. When so much of what we do today is dependent on having a high quality Internet connec-

<sup>1</sup> <http://libraries.pewinternet.org/2013/01/22/library-services/>

<sup>2</sup> [http://www.ala.org/research/pliftas/2011\\_2012](http://www.ala.org/research/pliftas/2011_2012)

tion, the library has become a lifeline. Our libraries could not provide this basic service without E-Rate.

As we all hoped in 1996, the E-Rate program has transformed libraries for the digital age. It remains a critical Federal telecommunications funding source that goes directly to libraries, and it has done a tremendous job in connecting them. Today we can boast that nearly all libraries provide public Internet access and about 91 percent provide access to Wi-Fi, an increasingly important service in our communities. Though our libraries are connected at some level, the issue today is the quality or speed of that connection, which is often inadequate.

We must strengthen and add to the capacity of the E-Rate program to ensure libraries and schools are equipped to engage students and learners in the 21st century. I would like to share with you some examples that illustrate the internet-enabled services supported by the E-Rate program that libraries provide their communities. I will also talk about what we see on the horizon.

The nature of how information is delivered and shared is changing. Education increasingly relies on networked and online experiences. Whether it's checking for an assignment through a course management system, watching a biology video on YouTube, or practicing French pronunciation via a librarian-selected tutoring website, K12 students at the library are eating up the available bandwidth. This problem is exacerbated as job training programs, continuing education instruction, and government officials (*e.g.*, local, state, and Federal elected officials) increasingly rely on streaming media and Web-delivered videos to reach individuals across the country and they often promote the library as the place to receive this information. A single patron watching a high-definition video will consume nearly all of a traditional T-1 (1.5 Mbps) connection, leaving other patrons using the library's other computers or personal laptops with intermittent or no access. Inadequate bandwidth also limits a library's ability to effectively provide new Internet services, such as interactive online homework help or videoconferencing, let alone the full spate of emerging technology-enabled services, some of which we have not yet imagined but for which we need to be prepared.

As you know, the Internet is a vastly different place than it was in 1996 with the proliferation of social media and production tools pushing the envelope of what we expect to be able to do online—Facebook, Flickr, and Gmail began in 2004, YouTube in 2005, Twitter in 2006, Google Docs in 2007, and now Instagram and Pinterest, which to tell you the truth, I am not even sure how to use, though our young people are adept at all of them.

In 1998, the first year of the E-Rate program, I could not have envisioned a new program we now offer through Maine libraries. We use videoconferencing technology to connect rural Mainers with volunteer attorneys in our "Lawyers in Libraries" program. We offer clinics in real-time on various legal topics like filing taxes, renter's rights and responsibilities, and debt counseling to any public library patron. Our program also allows low-income residents to set up private consultations using the same video conferencing technology.

Even our small libraries can provide connections to information and experiences outside their local communities. The director of the Cherryfield (Maine) Public Library, which serves a population of about 1,200, told me about a partnership with the Smithsonian's Interactive Video Conference Program here in Washington. The library hosted 28 elementary students to view in real-time an exhibit at the Smithsonian. These students would otherwise not be able to experience the resources available through these virtual field trips. This library also has had a video conferencing program with the IRS for small businesses.

I couldn't be more impressed with what our libraries are doing, and know similar things are happening in other states. As a matter of fact, the Jessamine Public Library in Nicholasville, Kentucky recently partnered with one of its local elementary schools to offer a virtual field trip for students and their families to the Texas State Aquarium located in Corpus Christi. The aquarium has video cameras located around the facilities that allow the audience to experience their exhibits live. Guided by a docent at the aquarium, students visited the various habitats and saw the birds, sea turtles, river otters, fish, sharks and dolphins that make up some of the attractions. Enabled by strong and reliable Internet connection, these children could take part in a unique educational experience.

These stories should be commonplace in the coming years and, in fact, can be if libraries have access to affordable high-capacity broadband connections. I know it is the backbone of E-Rate support that lets the library provide these dynamic services, but the message here is that there is a group of kids that were connected outside of their small community to a learning opportunity that would not have been possible even five years ago. Librarians think this is just the beginning.

But there aren't nearly enough of these stories and there could be many more with adequate bandwidth. In a 2010 FCC report on the E-Rate program, 78 percent of applicants reported their connectivity was inadequate. There is clearly more work to be done, and the ConnectED initiative provides a perfect and timely opportunity to ensure that libraries and schools are prepared to meet the 21st century needs of their patrons and students. As we consider changes necessary to build a robust and sustainable E-Rate program for everyone, we must also be mindful of some of the unique challenges our small and rural libraries have in securing adequate bandwidth and securing the E-Rate funding they require. Though progress has been made, there are still areas where libraries just can't get the bandwidth they need because it isn't there or the costs are too high to reach where it is. And, when it comes to the E-Rate application process we must consider processes that encourage smaller libraries to apply. We must not let bandwidth be the limiting factor in the services libraries can provide our communities.

I would like to talk a little about Maine's most precious resource and one we are pinning our hopes for the future on—our young people. Among all the challenges they face upon leaving high school, whether it's to enter the workforce or go on to higher education, we must make sure that they are equipped with the skills necessary to be successful, to be engaged citizens, and to contribute to the well-being of their communities as well as our global economy. In reality this means that they must have access to high-quality and technology-rich educational experiences at the snap of the fingers—or really with the tap on a device.

Maine was a forerunner in the one-to-one computing trend with then-Governor Angus King working hard to provide all our middle-school students with laptop computers. Since then we have seen the program blossom not only in Maine, but also in other states. As most anyone visiting their public library in the afternoon knows, many of these students head to the library after school to connect via the library Wi-Fi, to work on homework assignments and research resources, and to get assistance from librarians. Public libraries support learners at all ages and stages. We are the wrap-around support network that supports K12 students after the school bell rings and after the school doors close for the summer. Through data from the Pew Internet and American Life Project we know that 70 percent of parents report that their child visited the public library in the past 12 months.<sup>3</sup> Of these, 77 percent of children ages 12–17 went to the library to do school work; this is true of a majority of all children. Together libraries and schools ensure that learners have access to technology-enabled and personalized educational opportunities during the school day—and beyond—via libraries. Through this partnership, our students have the broad support they need, and always have learning opportunities in front of them.

In addition to supporting traditional K12 education, libraries are a key ingredient to the success of our non-traditional students, such as home-schooled students that now number more than 1.5 million. In the Santa Maria (Calif.) Public Library, for example, there are two classrooms in the library, run by local high school teachers, which are dedicated to the Santa Maria Joint Union High School District home school program.

Students—particularly those in rural areas who may not have access to AP or specialized STEM classes—taking distance education courses to augment the local curriculum, regularly turn to the library for Internet access to take these classes. In many cases, libraries also serve as proctoring centers. We have numerous examples, such as in Florida, where K12 education is becoming a hybrid model that includes online learning. We anticipate seeing more of these students in our libraries. Many students also prepare and take practice tests—including for the GED or SAT—in our libraries, and we expect to see increased use as the GED test is revamped and more states switch to computerized GED testing, which will be only online beginning in 2014.

Libraries also support adult learners and continuing education for those who may not have received the education they needed early in life or need to retool for new job prospects. At one of the branches of the Chattahoochee Valley Libraries system in Georgia, for example, a patron taking online classes needed to take an online, proctored test. This also involved a device to monitor him and take a fingerprint. The library staff set up the necessary device and installed the software he needed in one of the offices so that he would have privacy. The library reported he passed his test and is so pleased that he hasn't yet stopped telling anyone who will listen, "how much [the] library cares about our education." Libraries are essential for making sure everyone has the skills they need to be part of the 21st century workforce.

<sup>3</sup><http://libraries.pewinternet.org/2013/05/01/parents-children-libraries-and-reading/>

We cannot contemplate fulfilling the needs of these students (or adult learners) unless our libraries have access to affordable, reliable, high-speed broadband connectivity. From my colleagues across the country I hear stories from their local libraries about needing more bandwidth. In Wisconsin one regional library system relied on the E-Rate program to add an additional 100 Mbps of bandwidth when the network reached capacity for its 49 member libraries. In Indiana, a library director said she used to think a T1 line was sufficient, but quickly found that it was nowhere near enough. The library doubled, then tripled its broadband capacity, then jumped to 15 Mbps as staff reported that patrons quickly used capacity as it was added. By revamping the E-Rate program we have an opportunity to address this shortfall and lay the groundwork to address future bandwidth needs.

Now let's look a little into the future. Just as libraries in 2013 are not the library we remember in 1998, we are beginning to see other emerging trends. Libraries are providing innovative services that are technology-rich and build on developing skills learned in the formal classroom setting. One form this is taking is the creation of digital media learning labs and makerspaces. For example, The Labs at the Carnegie Library of Pittsburgh offer young people an opportunity to produce rich, multimedia products using the latest technology tools while connecting these learning experiences directly back to school and careers. There is a specific emphasis on STEM education, and the Lab devotes significant resources to developing interest and ability in STEM areas. Digital learning labs are not confined to large urban libraries, however. The Allen County Public Library in Fort Wayne, Indiana, provides a maker space to encourage innovation and entrepreneurship. In collaboration with the John D. and Catherine T. MacArthur Foundation, the Institute of Museum and Library Services is funding the creation of up to 30 learning labs.

Libraries are also beginning to leave their physical spaces and find opportunities to bring their services out into the community. In Philadelphia, the Free Library brings its services into the community, literally. The Hot Spot Techmobile brings Internet access, computers, and digital literacy training to where the city's most vulnerable citizens are.

These and services like them are sprouting up in libraries across the country and are part of the wave of the future in library service. Libraries feel the urgency that schools, colleges, and businesses feel. We must have students prepared for the competitive global economy as they are the key to the future success of our country. The momentum is now, and we must seize the opportunity to ensure the E-Rate program continues to support libraries and schools so that we can do our job by the current and future generations of young people.

As with people, there are "early adopter" libraries beginning to leverage gigabit networks, as well as libraries that are farther down the technology curve. We must take lessons from both of these groups. And, we must find solutions that help libraries bridge this gap by ensuring libraries have access to affordable, high-capacity broadband no matter if they are in a rural remote or urban location or somewhere in between.

As we embark on E-Rate 2.0 to keep pace with the technology platforms our students access today, as well as plan for tomorrow's needs, we must lay the groundwork carefully and with purposeful goals. E-Rate has meant a world of difference to libraries, but it was designed in a vastly different technology landscape. We know now that the connectivity needed to support our K12 students and our broader communities is far greater than we might have imagined 17 years ago. We also know the need is far greater than the current program can support.

The original mission of the E-Rate program—to provide libraries and schools with advanced services—is still valid and necessary. But the technological landscape continues to push the boundaries of libraries' Internet capacities, and as Cisco's Internet traffic measurement studies demonstrate, there is no end in sight to the demand for high-capacity Internet access. Many libraries are going to need fiber optic cable connections that can provide a "future-proof" platform for increasing capacity simply by changing the electronics at either end of the fiber. Investment in fiber will pay dividends for decades into the future and will ensure that libraries do not have to keep playing catch-up with the emergence of every new application.

Due in no small part to the leadership of Senators Rockefeller and Snowe, the E-Rate program from its inception focused on providing high-capacity transmission services to libraries and schools. The purpose of the E-Rate program is to ensure that libraries and schools have the underlying telecommunications and broadband capacity to carry the next generation of Internet-dependent services. This focus on transmission provides a foundation for future growth and the development of new and innovative services. Without question the job is not over. As technologies continue to change, the E-Rate program must adapt as well. The current level of telecommunications services demands an E-Rate 2.0. Revisiting the E-Rate program

with the goal of bringing the highest capacity broadband possible into communities across the country was initiated through the National Broadband Plan in 2010 with the recommendation that communities have access to 4 gigabit service so that anchor institutions, like libraries, can provide advanced and innovative services to all who need them.

The fundamental question before us today is how do we most effectively harness the opportunities enabled by technology for the benefit of our young people and, through them, our society? While our vision for the future may differ in some fashion, and the path forward may have variations, I think we can concur that it will be technology rich and heavily dependent on a robust broadband infrastructure. We already see a trend towards more diffuse networking capabilities in large swaths of the population which means more demand for technology-based services.

This is an exciting opportunity for libraries as we contemplate new avenues to serve our communities. It's a critical juncture for our Nation. For libraries, what we can achieve for K12 students and our communities depends to a great degree in the continued success of the E-Rate program which in turn depends up on how we shape E-Rate 2.0.

In closing, libraries are vital community technology hubs, and we simply cannot allow inadequate bandwidth to be the factor that limits what our students and our Nation can achieve. We are at a turning point with ever changing technology and the need for a 21st century workforce where we can continue to watch demand overwhelm the E-Rate program or we can step boldly forward with a proactive vision for meeting the educational and other learning needs of our communities for the next 15 years and beyond.

But like the true Mainer I am, I believe in not losing sight of what works while at the same time allowing for the space to for necessary changes. As we re-envision the E-Rate program for the future, we should be mindful of bringing along the successful elements and build on that firm foundation. Libraries are committed to making sure our communities have access to technology and broadband and the skills to turn these tools into opportunity for years to come.

Thank you for this opportunity to share the library experience at this formative time in the E-Rate program. I look forward to responding to your questions.

The CHAIRMAN. Thank you, Ms. Lord.

And we go now to Mr. Patrick Finn, who is the Senior Vice President at a little company called Cisco Systems.

[Laughter.]

The CHAIRMAN. And he's here today, standing in for Cisco's Chairman and CEO, John Chambers, who could not be here today. And he's a native West Virginian, so that—you know—

Mr. FINN. Yes, sir.

The CHAIRMAN.—everything he says is bound to be truthful.

[Laughter.]

The CHAIRMAN. Please, sir.

Mr. FINN. Good—

The CHAIRMAN. And we do have votes coming up, and so we want to maximize our time, as well—as best as we can.

Mr. FINN. Great.

The CHAIRMAN. Was I subtle?

Mr. FINN. Say again?

The CHAIRMAN. Was I subtle in saying that?

Mr. FINN. Yes.

The CHAIRMAN. Thank you.

[Laughter.]

**STATEMENT OF PATRICK FINN, SENIOR VICE PRESIDENT,  
U.S. PUBLIC SECTOR, CISCO SYSTEMS, INC.**

Mr. FINN. Good afternoon, Chairman Rockefeller, Ranking Member Thune, and members of the Committee.

Our nation's children are in the fight of their lives and their future livelihood. In this globally connected world, our children aren't

just competing against the kids down the street for a job or a spot in a college, they're competing with kids around the world.

To compete and succeed, our children need to have the latest technology in their hands and access to the world's libraries at their fingertips. And this access should not be limited to the privileged few, but to all kids, whether in San Jose or Shepherdstown or Sioux Falls.

That's where the E-Rate Program comes in. E-Rate is the foundation for Internet access in schools and libraries across America. Since its inception, 15 years ago, E-Rate has connected over 100,000 schools to the Internet in all 50 States, and the results have been nothing short of amazing.

After Hurricane Katrina, Cisco provided \$80 million to fund the 21st Century Schools Initiative and provide the latest network technology to rebuilt schools in Mississippi and Louisiana. In Jefferson Parish, the math scores of 8th-graders increased by 16 percent between 2005 and 2009. Significant gains were also seen in English, science, and social studies at all levels. And when Morrisville School District in North Carolina invested in wireless technology, the digital devices, and digital textbooks, individual students showed 20-to 40-percent improvements in reading, math, and science test scores. Graduation rates increased by 22 points.

Similarly, videoconferencing technologies allow teachers in Long Branch and Fresno School Districts to share best practices in realtime. The results? Two thousand more students tested as proficient or advanced in math than the year before. That's 2,000 lives improved through better education and better collaboration.

So, the impact of E-Rate has been significant. But, the simple truth is, the technology has dramatically changed over the last 15 years, and E-Rate needs to keep up with the times. School networks need to be able to handle increased traffic from video and digital textbooks, video collaboration, and iPads, laptops, and other mobile devices.

Additionally, these networks should enable remote learning and remote network access, especially in rural areas. In these areas, graduation rates are less than the national average by almost 10 points. This requires high-speed communications at speeds far greater than many schools and libraries have today.

Furthermore, the current E-Rate Program primarily focuses on providing a broadband Internet connection to the school and, secondarily, to deploying a network within the school. This model is no longer sufficient. We need to consider all elements of a network, including broadband Internet access, individual school networks, and district-level wide-area networks. This is how businesses build networks to be cost-effective and to meet their communication needs. School networks should operate on the same principles.

So, policymakers should consider three things in modernizing the E-Rate Program:

First, program funding levels have barely changed since 1998, while the bandwidth and networking needs of the schools have dramatically increased. Today, 80 percent of schools and libraries believe that bandwidth does not meet their current needs. In the early years of the program, the funding met the majority of the requests from applicant schools and libraries. In recent years, fund-

ing has only been available for about half of the requested amounts. Funding levels should meet the needs of more schools and students, not fewer.

Second, minimum bandwidth requirements should be adopted, based on the size of a school, to ensure that all schools have both in-building and district-wide networks that are capable of supporting modern educational technologies and devices.

Third, current E-Rate rules which fund Internet connectivity first as Priority 1 services and then send the leftovers to fund priority-two networking inside the schools no longer make sense. Internet access is an important element of a network. Both school districts have to be able to access content of their own servers for distribution within the district, and the content is meaningless if it cannot be delivered to students and teachers through efficient in-building and district-wide networks. So, the outdated distinction between Priority 1 and Priority 2 should be eliminated.

In summary, I believe that our nation's children are in the fight for their futures in the context of a globally connected world in a rapidly changing technology environment. Modernizing the E-Rate Program is a critical investment, which will benefit our children and our country by creating a future where we build a workforce focused on innovation, competitiveness, and job creation.

Thank you for your attention on this important matter today, and I look forward to answering your questions.

[The prepared statement of Mr. Finn follows:]

PREPARED STATEMENT OF PATRICK FINN, SENIOR VICE PRESIDENT,  
U.S. PUBLIC SECTOR CISCO SYSTEMS, INC.

Good afternoon Chairman Rockefeller, Ranking Member Thune and Members of the Committee.

Our nation's children are in the fight of their lives.

In this globally connected world, our children aren't just competing against the kids down the street for a job, or a spot in college. They are competing with kids around the world.

To compete and succeed, our children need to have the latest technology in their hands and access to the world's libraries at their fingertips.

And this access shouldn't be limited to the privileged few, but to all kids—whether in Silicon Valley, or Shepherdstown, or Sioux Falls.

And that's where the E-Rate program comes in. E-Rate is the foundation for Internet access in public schools and libraries across America. Since its inception 15 years ago, E-Rate has connected over 100,000 schools to the Internet—in all 50 states.

And the results from connecting schools have been nothing short of amazing.

After Hurricane Katrina, Cisco created the \$80 million 21st Century Schools initiative to provide the latest networking technology in rebuilt schools on the Gulf Coast. In Jefferson Parish, Louisiana, 8th grade students' math test scores jumped by 16 percent between 2005 and 2009. Significant gains were also seen in English, Science, and Social Studies at all grade levels.

And when Mooresville School District in North Carolina invested in wireless networking, digital devices and digital textbooks as part of a turnaround program, individual students showed 20–40 percent improvement in reading, math and science test scores. The school district's ranking jumped by 13 points, and graduation rates increased by 22 points.

Similarly, video conferencing technologies allowed teachers in the Long Beach and Fresno school districts to share best practices in real time. The result: 2,000 additional students tested as proficient or advanced in math than the year before—that's 2,000 lives changed through better education and better collaboration.

So the impact of E-Rate has been significant.

But the simple truth is that technology has changed dramatically over the last 15 years, and the E-Rate program needs to keep up with the times.

School networks need to be able handle increased traffic from digital books and video, video collaboration technologies, and a wide array of mobile devices like iPads and laptop computers.

Additionally, these networks should enable remote learning and remote network access—especially for rural areas, where graduation rates are less than the national average by almost 10 points and access to specialized instructors who can offer courses not available everywhere is extremely limited.

All this and more requires high-speed connections at speeds far greater than many schools and libraries offer today.

Furthermore, the traditional E-Rate program primarily focused on providing a broadband Internet connection to a school, and secondarily on deploying a network within the school. This model is no longer sufficient.

We need to consider all aspects of a network—including broadband Internet access, individual school networks, and district-level wide area networks—when designing a structure for E-Rate for the next 15 years. This is how medium and large businesses build networks to be cost effective and to meet their communications needs. School networks should operate on the same principles.

So policymakers should do three things to modernize the E-Rate program.

- First, program funding levels have barely changed since 1998 while the bandwidth and networking needs of the schools have dramatically increased. Today, 80 percent of schools and libraries believe their broadband connections don't meet their current needs.

In the early years of the program, the funding met the majority of the requests from applicant schools and libraries. In recent years, funding has only been available for about half of the requested amounts. Funding levels should meet the needs of more schools and students, not fewer.

- Second, minimum bandwidth requirements should be adopted, varying based on the size of a school, to ensure that all schools have both in-building and district-wide networks that are operationally capable of supporting modern education technology and devices. Just as our expectations for broadband have evolved, so too should the capacity of networks deployed in schools.
- Third, current E-Rate rules—which fund Internet connectivity first as “Priority 1” services and then send the leftovers to fund “Priority 2” networking inside the schools—no longer make sense. Internet access is an important element of a network, but districts have to be able to access content on their own servers for distribution within the district. And that content is meaningless to teachers and students if it cannot be delivered via effective in-building and district-wide networks. So the outdated distinction between Priority 1 and Priority 2 should be eliminated.

In summary, I believe that our Nation's children are in a fight for their future in the context of a global connected world, rapid changes in technology and the digital divide. Our view is that investment in technology and an enhancement of the E-Rate program will benefit our children and our country by creating a future where we are building a competitive workforce focused on innovation, competitiveness and job creation.

The bottom line is this: Modernizing the E-Rate program is a critical investment in the future of our nation, and Cisco looks forward to working with this Committee, the FCC, and the schools to provide our children with the best education possible.

Thank you for your attention to this important matter today, and I look forward to answering your questions.

The CHAIRMAN. Thank you very, very much for that.

And then, finally, Mr. James Coulter, who is the cofounder of TPG Capital. He and I had a conversation. He also, as importantly, or maybe more importantly to me, co-chairs the bilateral LEAD Commission, which is hooked up into this whole future of E-Rate discussion in a very major, major way—creative way. He has devoted a lot of time to this. He has spent a lot of time in other countries, so he has a sense of what they're doing and what we're not.

We're very glad that you're here, sir.

**STATEMENT OF JAMES G. COULTER, CO-CHAIR, LEAD  
COMMISSION (LEADING EDUCATION BY ADVANCING DIGITAL)**

Mr. COULTER. Chairman Rockefeller, Ranking Member Thune, members of the Committee, thank you for the opportunity to speak to you today.

I want to begin by recognizing the extraordinary leadership Congress showed, nearly 20 years ago, in passing the E-Rate Program. Under the leadership of Chairman Rockefeller, former Senator Snowe, then-Congressman Markey, and others, the decision was made to invest in the technology of our schools and libraries. It's widely acknowledged, by everyone on this panel, it was a monumental success. From 1996 to 2004, schools connected to the Internet increased from 14 percent to 95 percent.

However, technology marches on, and so does the need for the technological support of our schools. Today, I urge you to strengthen and modernize the E-Rate Program. I believe that modernization of E-Rate is critical to providing our nation's students with the education they need to compete in today's technology-enabled economy.

As the Chairman told you, I appear before you today as one of the four chairs of the bipartisan commission, Leading Education by Advancing Digital, or LEAD. The LEAD Commission was formed 16 months ago to answer a challenge from the FCC and the Department of Education to create a national roadmap for the adoption of educational technology.

Our work involved hundreds of interviews, product demonstrations, school visits, travels around the world. LEAD's findings suggests we are at a transformative moment for our nation's education system, a moment filled with promise, yet fraught with risk. Allow me to share four brief observations:

First, an international educational technology race is swiftly developing: South Korea is eliminating paper textbooks by 2016; 100 percent of Singaporean schools are wired for broadband; 100 percent of Korean teachers are technology-trained; Turkey is seeking to supply 10 million tablets to its students by 2015; next year, the Thailand Government will distribute hand-held computers to 13 million children. In 1957, the Soviet Union launched the first satellite, Sputnik, striking fear into Americans that we could fall behind in the space race. LEAD's work suggests this is a Sputnik moment in education. We risk losing the international race to educational technology.

Second point, a technological tipping point is driving all this. Five years ago, I couldn't have suggested this. The national implementation of educational technology would have been prohibitively expensive. Today, plummeting costs of tablet computers, Cloud-based software, and Wi-Fi make the implementation affordable. Technology-enabled schools today are driving extraordinary results. LEAD's work shows the long-held promise of educational technology is poised to become an affordable reality.

Our third observation. Without a clear, concerted action, we risk falling behind. America lacks a clear national plan for digital education. We approach the challenge at 16,000 separate school districts. Absent a national plan and collaborative action, we bear the risk of exacerbating the digital divide. Four weeks ago, LEAD re-

leased a five-point national blueprint to accelerate the deployment of digital learning. The first, and, in my view, most critical, point in the plan is a call for a national effort to ensure sufficient connectivity to our schools.

Chairman, as you've noted, in a time where we demand free broadband in our coffee shops, it's shocking how little bandwidth is available in our schools. Only 23 percent of schools are wired for today's broadband demands, and less than 10 percent are wired for 2017 needs. It's 100 percent in Korea and Singapore.

We need to move the average schools from 20 megabits, enough bandwidth for a handful of students to watch one video, to 1 gigabit, enough for all the students in the school to take advantage of digital learning.

In the last century, it would have been unimaginable to send our children to schools without heat and electricity. Broadband is, in our opinion, the heat and electricity of 21st-century learning. We are falling woefully short in filling our students' needs.

Our fourth, and final, observation. A modernized E-Rate is essential to address our infrastructure challenges. E-Rate successfully addressed the issue of access. We must now strengthen E-Rate to address the problems of capacity and speed. A modern E-Rate should focus on Internet infrastructure, increased transparency, be much easier to use, and should drive down school technology costs.

In the private sector, we know we must invest in technological infrastructure to remain competitive. E-Rate can be the vehicle to encourage and support the same type of investment in our schools.

In conclusion, our work demonstrates we create substantial long-term risks to our national competitiveness if we fail to invest in educational infrastructure. Just as America needed the Federal Aid Highway Act of 1956 to widen our roads, we need Federal action today to widen broadband in our schools. We invest tens of billions of dollars a year to reduce the traffic jams on our roads. Shouldn't we invest a fraction of that, through E-Rate, to reduce the digital traffic jams developing in our schools?

Chairman Rockefeller, today's hearing is a call to action. We are facing a Sputnik moment in education. We must act. I urge this committee to continue its bipartisan tradition and support a modernized E-Rate.

Thank you for the opportunity to testify, and I look forward to taking any questions.

[The prepared statement of Mr. Coulter follows:]

PREPARED STATEMENT OF JAMES G. COULTER, CO-CHAIR, LEAD COMMISSION  
(LEADING EDUCATION BY ADVANCING DIGITAL)

### **Introduction**

Chairman Rockefeller, Ranking Member Thune, Members of the Committee, thank you for the opportunity to speak with you today on this important national issue.

My name is Jim Coulter and I am a father of three, a career businessman, an entrepreneur, and an American deeply passionate about our education system.

I want to begin by recognizing the extraordinary bipartisan leadership that Congress showed nearly 20 years ago in passing and implementing the E-Rate program. It was under the leadership of Chairman Rockefeller, former-Senator Snowe, then-Congressman Markey and others that the decision was made to initially invest in technology in our schools and libraries. It is widely acknowledged that E-Rate has been a monumental success: from 1996, when E-Rate was first implemented, to

2004, schools connected to the Internet increased from 14 percent to more than 95 percent.<sup>1</sup> This Committee's support of the E-Rate program has provided tremendous benefits for rural and urban schools, public and private.

However, just as technology marches on, so does the need for technological support for our schools. Today, modern teaching methods utilizing digital tools are poised to revolutionize education around the world. Initially, technology was only in the principal's office; now it is on the teacher's desk and is moving into the hands of students. We are increasing our bandwidth users from five million teachers and administrators to 55 million students. Sadly, in spite of E-Rate's success, today fewer than 25 percent of our Nation's schools have the high-speed bandwidth necessary to support this technology evolution.<sup>2</sup>

I am here today to urge you in the strongest terms to support an expanded and strengthened E-Rate program. I believe expanding and strengthening E-Rate is a critical component for providing current and future generations the education and skills they need to compete in today's global and technologically-enabled economy.

### **LEAD Commission Findings**

I was invited to appear before you today as one of the four co-chairs of a bipartisan commission, Leading Education by Advancing Digital, or "LEAD". The LEAD Commission is also chaired by Lee Bollinger, President of Columbia University, Margaret Spellings, former Secretary of Education, and Jim Steyer, founder of Common Sense Media. LEAD was formed over 16 months ago to answer a challenge from the FCC and the Department of Education to create a national roadmap for the adoption of educational technology. We released the LEAD Commission recommendations four weeks ago.<sup>3</sup>

The LEAD Commission's work involved hundreds of interviews and product demonstrations, school visits, and travels throughout the United States and around the world. We spoke with a broad cross-section of teachers, parents, students, government officials, school administrators, and educational technology industry leaders. This extensive work has made it clear to me that we are at a critical, transformative moment for our Nation's education system, a moment fraught with both opportunity and risk. Allow me to share four observations.

*LEAD's First Observation: Other countries have moved rapidly and decisively to make educational technology a national priority.*

I have met with Education Ministers in Singapore and South Korea who report 100 percent broadband wiring of their schools. South Korea is eliminating paper textbooks in 2016. One hundred percent of Singaporean teachers are technology trained.<sup>4</sup> Over the last few months, Turkey's Prime Minister has been on a tour to identify a technology provider that will supply 10 million tablets to Turkish students by 2015.<sup>5</sup> Thailand's "One Tablet Per Child" policy aims to reduce the education gap between the Nation's urban rich and rural poor. By the end of 2014, the Thai government will have distributed handheld computers to 13 million school children.<sup>6</sup>

These countries believe the earlier they put technology in the hands of students and make it an active part of their education the better prepared those students will be to participate in an increasingly tech savvy work force.

In 1957, the Soviet Union launched the first satellite, "Sputnik", into space, striking fear in Americans that we could lose the space race and nationally spurring us into action. LEAD's observation of initiatives around the world has led us to believe today is a "Sputnik Moment" for education in this country. Our country already does not perform well on international tests, ranking 31st in math, 23rd in science and 17th in reading.<sup>7</sup> If we do not find the national will to move forward with technology in the classroom, we risk falling further behind and creating a challenge to our long-term competitiveness. The E-Rate program we are discussing today can and should play a vital role in meeting this challenge.

<sup>1</sup> Rosenworcel, Jessica. "Remarks of Commissioner Jessica Rosenworcel." Washington Education Technology Policy Summit. Washington, D.C. 11 Apr 2013. Address.

<sup>2</sup> EducationSuperHighway, *Internet Infrastructure for America's K-12 Students*, 2012.

<sup>3</sup> <http://www.leadcommission.org/>

<sup>4</sup> Digital Trends, *South Korean school textbooks will be all digital by 2015*, July 5, 2011

<sup>5</sup> <http://www.invest.gov.tr/en-US/infocenter/news/Pages/200513-turkey-fatih-project-tender-process-start.aspx>

<sup>6</sup> <http://www.japantimes.co.jp/news/2013/06/19/asia-pacific/tablet-computers-thrust-thailand-classrooms-into-digital-era/#.UeQtk5zjLKc>

<sup>7</sup> OECD Program for International Student Assessment. "What Students Know and Can Do: Student Performance in Reading, Mathematics and Science." 2009 Database. <http://www.oecd.org/pisa/46643496.pdf>

*LEAD's Second Observation: There is evidence that we are at a technological and teaching practice tipping point that will allow the long-held promise of educational technology to become a transformative and affordable reality.*

Five years ago, the national implementation of educational technology in a large-scale fashion would have been prohibitively expensive with \$1,000 work-stations, shrink-wrapped sub-par software and torn up walls to wire school buildings. Today, thanks to the plummeting costs of tablet computers, innovative cloud-based software and enterprise Wi-Fi technology, implementation is affordable and achievable.

Mooresville, North Carolina, a community outside of Charlotte, has risen as an example of the power of a digitally enabled school district. Walk into any classroom in Mooresville and you will find a student with a laptop working with a teacher equipped and trained to use the latest online tools to provide students with a personalized interactive learning experience. One of North Carolina's poorer school districts, Mooresville has risen to become one of its most effective and efficient. Since making the digital transition three years ago, the district pass rate on state tests in reading, math and science has increased from 73 percent to 88 percent.<sup>8</sup> In addition, Mooresville ranks 100th out of 115 districts in North Carolina in terms of dollars spent per student, but is now third in test scores and second in graduation rates.<sup>8</sup> Mooresville and numerous other innovative school districts are showing us the technology exists, teachers are deploying it with vigor and creativity, and learning environments are being transformed for the better with measurable improvement in student achievement.

LEAD's Third Observation: While the U.S. remains a hub of educational innovation, we face the risk of falling far behind in the deployment of digital learning technologies.

We are uncoordinated and lack a clear national plan for digital education. We currently approach the challenge as 16,000 independent school districts. Absent a national plan and collaborative action, we bear the risk of further exacerbating the digital divide that troubles the Nation's poor and rural communities.

The primary reason for this national risk is that our school technology infrastructure is inadequate to meet the demands of 21st century learning. In today's world, where we expect fast Wi-Fi access with our coffee, it is troubling how many of our schools rely on slow and outdated Internet connections. According to EducationSuperHighway, a highly-respected non-profit focused on removing the roadblocks to high-speed Internet in our schools, only 23 percent of schools are sufficiently wired for today's broadband demands and less than 10 percent are wired with the broadband that will be needed in 2017.<sup>9</sup>

Four weeks ago, LEAD released a five-point national blueprint to accelerate the positive deployment of digital learning. The plan is both ambitious and attainable, offering significant long-term gains for our children. We have included the blueprint as an addendum to this statement. In summary, our five points are:

- Broaden School Broadband
- Deploy Devices Nationally by 2020
- Accelerate Digital Curriculum Adoption
- Fund and Celebrate Model Schools
- Train Teachers for Digital teaching

It is no accident that our first and perhaps most critical point is a call for a national effort to broaden the total broadband available in our schools. According to EducationSuperHighway, broadband availability in our schools must increase from two and a half terabits today to 55 terabits by 2017.<sup>10</sup> In other words, we need to move the average school from 20 megabytes, or enough bandwidth for a handful of students to stream a single video, to one gigabyte, or enough for all students in the school to take advantage of digital learning. In the last century, it would have been unimaginable to send our children to schools without heat and electricity. Broadband will be the "heat and electricity" of 21st century learning solutions. It is imperative that we unlock the promise of digital learning: broadband is the key.

America is known world-wide as the home of information technology and the birthplace of tomorrow's innovations. However, our connectivity limitations and our lack of national coordination on this issue will have a direct impact on learning outcomes, the education ecosystem and our Nation's ability to prepare current and fu-

<sup>8</sup> Mooresville Graded School District's Digital Conversion Report, April 2011.

<sup>9</sup> EducationSuperHighway, *Internet Infrastructure for America's K-12 Students*, 2012.

<sup>10</sup> EducationSuperHighway, *Internet Infrastructure for America's K-12 Students*, 2012.

ture generations for a highly competitive global workforce. If we don't act now, we risk losing our position as the global leader.

*LEAD's Fourth Observation: E-Rate provides an invaluable tool for addressing the Nation's educational technology infrastructure challenges. It is time for a coherent, collective effort to modernize E-Rate and to implement the digital learning technology essential for 21st century schools.*

We are fortunate as a country that Senator Rockefeller and others saw fit to lead the Nation's schools and libraries into the digital era with E-Rate in the 1990s. Likewise, the country will be well served if this committee supports the efforts to upgrade and modernize E-Rate currently in front of the FCC. We would hope E-Rate modernization would reflect the following objectives.

First, E-Rate has already successfully addressed the issue of access; E-Rate must now address the problem of capacity and speed. We recommend E-Rate update its goals to focus on Internet infrastructure. Curriculum development will lag and private sector investment will languish if the infrastructure remains inadequate. It will simply be less attractive for educators and businesspeople to drive educational technology innovations if only 10 to 20 percent of schools are wired to use them.

Second, we need to enable districts to invest in fiber connections to their schools. E-Rate currently supports operating expenditures but does not incentivize long-term investment in fiber. Businesses regularly make the decision to invest upfront capital in order to significantly lower ongoing operating expenses. We must empower schools to do the same in order to get them the bandwidth they need while maintaining a reasonable E-Rate budget.

Third, we hope modernization of the program will increase transparency, simplicity and accountability. We need an E-Rate that encourages broadband adoption because it is easy to use. We need an E-Rate that makes data and pooled purchasing available to schools, allowing them to drive down costs.

This country has a long and successful history of Federal action to aid infrastructure development and ensure universal access to communication technologies. Just as America needed the Federal Aid Highway Act of 1956 to widen our roads, we need Federal action today to widen broadband in our schools. If America can invest tens of billions of dollars a year to reduce traffic jams on our roads, shouldn't we invest a fraction of that to reduce traffic jams in our schools?<sup>11</sup> E-Rate is the key. It worked to solve the problem of access. We can call on it again to solve the educational broadband needs of our country.

### Conclusion

While technology is not a panacea, it transforms almost every industry it touches. In my day job as an investor I realize that it would be long-term economic suicide not to provide our companies with the technological infrastructure and tools to compete in an increasingly global and competitive marketplace. Likewise, it would create substantial long-term risks to our national competitiveness if we fail to make a national investment in educational technology infrastructure. Fortunately, E-Rate gives us an affordable and effective path to make sure we give schools and teachers the digital learning tools they need to prepare our children and our country for the future.

We Americans pride ourselves on always being solution seekers, no matter how difficult the problem. Yes, our U.S. education system faces significant tests and tough international competition, but just like after the Sputnik launch, we as a nation can rise to the challenge. Today, we are facing a "Sputnik Moment" in education. It is time for our country to collectively say "modernizing our schools is a national priority."

Thank you for the opportunity to testify today, and I look forward to responding to any questions.

For more information, please visit the LEAD Commission website: <http://www.leadcommission.org/>

The CHAIRMAN. Thank you very much, Jim Coulter.

I should inform my colleagues—is that a vote? A vote is just imminent, and—oh, 10 minutes, OK. What I plan to do is miss the first vote. And so, I will stay here, unless this is not agreeable to my colleagues, so we can keep this going. The upside is that we keep it going; the downside is, if you're voting, you—and you prob-

<sup>11</sup> <http://www.artba.org/faqs/#7>

ably don't want to miss the first vote—then the second vote, I will go to. But, we'll do the best we can.

Let me just start with a—sort of a catch-me question. The thing that's amazing to me is that, when we started this program, when you said "E-Rate and connectivity," everybody assumes, myself included, that that means that the whole thing was working, that there was a teacher there, the software was there, there was a computer there, et cetera, et cetera. And, of course, that was wholly untrue. It just meant that it was physically available, it was wired to receive any of those necessary parts to the E-Rate. And so, Ms. Lord, when you talked about, you know, how far we've come and how far we have to go, I always try to bear that in mind.

So, I would like to ask, Mr. Coulter, if—you talked about the speed—what, we get up to 100 times faster speed return if we do the right things, if it's in our will—and also the new technology. And then you said something that was very important to me, and that is that the competition between technology companies is such that prices are coming down, to the extent that it's becoming more affordable. Could you expand, starting on that last one, and then talking a little bit about what we have to add on to the connectivity, which has since been supplemented by States and privates, you know, others, to give us computers and teacher training? I know not.

Mr. COULTER. Yes. If you look the LEAD plan, it has five parts. A necessary condition to any of those parts is that the schools are wired. If you are an investor and are thinking about investing in educational technology, it's hard to make that investment when you realize only 10 percent of your customers could use it, even if you had the perfect product today.

So, I would note that E-Rate was a success. And at the time it was built, these technologies were not available at a cost that would have made sense for schools. So, E-Rate did the right thing at the right time. We're asking it to do the right thing at this right time now.

The technological change from wired walls to Wi-Fi and tablets—we have to remember, the iPad was delivered for the first time in April 2010. So, this change is new, and people around the world are realizing that it will bring down costs to the point where educational technology can be delivered within textbook budgets. That's a very different situation than where we were when E-Rate was first created.

In addition, competition for this market, if we get it to scale, will drive down costs farther. It's interesting to see what Turkey is doing. The Prime Minister of Turkey is in Silicon Valley, touring technology companies, asking them to compete with each other for a \$7-billion contract to take American technology over into the schools of Turkey. I guarantee you, they will get a pretty good price when they are asking for that size of a technological contract.

So, it is a new era. E-Rate has to reflect that new era. And the good news about the new era is, the technology that you've enabled over time has come to a cost area that it can now be a reality within our nation.

The CHAIRMAN. Thank you, sir.

I would call upon my friend and colleague, Senator Thune.

Senator THUNE. Thank you, Mr. Chairman.

And I would direct this to the panel, whoever would like to comment. E-Rate support is not based on the actual cost of delivering the service, but rather provides discounts based on the percentage of a school's student population eligible for the National School Lunch Program, with a small additional increase for rural schools.

As we discuss modernizing E-Rate, and specifically setting bandwidth goals, does that current distribution method equitably provide for schools that may have fewer poor students but dramatically higher costs of service?

Whomever.

The CHAIRMAN. I join in that question. We both suffer, as rural States, particularly under the sequester.

Mr. COULTER. As you know, I'm a big fan of E-Rate, but I also believe, in business, that there are few things that can't be made better and more efficient. I think, as you open up E-Rate in the FCC process, issues of fairness should be looked at in all areas—across States, across rural and non-rural, across poor and wealthy. And, just as technology has changed over time, there may be good ideas that are available to you today to address some of these issues, Senator.

I would highlight, however, that one thing we've learned in business is, if you have something that works, don't mess with it too much. So, while we look for an even better and modernized E-Rate, I hope we will learn from the success we've had.

Mr. FINN. Senator, it's a good question, and I'm not an expert on the distribution of various schools, but what I would say is, the recommendation that we've made and are focused on is really to build the minimum standards in bandwidth for schools based on the number of students, whether they be in a rural area or an urban area, so that we're actually not just driving the connectivity to the school, we're driving the connectivity and the benefits to the student. And I think that that's really the clear focus as it relates to: How do we ensure that all students are participating in the technology advancements that can be benefited from a new E-Rate Program?

The CHAIRMAN. Please.

Dr. ABSHIRE. I would just say that my direct experience over the last 15 years in our district is, it's a—our district covers 1,036 square miles in southwest Louisiana, so we have urban areas, we have suburban areas, and we have deep rural areas, down in the Bayou and in the rice fields. And what E-Rate has done with that formulaic approach to it is that we have been able to build out, in last-mile initiatives, to our rural communities, where, I think, as Mr. Coulter or Mr. Finn expanded upon, that it has been a community-wide effort. So, as we have grown and had that connectivity to our schools, the fiber has been laid that's allowed the entire community to grow and expand and have opportunities that were not there before.

So, I would say, for the most part, the approach is working well. I think there's some tinkering to be done with that. But, I have confidence that the FCC and USAC, with the massive amount of data that they have, can examine and look at the metrics and

make good, reasonable, reasoned proposals that will do this last bit of work that's to be done.

But, we have gone tremendous lengths to reach out into our rural communities, I know, in our state, and it has made a difference—for the economic development in the entire state.

The CHAIRMAN. In order of appearance, the next question will come from Senator Schatz.

**STATEMENT OF HON. BRIAN SCHATZ,  
U.S. SENATOR FROM HAWAII**

Senator SCHATZ. Thank you, Chairman, and thank you, Ranking Member.

Thank you, Chairman, for working on this over the years. Certainly, the State of Hawaii, over the last couple of years, has really benefited through our applications. And, in the interest of the—in the interest of time, I'll go straight to one of my questions.

The FCC's definition of "rural areas for schools and libraries" is one that is located in a non-metropolitan county, as classified by OMB's list of metropolitan statistical areas. The problem with that is that the island of Oahu, which contains Honolulu, the entire island is considered urban, which is just not true, as a matter of common sense. And so, I wonder if any of the testifiers could offer some insights with respect to what kinds of modifications could more accurately reflect the true nature of communities and how broadband ought to be distributed through those communities.

Ms. LORD. I would only respond, Senator, that that's a very complex question, and I hope that the Notice of Proposed Rulemaking, which the FCC is releasing soon about both the E-Rate Program, would give us a chance to study that and address it.

The complexities of the E-Rate Program are, as you well know, that if you change one tiny thing, there can easily be a domino effect in unanticipated consequences. So, I wouldn't hesitate to give any—I would hesitate to give any specifics here.

Senator SCHATZ. I just have one quick additional question, for Mr. Coulter. You said something very intriguing, which is that, "Educational technology can eventually be delivered within the textbook budget." In that, do you—are you talking about just curricula and programs, or do you imagine that eventually it will be—it'll basically be an all-in cost covered by the current cost of textbooks?

Mr. COULTER. The most recent data I have on this is—L.A. Unified School District did a recent tablet RFP. They required those tablets to be loaded with usable curriculum; in this case, from Pearson. Those tablets were delivered for under \$700—about \$680—include with insurance, et cetera, fully loaded with curriculum, insured for 3 years. So, think of that as \$230 a year. If you look at the textbook budgets in the school district, that's below the textbook budget.

Senator SCHATZ. Thank you.

Thank you, Mr. Chairman.

[The prepared statement of Senator Schatz follows:]

## PREPARED STATEMENT OF HON. BRIAN SCHATZ, U.S. SENATOR FROM HAWAII

Thank you, Chairman Rockefeller, for holding this hearing and your leadership on the E-Rate program. Every student should have the opportunity to develop the skills that they need to be competitive in the workplace, no matter where they live or go to school. The E-Rate program is the cornerstone of bringing technology to schools and libraries.

Rural areas in Hawaii rely on E-Rate to provide telephone and Internet connectivity. Schools located in these areas tend to have low-income communities where 60 percent of students are on the free and reduced price lunch program. Last year, the state received record breaking funds—\$17.8 million—through E-Rate because of its efforts to upgrade the network in schools. On the rural western coast of Oahu, E-Rate has helped to implement network upgrades that provide real time data to personalize instruction for the student. According to Wendy Takahashi, Principal of Nanakuli Elementary School:

“Now every student has access to online instruction and teachers have access to student data throughout the school day. These upgrades have provided wireless access to the entire school, whereas previously our coverage was inconsistent and sporadic throughout the day.”

The E-Rate program has also modernized schools’ daily operations. School attendance, announcements, and student assessments are done electronically. As an island state, videoconferencing has become an essential communication tool for teachers and principals. For instance, one Complex Area in Maui County includes schools from West Maui, Hana (East Maui), and the islands of Molokai and Lanai. With budget shortfalls and the high cost of inter-island flights, video conferencing provides ease of access and ultimately saves faculties’ time and schools’ money.

Digital learning technologies are transforming the classroom learning experience. The Hawaii Department of Education is looking to purchase and distribute digital instructional materials and devices to each student. For students where English is their second language, the state is implementing an online learning program to increase their English proficiency.

One of the state’s goals is to increase science, technology, engineering, and mathematics proficiency statewide. E-Rate makes it possible for students to access STEM carts, which provide interactive lessons in science, mathematics, and engineering to students. As the state continues to implement digital curriculum, more robust levels of connectivity are needed.

In Hawaii, I have heard of instances of when classrooms are not able to use the Internet while other grade levels are conducting online testing because of insufficient bandwidth. Clearly, we must continue to work toward increasing the bandwidth in order for schools to handle increased traffic to their networks. This is why I support President Obama’s ConnectED Initiative to connect 99 percent of students to broadband and high-speed wireless. Improving connectivity in the classroom is a critical step to preparing our students to compete in the global economy.

I appreciate the witnesses for testifying today, and I look forward to working with Chairman Rockefeller and the FCC to update the E-Rate program.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator.  
Senator Johnson.

**STATEMENT OF HON. RON JOHNSON,  
U.S. SENATOR FROM WISCONSIN**

Senator JOHNSON. Thank you, Mr. Chairman.

Based on my briefing, it would have been nice to have somebody from the FCC that could maybe answer these questions directly, but it does look like there are some problems with the program. For example, that apparently there is currently \$5 billion in the E-Rate account. There are certainly backlogs, in terms of appeals that date back to 2003, a backlog for funding commitments go back to 2010.

Are any—anybody on the panel aware of some of those problems with the program that they can speak to?

Mr. COULTER. As I said earlier, I'd be surprised if there weren't a number of things we could do to make this longstanding, successful program more efficient.

One of the things I'd note—and it's perhaps a bit ironic—is that E-Rate is predominantly a paper-based program for applications. And those paper-based applications have become so complicated that one estimate has \$50 million to \$100 million of consultants are used by schools just to figure out how to use the paper-based processes.

Senator JOHNSON. So, you're—

Mr. COULTER. I'm sure that—

Senator JOHNSON. Right, you're dealing with a Federal program, here, and that's part of my problem, my skepticism of this.

Mr. COULTER. I think that can be fixed in this process.

Senator JOHNSON. Well, that—you know, I hear that all the time, you know, that we just—there's a government reform right around the corner. And it's amazing how many decades have gone by without that reform.

Mr. Finn, how much—how many sales does Cisco have to the school market?

Mr. FINN. Well, we don't break it up specifically by segment. I am responsible for U.S. public sector, which includes the State/local education and the Federal business. And our business is about a \$5-billion business.

Senator JOHNSON. Out of that \$5 billion, can you give me an estimate of how much of that is funded by local school districts, possibly states, versus the Federal Government?

Mr. FINN. I don't have that breakdown with me, Senator. I'd be happy to provide that to you and the Committee.

That's not the way we measure our business. Our real focus—

Senator JOHNSON. OK, the reason I ask is, as I look at the figures I have, of total spending on education, we spend an enormous amount on education in this country—over a trillion dollars this year. About 6 percent comes from the Federal Government. I, personally, think education is, by and large, a local issue. And when you take a look at the problems in the E-Rate Program—again, you know, I mean, we're spending a couple of billion dollars, there's a \$5-billion backlog; it's a paper system. I'm not quite sure why we'd want to expand this program if it's not really working all that well.

And I have to also challenge—when you take a look at test scores over the years—I was involved, in a local basis, in local education. We did something called an Academic Excellence Initiative. This was probably about 10 years ago. I typed into the computer—back then, probably Yahoo!—"educational productivity." Zero results.

So, I guess my—I understand it all makes wonderful sense and technology can drive productivity. I just don't see the results, truthfully—I mean, I see anecdotal evidence, but, I mean, overall, test scores are flat. I guess I'd to talk to Dr. Abshire about that.

Dr. ABSHIRE. Thank you, Senator. I'd be happy to comment on that.

Let me, first, begin by saying that I would say that the E-Rate Program, in its infancy, which—I began processing applications as a local district person responsible for that in year one—has undergone what I—substantive changes, in terms of paperwork. As an

example, last year, when we filed our applications, we did not use any paper at all. Many, many applicants have gone to the online. While the paper option is still there, I would say that, for the most part, that's people that are just getting into the program. Those of us that have been filing for several years, USAC has made tremendous progress, in terms of their online applications process.

What used to take us, really, 2 weeks, myself and an administrative assistant, now took us, this year, about 4 hours. And so, the productivity and the efficiency component for the online application has been considerably improved. And that's come from the field, people like myself, practitioners that do this work every day and every year, that have made recommendations to the FCC and to USAC, and that's begun to tighten up.

So, in that aspect, I think we've seen growth. Does that mean that we don't have improvements that could be, and should be, made? Absolutely not. But, this is a continuous improvement process. And, from when we began to where we are now, the two processes don't even resemble each other. I'd take that for your consideration.

Senator JOHNSON. Why shouldn't this be, really, a local control and local funding, where—again, if it's locally controlled, locally funded, aren't you going to make sure that you're going to have the most efficient and effective system—

Dr. ABSHIRE. Well—

Senator JOHNSON.—versus just relying on Federal Government funding?

Dr. ABSHIRE. Well, let me share with you, in terms of local control—all of us have local technology plans that are adopted by our community and our board. And those plans drive our E-Rate application process.

So, as an example, my district was one that was put through a full audit, several years ago. And part of that audit required going back into the board minutes and me providing the alignment between our local-controlled plan, funding, cofunding, and the pieces that we requested for E-Rate, and then went down into the schools to look at how the equipment was being used, how were we supporting it, in terms of teacher training, computers at the end of the wire, and professional development for all of our staff. And so, you know, we came out and reported very well, because we had that local decision.

It is my decision, along with my staff and our board, as to what we apply for, in terms of needs assessment and based on the types of connectivity and digital content that we need, and online assessment.

So, I would say that there is a great deal of effort being expended locally to make those decisions, and only requesting from E-Rate what we can support, the non-discounted portion.

Senator JOHNSON. OK.

Thank you—

Dr. ABSHIRE. I hope that helps, Senator.

Senator JOHNSON. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Johnson.

Senator Blumenthal.

**STATEMENT OF HON. RICHARD BLUMENTHAL,  
U.S. SENATOR FROM CONNECTICUT**

Senator BLUMENTHAL. Thank you, Mr. Chairman.

I would begin by taking issue, with all due respect, with my colleague from Wisconsin and his statement that the program isn't working all that well. You know, at a time when we bemoan and criticize government, this program is a real American success story—the government providing resources and shared responsibility for a means of communication that is vital to many underserved and technological needy parts of our country.

So, I want to thank and commend the folks who are here today to give us their insights and to reinforce that view.

I want to thank our Chairman for really pioneering and championing this program, E-Rate, along with a new member of our committee, Senator Markey, who is attending this committee for the first time. But, most particularly, Mr. Chairman, thank you for holding today's hearing so that we can amplify and really emphasize the importance of improving the program, as our witnesses have said, where it's necessary to do it, to make a success story even more successful.

And certainly in Connecticut, the E-Rate Program has helped provide \$370 million to Connecticut schools and libraries in need, connecting communities and improving learning opportunities. The impact is not on a few handfuls of students here and there; it is literally on tens of millions of students across the country.

And rather than focusing on the negative, I really want to elicit from you, perhaps, your comments on how the application process for these communities can be made less time-consuming and burdensome. I'm going to be limited, in terms of my time, but I hope you will give us—both you, Ms. Lord and Dr. Abshire, and our two other witnesses the benefit of your views on that subject, because you've really been there in the trenches, working for this program.

And I want to just emphasize another point that has been made, because I am Chairman of a subcommittee called Competitiveness, Innovation, and Export Promotion. And if there is an area where we need to be more competitive—and both of you put your finger exactly on that point—other countries are moving ahead of us, which is just unconscionable for the greatest nation in the history of the world, the most technologically advanced—to have its children learn less than other children through this means of technology, is just unforgivable.

So, maybe if you could share your insights, Ms. Lord and Dr. Abshire.

Ms. LORD. Thank you. I'll try to be fast.

In Maine, we give a tremendous amount of support to our libraries and our schools with the paperwork. And, in fact, we do a consortial application that includes over 900 schools and libraries. And what the schools and libraries need to do is sign a letter of agency, that's very carefully crafted, that gives the Maine School Library Network, which is run by a group called Network Maine, the authority to apply for the Federal E-Rate Program on their behalf. So, they have to do practically nothing; they have to sign a letter. This works really, really well for us. There's no school or li-

brary in Maine, to the best of my knowledge, that's ever been accused of waste, fraud, or abuse.

And the reason that we are so pleased to hear your words and so desperate for E-Rate 2.0 is that we still have lines, waiting for our computers, just as Senator Rockefeller said. We still have video latency, where a student can be taking a course and all of a sudden the video freezes and you have to wait for it to proceed. These are kids that are used to HDTV. That doesn't impress them at all. We still have time limits on our computer use in our libraries. The Bangor Public Library sees 800 people a day, and so they have to limit the amount of time anybody can be on a computer. That's a little bit aside from your question, but I think—

Senator BLUMENTHAL. No, it's very valuable. Thank you.

Ms. LORD. Thank you, sir. I think it depends on how much support the State can give, and we give a tremendous amount of support.

Senator BLUMENTHAL. Thank you.

Dr. ABSHIRE. Senator, thank you for the opportunity.

I would say, just as our country has changed and evolved, our schools have changed and evolved, and E-Rate is changing and evolving. And your question around, you know, "What are the things that we could do?"—one of the things, I think, that would be very helpful—and many groups that I'm a member of and, you know, have worked with these organizations, that are my peers—ISTE and CoSN—we've proposed the concept of an Evergreen 470, which would allow those of us that have long-term contracts already in place for pieces of business, that that process would be shortened in somewhat—a little bit more concise around doing that. And I know that's being considered.

There's—you know, we have a great opportunity, with the opening of the rulemaking process. And I know that those of us that do this work in the field every single day, and have done it for—you know, going on two decades now, have a lot of feedback and input that we're going to provide to that process. And we are delighted that the FCC and USAC will afford us those opportunities.

The other thing I was going to just mention very briefly is what you mentioned about the global competitiveness and the concept that we cannot fall behind. In my role as the past Board Chair of the Consortium for School Networking, which is the membership organization for my peers—have the opportunity to very—visit South America, spent some time in Uruguay. I was blown away by the concept of—every student in a very poor country now has a device, and they have built a wireless grid across that country. Wherever those children are, and their parents, they have access to a broadband connection for learning, 24/7. While they have not eclipsed us, in terms of learning capacity yet, they are on their way. And to drive down the road and to see very, very poor communities, that really didn't even have basic sanitation, and the children were sitting out on porch steps, connected with a device, working at 7 or 8 or 9 o'clock at night—was something that was a wake-up call for me, as a person who has spent 40 years being very passionate about children and learning.

And we have our work cut out for us, but, as you said, this is the greatest nation in the world, and, if not now, when, and, if not us, who?

Senator BLUMENTHAL. I thank all of you for being here today. I hope the FCC hears you and hears us. And thank you.

Thank you, to our Chairman, for your historic contribution.

Thank you. Forgive me, I've got to go vote.

The CHAIRMAN. You've got to scram.

Senator BLUMENTHAL. Thank you.

The CHAIRMAN. Well, I guess I get to ask a question, don't I?

[Laughter.]

The CHAIRMAN. A couple of things I'd like to clarify. We always talk about America falling behind. And then we have plenty of data which shows that that's happening in math and science and other things—languages, whatever. But, then when I hear that South Korea and others are—actually, I remember when we—when the E-Rate started—something I still haven't figured out; one of you can help me on this—there was a lot of, sort of, fulminating and “What's going on here?” and, you know, “Where's the computer and where's the teacher?” Houston went wireless and was—achieved 100 connectivity in one day. I don't know how that was possible, but that's an example of America not falling behind. Whoever that superintendent was, it—of education in Houston—he did something extraordinary.

So, when we talk about falling behind—Mr. Coulter, I'll call again on you and others—Korea, Japan, other countries—it's not really a matter of national pride. You know, if somebody doesn't score a touchdown, it isn't any big deal. In fact, I was very pleased to read—I think it was in the *Wall Street Journal* the other day—that, in this mania of sports which has overtaken our nation, to the detriment of education, only 4 percent of Americans watch something called baseball; 2 percent watch hockey. Puts things in perspective. Everybody goes to school.

So, what—I'll go again to you, Mr. Coulter—what, on the international side—what price do we pay, in terms of not being able to do what others have either achieved or are much more aggressively going after than we are?

Mr. COULTER. As I said, I had my Sputnik moment when I sat with the Minister of Education and Technology—note that's a single agency—in Korea, and I asked him where he goes for innovation. Without a moment of hesitation, he went—he said he goes to the United States.

So, we remain the hub of educational technology innovation. But, in many industries, we have a—seen situations—semiconductors, for example—where things invented here are deployed, creating jobs in other countries. And we bear that risk here, that our innovation will be better deployed elsewhere.

So, essentially, the risk to us is not that they are more innovative than we over time, I believe; it's but that they have a better deployment mechanism. And the reason is, Korea acts centrally on education. I think we have been very well served by being 16,000 individual school districts, on most issues—local involvement in education. However, technology requires scale. And places like Korea and Turkey can scale more quickly.

So, the long-term risk to us is this. When I spoke to the Korean Education Minister and asked him about, you know, how he was thinking about the tradeoffs between paper and technology, he stopped me and said, “I just believe that if we get technology into our kids’ hands, they will do wonderful things with them—with it, and they will be more prepared for the jobs of the future.”

Our children today live largely in a technologically enabled world, and we send them to school with 40-pound backpacks filled with paper. And that risk to us will play out in any number of ways. We bear the risk of losing a generation of technologically enabled students and a technologically enabled workforce if we don’t act more quickly than we have so far.

So, that’s the long-term risk, is that our skills and innovation somehow fall behind. They haven’t, so far. I hope they won’t in the future. But, this is an investment we can make to protect that.

The CHAIRMAN. Thank you for that.

It occurs to me—and Senator Ayotte has come in, and I want to call on her—and I think you answered this question very well, Dr. Abshire—you keep improving what you’ve got, what was put in place a couple of decades ago. And it’s not always even a conscious decision; it’s just that you have to, and you do, and you get—and Louisiana’s not a rich state, so the State funding that you get is precious to them. And so, I think what we’re talking about here—and I get this sense from the panelists—that we need to look for what isn’t working well in the E-Rate system, but the focus, assuming, therefore, that we are honorable people and will do this—and many people will do it for us, advise us—but, to focus on the future. If we get dragged down into some of the kinds of questions that I can imagine—I mean, I could ask all kinds of questions about West Virginia, and I am sure that Senator Ayotte could, too, about funding-formula fairness and small states.

And I will, and I want to see that change, and I want to see that better. But, if we are going to get to where we need to go, we have to concentrate on—not because he’s the President, but what he suggested and what you, sir, suggested in your—are going to suggest when your report comes out—and that is that we go to E-Rate 2—and getting there is going to be major, fundamental for our country, a huge challenge, something we absolutely cannot miss in that opportunity.

Senator Ayotte.

**STATEMENT OF HON. KELLY AYOTTE,  
U.S. SENATOR FROM NEW HAMPSHIRE**

Senator AYOTTE. Thank you, Mr. Chairman.

I want to thank the witnesses for being here today.

And I do have to say, up front, that New Hampshire happens to rank 50th out of 50, in terms of what we get on our return for the E-Rate Program. So, this issue of fairness is very important to me, in terms of not only how the funding formula is used, but also access: access for smaller states. I know the Chairman shares this concern for rural communities. And so, I hope that we will work on this issue from the broader context of how states are treated under it.

I hope that we will also, at some point, hear from the FCC on this issue. They are about to undertake an important rulemaking on this, and they have an important role in front of this committee on E-Rate.

I had a chance to meet with Mr. Coulter in advance of this hearing, and something that we talked about, and that I've been thinking a lot about—in terms of how E-Rate operates right now. How can we be more efficient in how E-Rate is operating, because the application process seems like a real challenge. And I certainly would like to hear the perspective from Dr. Abshire, as well as, I'm sure Ms. Lord has a perspective on this, too, about how we can better accomplish what we all want to accomplish—bringing technology into the school systems, and making sure that kids can take advantage of that technology.

So, I will start with Mr. Coulter.

Mr. COULTER. We had had some discussion already of the evolution that's necessary in the application process to make it less painstaking and more accessible, particularly to schools who can't use some of the infrastructure that places like Maine have put in place, wisely, over time.

A couple of other areas I would point out:

First of all, I would hope that E-Rate 2.0, if that's what it becomes, has more transparency. We know, broadly, everywhere today, the value of data. There is massive data within E-Rate, and we don't offer it to schools as openly as we might. Schools in the same district may be buying from the same provider—excuse me for this—

Mr. FINN. That's fine.

Mr. COULTER.—but, they may not know what the other provider—what they're paying. That information, if it were broadly available, I think will drive savings beyond the program itself. So, if we can create some transparency to get market data about what's right—there are schools out there, outside of E-Rate, that are paying probably four times market for broadband connections just because they don't know. And we can—I think we can go a long way to solving that. It would be extraordinarily effective.

Second, within E-Rate today, there are priority levels that are set up for access that don't work exactly correctly for Internet infrastructure. They separate getting the wire to the school and then spreading the Wi-Fi into the school. So, I think we can create some efficiencies just by looking at the problem in today's way. And I know the FCC is on this, and I am optimistic that they will make progress on it. But, the issue of fairness, the issue of efficiency, Senator, I'm exactly aligned with you on that, and I think this modernization effort gives us the path to get those things done.

Senator AYOTTE. Great. Thank you.

And I certainly would like to hear the school and the library perspectives, as well, from those who've had to work their way through this.

Dr. ABSHIRE. Thank you, Senator. I'd be happy to provide some remarks on that.

I think, as we mentioned a little bit earlier in the hearing, those of us in the field that are filing for E-Rate every year, responsible and accountable for the dollars and the services that come into our

district, are keenly aware of the growth in the program over almost two decades. As I said earlier, the predominantly paper process has made extreme changes, in terms of online filing. There are still pieces that can bring more efficiency, but I would—

Senator AYOTTE. I'm sure we've already talked about the—

Dr. ABSHIRE. Yes.

Senator AYOTTE.—irony of—

Dr. ABSHIRE. Yes.

Senator AYOTTE.—the technology issue and the paper filing for E-Rate.

Dr. ABSHIRE. Yes. Well, to—the good news piece of this is that many, many of us use—are now in a fully online filing process. So, that's the good-news piece. There's still room to improve, as in any process. But, the improvements have been dramatic.

The other efficiency piece, the concept of filing every year, there are several service pieces of E-Rate that we could file a multiyear application, which would do several things. It would reduce the burden on the district, which is significant during certain periods of time. It would also reduce the burden, at USAC, on having to process all the paperwork, and the personnel that are required to look at the applications. So, I'm strongly in favor of a multiyear application.

And I think that—the keyword for me in this whole process is “opportunity.” What an opportunity we have to look back and use the data, as Mr. Coulter has mentioned, that is there. I know that many State purchasing consortiums have come to be. I know, in Louisiana, we have a State E-Rate coordinator, and all of the CTOs and COs in our State work together and regularly meet to discuss these processes to be able to fine-tune and to provide in-State efficiency.

So, I hate to say this, but it has always been about leadership. And the leadership in some states and some districts is strong. But, I look forward to renewed and increased leadership at the Federal level with the FCC and USAC and certainly with Congress taking a look at this again. Because I can say, unequivocally—because I've been doing this for 40 years, so I'm one of those more mature individuals that remembers when there was no Internet in schools. And—

Senator AYOTTE. I think almost everyone up here would be in that position.

[Laughter.]

Dr. ABSHIRE. Well, I didn't want to—I didn't want to be bold and say that—

[Laughter.]

Dr. ABSHIRE.—Senator.

But, to see what has happened, transformationally, in our schools, and to watch—because I—every week, I'm in classrooms. I'm not a figurehead that sits in a central office and signs papers; I'm in school with children and with teachers and with principals, and I know firsthand what has happened, in terms of educational attainment and achievement. And, while we can't quantify and say, “Well, absolutely, definitively, this is E-Rate that made that difference”—and some of it is anecdotal, but I can tell you firsthand, I've seen it happen classrooms with preschool students and high

school students that are more connected at home than they are in our school. And these aren't children from wealthy families; these are children that are in Title I schools, but still have connectivity in the community, and they have a smartphone, and they are extremely connected, in terms of knowledge and information and research. And maybe they're just Googling something about the entertainment industry, but they're reading at phenomenal rates. And, as a former librarian myself, I'm OK they're reading online. I'm OK with reading online.

[Laughter.]

Dr. ABSHIRE. So, I hope that helps, Senator.

Senator AYOTTE. Well, I have a 5-year-old and an 8-year-old, so I'm experiencing this myself, and they're much more tech-savvy than I am.

I don't know if you wanted to add anything, Ms. Lord. I know my time's up, but I certainly want to hear your perspective if there's anything.

Ms. LORD. Thank you.

We have spent an awful lot of time, in Maine, educating our schools and our libraries about the E-Rate participation, the return on investment from that fairly minimal participation. If somebody can spend a day filling out paperwork and get \$20,000 for their school district or their library, it's just a—it's just a no-brainer.

I would love to meet with you, aside from this, and go into the details about how we have done that in Maine, because 99 percent of our libraries are connected to the Internet, and there's—something like 96–98 percent also have wireless connectivity.

But, back to your question about how the process could be altered, we do a statewide consortium that includes over 900 schools and libraries. And, because we submit a consortial application, our application is one of the last reviewed by the SLD. And we wish that there was some way to expedite looking at these large consortial applications. We've been submitting them now for—since—I think it's 1998 or 1999. And the same thing about the extended contracts that you mentioned, there's never been any question of waste, fraud, or abuse, and we sure would love not to have to be at the tail end of getting that money approval. We find schools and libraries applying for the needs and not having a clue of when funding is going to come in for what they need for the very next year. So, that would be my suggestion, on expediting the process.

And I'm so glad the NPRN is coming out—NPRM is coming out, because I'm sure that there are other ways that it can be done, and we'll have time to study those and formulate responses.

Senator AYOTTE. Good.

Well, my time is expired. And, Mr. Finn, I'm not picking on you. I'm probably doing you a favor, actually, by not asking any questions.

[Laughter.]

Mr. FINN. That's OK.

Senator AYOTTE. But, thank you all for being here, and I look forward to New Hampshire not being 50th on the rate of return for our E-Rate contributions.

[Laughter.]

Senator AYOTTE. So, thank you.

**STATEMENT OF HON. MARK BEGICH,  
U.S. SENATOR FROM ALASKA**

Senator BEGICH presiding. Thank you very much, Senator Ayotte.

I appreciate you all being here. Senator Rockefeller will be back momentarily; he had to go down and vote. And I know we have another vote in progress, a second vote right now occurring. Yes, I—yes, that's why I wanted to make sure, so you wouldn't miss that one.

So, let me, first, say, again, thank you all for being here. I want to, obviously, thank the Committee for having this.

In Alaska, all school districts, eight private schools, one State school, 74 libraries, and two education service agencies apply for E-Rate funding on a regular basis. The average discount for Alaska is 78 percent, to give you a sense of the high cost and the capacity. And so, we're very familiar with this program, more than probably we'd want to be, but it's important for our livelihood and ability to do the work in Alaska.

I know, Sheryl, you made some interesting—in your written statement, I really appreciated, and I can't agree with you more, and many of you, that—on your testimony, that I was able to step and also read. In Alaska, 90 percent of our libraries are connected; 40 percent of our schools are connected, at 1.5 megabit. To achieve 1 gigabit will be a huge challenge for us. I mean, no question about it. Four, kind of, simple things we think are a part of the equation, and then I have one or two quick questions for you all.

One, we think the availability to offer this level of connectivity on the part of the service providers is very important. Improved infrastructure, including upgrades to videoconferencing—we utilize, as you can imagine in Alaska, videoconferencing, video health services, as a driver in our rural communities and in schools and libraries, to make sure they can handle this, so the infrastructure is there to handle this capacity.

And also, the dollars. We appreciate the 78 percent, but, honestly, in a rural village which has no property tax base, 22 percent is just an unbelievable burden. When you think of the high cost to deliver—even though we debate the FCC recently, and we think they should correct this, and I think they will—when they made the claim that it was cheaper to build in Alaska than in the Lower 48, which—I missed that, in all my life, being born and raised in Alaska. So, they're a little confused on that, and we're working with them to help them see the light. But, also the continuation of universal service for universal health as well as education, this is very important.

You know, the idea—and I think—again, Sheryl, you talked about modernization, which we agree, and I don't know if you're familiar with the recent comments filed from FCC on Funds for Learning. I don't know if you're familiar with that at all, but here's what it does. In the filing, the group suggests that the program move to a per-pupil allocation at an E-Rate formula. And you can imagine—I have a small village community, Pelican, 17 students—basically, they ain't getting any E-Rate that's going to do anything.

I mean, at that kind of formula. You know, raising the program cap to \$4.5 billion is great, but, you know, it's long overdue, and there's a lot more that needs to be done here.

And so, when you think about this issue—and I know you're kind of in the trenches, and I appreciate that; and, as a head librarian, you're head of the library association in Maine. I mean, I—you understand it, also. We have to be careful. And I know sometimes it's easy for FCC—and this is more of a commentary, and just—if you have any response, that's fine—for the FCC to kind of get a one-size-fits-all, because it's easy to manage and it's easy for the—you know, honestly, for the companies to manage. But, the reality is, when you have 80 percent of the villages not accessible by road in Alaska, and you have communities that are in desperate need of this technology in order just to survive, or it takes one day to download a video, right now—one day to download the video that the school will use, if they can use it—you can imagine what that does and what it—what the—gap.

So, at the end of the day, you know, we need to make sure that it's truly a universal system, not based on who can invest the most, who's closer to the proximity of the service provider. And I'd be interested in, first, maybe, Sheryl, if you want to respond, on the Funds for Learning, if you're familiar with this per-pupil ratio that they're—that has been kicked around, if you have any comments, or this—then, generally, any comments you all have.

I know I've read your testimony, and I appreciate that. I knew I'd be in and out of this meeting, so I wanted to take a glance at that. But, maybe if you want to make any comments. And again, thanks for your—did you say 40 years in—

Dr. ABSHIRE. Forty, uh-huh.

Senator BEGICH.—in the trenches? Appreciate it.

Dr. ABSHIRE. It's a lot of good hair color that—

Senator BEGICH. Yes.

Dr. ABSHIRE.—helps me get through the—

[Laughter.]

Senator BEGICH. My parents were teachers, my sisters are teachers, my sister-in-law is a teacher—one just retired after 26 years in the trenches, working with students and creating capacity of learning. So, thank you.

Dr. ABSHIRE. Well, it's an honorable profession. I know that your parents raised you well if you came from educators, so you certainly understand.

Senator BEGICH. I don't know if they'd say that at times, but I appreciate that.

[Laughter.]

Dr. ABSHIRE. I'm going to bet they would say that. I have a daughter that teaches in Texas, so I know the pride in having, you know, a child that's in education.

I am somewhat familiar with that proposal, and I think what I would say, Senator, is that—again, I sound like a broken record, but this whole concept of opportunity. I think the more conversation that comes to the table about E-Rate and the opportunity to finesse and to tweak a system that has, quite frankly, had tremendous and phenomenal success in such a large-scale way, is a little bit overdue. So, we're having the conversation now. I think that

proposal—I think what we have to do in—when we look, in terms of goals, that we make sure that they’re crafted to fit the need. I also have, in my school district and certainly my state, very small rural schools, that that process might not work optimally without some type of a floor—

Senator BEGICH. Right.

Dr. ABSHIRE.—some type of a process that helps take that into account.

The other thing that I know you’re keenly aware of, coming from your state, is the fact that we’ve got to figure out a way where the rural communities cannot be left out of this Priority 2 internal connections piece. There are lots of ideas floating around, but I’d go back again to Mr. Coulter’s earlier comments about the fact that, with the tremendous amount of data that we have on this program, the concept of transparency and quantifying that data in some way that helps us really look at state-by-state, district-by-district, and parsing that data in a way where we can make what we—what everyone tells us in school districts to do, make data-driven decisions—I think that we need to apply that same rationale to these processes.

So, I think we’ve mentioned, several times, you know, the proposed rulemaking process is going to be active and engaged. And I think all of us welcome that, because it’s only through this connected and serious dialogue about, “How do we get from A to B to C and remain competitive, but yet understand the responsibility that we all have with this process around E-Rate?” that we’re going to come to consensus and middle ground that, at the end of the day, is going to do what the fund was originally crafted to do, which is to provide access and equity to every child in America, no matter where they live, no matter where their parents work, and no matter where they go to school, and in such strategic ways that we can point with pride to the program, as we do now—you know, I’m very proud of what’s happened in this program. And I know that we have an opportunity to continuously improve it and have it make sense for everyone. But, we’re not all going to get what we want. We know that.

Senator BEGICH. Sure.

Dr. ABSHIRE. But, I think it’s the data—is the key piece, Senator.

Senator BEGICH. And is it fair to say, when you say “equity,” you mean also universal, that it doesn’t matter where you live, who you are, how remote, how urban, that you should have equal access and speed and otherwise—

Dr. ABSHIRE. I think that—I think—yes, sir, I think that goes without saying. It—again, I come from a state—I have—we have a K–12 school that sits, surrounded by rice fields, and it doesn’t get any more rural than, perhaps, in Alaska, on a mountaintop. But—

Senator BEGICH. Right.

Dr. ABSHIRE.—we have significant problems there, and E-Rate has been the solution to inform and engage that entire community with connectivity.

Senator BEGICH. Fantastic.

Any other comments? Sure.

Ms. LORD. There are two organizations that are looking carefully at all States and their needs, and with the aim of exactly what you just said: equity for all.

I'll quickly mention that Maine, my home state, has an issue with islands that are populated—

Senator BEGICH. Yes.

Ms. LORD.—unbridged islands with schools on them, and getting equal connectivity for them is a huge challenge, as you might imagine.

I belong to an organization, because I am the Maine State Librarian, called the Chief Offices of State Library Agencies, and I'm the liaison between the Nation's State librarians and the American Library Association Office of Information Technology Policy. And I chair their E-Rate Task Force. And we talk to the E-Rate coordinators from every state that has one, and most states do, monthly and share common concerns and common issues. And we're very aware of the challenges that your state meets, and we hope that, in the Notice of Proposed Rulemaking, that we can make a point about this equity of access and to provide what people need.

We have tiny libraries in Maine that may be open 15 hours a week and run by volunteers. They're happy with the T-1. They may be happy with the T-1 forever. But, we have others who already have a gigabit of connectivity, because that's what they need. This program has always been based on basic connectivity, and that definition has changed radically, as we all know.

Senator BEGICH. Right.

Ms. LORD. So, just to let you know that State librarians and the Washington ALA Office are watching this whole scene.

Senator BEGICH. Thank you very much.

Mr. COULTER. For Senators worried about the rural issues, I would suggest you keep your eye on three things:

First of all, we understand that the digital divide is a large discussion today. We need to make sure the digital divide isn't just about income, it's about location also.

Once you define the digital divide correctly, you get to my second point, which is, the data emerging shows that we may make large investments on one side of the digital divide, but the payoff is highest moving those people across the digital divide. Any of the people on the right side of the digital divide today will find these services anyhow, so the payoff of making the larger investments into these rural communities is actually higher.

The third thing to keep an eye on is, there is a disproportionate cost as you get more rural. I believe that we have to bear that. So, as people try to cap the expansion of the program, we have to understand that that pressure will put disproportionate pressure on people on the wrong side of the digital divide.

Senator BEGICH. Yes, it's a good point. I mean, when you think of, maybe, the interstate system or the power or telephone or rail, you know, we made the decision, in those public policy decisions, that, you know, we're going to electrify the country, and no matter where you are. And the costs may be higher to get to some and less than others, but, overall, the benefit will be higher than it is without it, no matter where you live.

So, you know, where I think a lot of people are still grappling with the fact that we—this technology is no longer an “extra,” it’s the basis. And in the generation next, if someone has a landline, it’ll be a miracle. So, we have to think of all this as a longer value-add. And so, it’s a good point you make there, so thank you.

Let me—I’m going to turn to staff, because the Chair isn’t here, and I might have the chance to adjourn the meeting, but I don’t want to get the Chair upset. That would be bad, as a member.

[Laughter.]

Senator BEGICH. So, let me pause for just one second. Excuse me.

[Pause.]

Senator BEGICH. What we’ll do—look at that. See, it’s all about buying enough time—oh, and we got two members; this is even better.

Senator Rockefeller, I have made agreements with all of them on all kinds of issues. They’re—

[Laughter.]

Senator BEGICH. They’re very excited about your support. And—

[Laughter.]

Senator BEGICH.—I appreciate that all telecom in Alaska will now be coming from West Virginia.

[Laughter.]

Senator BEGICH. It’s back to you. I just finished, actually, so perfect timing. I’m going to go vote.

The CHAIRMAN presiding. Have you ruined our—you’d better hurry—

Senator BEGICH. I know. I—

The CHAIRMAN.—before they finish the vote.

Senator BEGICH. You know, if we actually used technology in the Senate to vote, we might be able to vote easier. But, that’s another story for another day.

[Laughter.]

Senator BEGICH. Some of us—others—never mind, I’ll stop there.

The CHAIRMAN. Thank you very, very much.

I want to call on the distinguished Edward Markey while officially welcoming him to this committee. He has been doing this for 27 years in the House—30. And he was, right at the very start, one of the—along with Olympia and myself—on the House side, the E-Rate champion. And it just so happens that he’s on the Commerce Committee, which make his Chairman very, very happy.

Senator Markey.

**STATEMENT OF HON. EDWARD MARKEY,  
U.S. SENATOR FROM MASSACHUSETTS**

Senator MARKEY. Thank you, Mr. Chairman. And—I have to learn how to—I have to push the button.

The CHAIRMAN. That happened to me the first time.

Senator MARKEY. Thank you.

The CHAIRMAN. I couldn’t eat for a week.

[Laughter.]

Senator MARKEY. Thank you, Mr. Chairman. It is an honor to be on the Commerce Committee with you and to know that you played, along with Senator Snowe, the key role, over here in the

Senate, in making sure that the E-Rate is available to children in America, to libraries in America, to making it possible to say that there is a democratization of access to opportunities through access to the educational tools, which the Internet provides.

As we were debating all of the big globalization issues in the 1990s, it was obviously critical that the children of America have access to the skill set which they were going to need in order to compete in that global economy. So, as we sped up the speed of change, we also had to speed up the rate at which young people got access to the tools they were going to need.

And so the E-Rate is a big part of that. And, in fact, the—access to the Internet in schools is the first educational technology to have ever been deployed at the same rate for affluent children as it was for the children of the poor. And that's quite a statement about a piece of legislation that has now actually allocated well more than \$30 billion.

And, while you and Senator Snowe were working on that over here, I was doing the same work, over on the House side, to put together the coalition that would make it possible for this incredible program to be there so that kids would have access to it.

And it's my honor to be here on the Commerce Committee with you. I've admired you for so long, and I thank you for your historic work on this legislation.

So, I—and I love the fact that my first hearing in the Senate is about the E-Rate, because, in a lot of ways, it is the educational program of the last 18 years in America. It's well over \$30 billion. It's targeted toward those who need the extra funding most. And you can see, in the hands of any kid, regardless of income, regardless of race, that, once you put the technology in front of them, they're going to be adapting to it just as fast as a kid in the most affluent neighborhoods of the country. And, ultimately, that is what is going to help to ensure that we are competitive in the 21st century, because education is what it is that makes our country great.

I actually had a conversation with George Lucas about this, back in 1993. We had lunch, talking about how we could do something that ensured that every child had access to it. And it was actually built into the 1994 Telecommunications Act, which passed the House, but, unfortunately—and we now know it's obsolete, but it got filibustered to death in the Senate in 1994. But, we're taking care of that now over here. And then Senator Rockefeller and Senator Snowe took up that cause in 1995 and 1996, and here we are, kind of enjoying it.

So, let me ask this. In terms of—and maybe you've already answered these questions—what should the FCC do to improve connections inside schools, including Wi-Fi, across Massachusetts, but around the entire country? Would one of you want to address—

Mr. FINN. Yes—

Senator MARKEY.—that question?

Mr. FINN.—Senator. First of all, congratulations and welcome. And I congratulate you and the Chairman for the historic work on E-Rate. I think that this is the foundation in which we can answer your question, because what we've been talking about this afternoon has really been a critical investment and then, how do we en-

sure that we're getting the results and the efficiencies that are required in order to keep our children competitive and ensure that we're creating the workforce of the future, not just for this country, but that we are globally competitive and having global workforce? So, the work that you've done in the past, and the work that's required in this legislation is really to focus on that.

One of the things that I think we need to ensure that we're looking at is, not just the connectivity of the schools, but the connectivity of the students, in order to put the technology in the hands of the students. It's easy to put technology in the hands of a student. So, you can put a cell phone in the hands of the student, but, without the battery, it's providing no value. And we have to make sure that we're focused on, not just the connectivity of the school, but also the value it's bringing to the student, in order to ensure they're participating in the education of the 21st century.

We've talked about minimum standards. One of the largest fears I have is that we focus on the negative, the waste. I'm from a family of 12 brothers and sisters, and one of the things that I've learned through that process—and it truly is a process—is that you can spend a lot of time focused on the wastefulness of more than you need, but if you don't focus on the wastefulness of less than what you need, you're in equal difficult situation.

And so, one of the things that we want to ensure that we're providing with technology and the policy for a student who can visit Africa, England, and South America from their desktop, whether they're in a rural community or in an urban community, becomes important. And so, I think that we're on the right track. I think the modernization of E-Rate is important for the children, it's important for the country, and it's important for our competitiveness.

So, thank you for the work that you've done.

Senator MARKEY. So, on wireless—

Mr. FINN. Yes.

Senator MARKEY.—do you have a specific plan for wireless?

Mr. FINN. Most of the education systems around the country, and most of the—and many of the E-Rate expenditures—is focused on wireless in order to ensure that these devices are really the devices of the future, in order to provide that access to the world. And I think that the architectural approach of, not just the wired, but the wireless really is a focus on ensuring that we're connecting the student and that we are in a mobile world and that the benefits do land in the hands of the students.

Senator MARKEY. Yes. So, I'm the author of the National Broadband Plan.

Mr. FINN. Sure.

Senator MARKEY. So, I built that into the 2009 stimulus bill. And the National Broadband Plan included a number of important recommendations on E-Rate: setting goals for greater speeds—the issue today is not one of access, it's one of speed—

Mr. FINN. That's right.

Senator MARKEY.—improving Wi-Fi and other internal connections in schools. If coffee drinkers assume there will be a Wi-Fi at Starbucks, then students should assume the same when they walk into a school.

And, third, streamlining the E-Rate application process for schools. Educators should spend their time educating, not filling out the paperwork.

So, I commend the FCC for the work which they have been doing. And I praise the President's commitment to making sure this is a high priority. But, I think it's time for us to establish a plan so that we maintain our excellence, and that it's an articulated plan that mothers and fathers can understand, and the country can understand, so that we ensure that our country is number one, looking over its shoulder at number two and three in the world. And the best way of doing that is ensuring that we take the E-Rate plan and move it to the 21st century in a way that everyone can understand.

Mr. Coulter.

Mr. COULTER. Yes. Since I have two visionaries left in the room, here, I would give you a vision to think about as you watch the FCC's action, going forward. We originally defined E-Rate as access into the school as priority one and then classroom as priority two. What we're saying here today is that we ought to expand that all the way to the classroom.

There's still a missing piece. Other countries have defined the connection all the way to the device. So, Turkey is out buying the device at a national level. We probably can't do that. But, if you can find ways, within modernization, to really complete the connection somehow, I think that would be of great purpose. We have misdefined the idea of "connection," once you get to educational technology.

The good news is, I believe that, if we define it into the classroom, that there'll be enough competitive juices among the device-makers that maybe it'll help us open that market. But, there may be some things that you can do to help that happen.

Senator MARKEY. OK, great.

Dr. Abshire?

Dr. ABSHIRE. Thank you. Thank you, Senator, and congratulations. We all watched your movement to the Senate with great pride, and so we're glad you're here and certainly supporting Senator Rockefeller in this work in this new capacity.

The concept of the wireless connectivity, I think, is one that is important. As the use of technology in classrooms has changed today—primarily, when we first began this process, we had a lot of desktop computers sitting in classrooms with wired connections. With the advent of the tablets, the iPads and—and I would bring a point up that we haven't talked about yet this afternoon, is—the student devices sometimes referred to as "bring your own technology" or "bring your own device" is growing at exponential rates, because the price of the device is becoming so much more affordable that many students, even in economically depressed areas, come to school with more than one device. They may have a phone and then they may have a tablet. And so, I know, in Louisiana, and certainly my district in Lake Charles, we've paid a lot of attention to what has happened, in terms of the shift between a wireless and a wired connection, and we've used E-Rate, I think, very, very wisely to cost-shift some of the dollars as we've been able to move

away from the wired connections and the expenses that that entailed and shifted that to wireless connectivity.

So, in all of our schools, all 70 of our campuses, you can park in the parking lot, you can walk outside, you can go into the gymnasium or the cafeteria, and you're going to have a connection, because that's what 21st-century education demands: kids that are always on. It's not just when you're in classroom.

So, I really appreciate that question, because I think it points to the fact that things have shifted. And so, in districts, with leadership, we've been able to cost-shift away from textbooks and move those costs into wireless connectivity, digital content that provides relevant, current information to students when they need it, not when we want to teach it.

So, I really appreciate the question, and I think it's a valuable point, and I think it shows that the evolution of the E-Rate is—and the fund is doing what it needs to do. The only problem is that pesky cap. If we could just increase the cap, then I think we could see the type of expansion that's needed and that you refer to.

Senator MARKEY. Thank you.

So—would you like to add something, Ms. Lord?

Ms. LORD. Yes. I'm ready to burst, and you recognized it. Thank you so much. I never in a million years thought I would be sitting here with you, Senator Markey and Senator Rockefeller, talking about E-Rate and its impact on libraries. I am so honored—

Senator MARKEY. Neither did we.

[Laughter.]

Ms. LORD. I am so honored to be here talking to you.

First of all, a lot of the conversation this afternoon has, rightfully and understandably, focused on schools, but I beg you to remember the 30,000 people each week who use our nation's 66,000 libraries. I think I just said that number wrong, because I'm so excited. Sixteen-thousand libraries who serve 30 million—

Senator MARKEY. There it is, yes.

Ms. LORD.—people each week. And that is a critical number. And it isn't just students whose worlds are changing, it's adults whose worlds are changing, too. People don't have the same jobs anymore. People need to reeducate themselves and train for jobs, and our libraries are helping them do that.

And, in terms of wireless, 91 percent of our libraries across the country do have wireless. And, in Maine, it's a higher ratio than that. In fact, in the capital of Augusta, where I work, one night watchman got relieved from his duties because he parked in front of the State Library every night and was online. And once somebody figured that out, the poor gentleman lost his job. Now, that's certainly not a plus of E-Rate, but I mention it.

[Laughter.]

Ms. LORD. Some of you may be aware of now-Senator King's effort for one-on-one student devices when he was the Governor of Maine and was one of the first people in the country to say, "Our students need one-on-one personal devices." And that worked in so beautifully with the E-Rate Program, it was the perfect merging, or a perfect storm, if you have.

Libraries are open when schools aren't. And children do come to libraries after school. Children do use libraries in the summer.

Children do use libraries on the weekends. So, I want you to remember that, too, please.

And libraries provide to students and to adult learners all kinds of online resources. Connectivity is great, but you've got to have some content there. You just have a line running around the country—you understand what I'm saying. I don't—

Senator MARKEY. Yes.

Ms. LORD.—need to belabor it.

So, we have all kinds of newspapers online, periodical articles online, and reference books online, which are much, much less expensive than every library purchasing them for themselves and which are available to all schools and libraries in Maine.

So, please, I beg you—and Senator Rockefeller said it beautifully in his opening remarks—libraries, there are fewer of us, but we are critical to the people that we serve, in terms of reaching out to the world, in terms of self-education. And I could sit here and tell you stories, for the next hour, about individual lives, people who have gotten jobs because of the training they had at the library or the online resources at the library; businesses in Maine that could upload huge files of information at the library; small businesses, which are the backbone of the Maine economy, who would not be surviving if they could not go to a library with a broadband connection and upload those files; tourists who come to Maine and stay because they can stay in touch with their businesses. And we've had people actually say, when they came to a library, in Rangeley, for example, a beautiful lake region, and the librarian said to one gentleman who came in every morning for 2 weeks, "I feel so sorry you have to do this on your vacation," and he said, "Are you kidding? If I didn't have this connectivity, I could only stay here a week. Because of this connectivity, I can stay here several weeks with my family." So, that's the kind of thing I can go on and on about all night.

Senator MARKEY. And we thank you for doing it. We—

[Laughter.]

Ms. LORD. Well, I thank you for listening. Schools are important. I taught in schools for 15 years. I just finished a term on a school board. I think I'd rather be in the Senate than on a local school board, I'll be honest with you.

[Laughter.]

Ms. LORD. So, I understand and support, completely, the needs of the schools. But, for goodness sakes, please don't let libraries get buried in all this. And we will be so active and put so much thought into the Notice of Proposed Rulemaking that comes up, and do our very best to support citizens who are not in our public schools, as well as the citizens that are.

Senator MARKEY.—thank you.

And thank—

Ms. LORD. Thank you.

Senator MARKEY.—you all. Thank you all so, so much.

Mr. Chairman, thank you for your leadership on this issue. We need greater speed, better Wi-Fi, a more streamlined process for applications. We've got to make this whole thing work even better, because we have to keep pace with the change that's going on. Our competitors are out there around the world, and they know that

this is key. And, in a lot of ways, it is the proxy, it is the measurement by which a nation is going to be able to determine how successful it will be in the future.

And so, this question, whether it be Massachusetts or West Virginia, is the same one. What are we giving to these kids? You know? And that's our obligation. You just don't take home your books in a book bag anymore. You have to just continue to move on. And the Chinese, the Indians, the Germans, and others, they have a plan. And we don't have to fear these nations, but we should respect them. When America has a plan, America wins. And so, we just need a plan that's articulated, that mothers and fathers understand, and that every community in the country, whether it be in West Virginia or Massachusetts or any other place—

Ms. LORD. Or Maine, and that includes libraries.

[Laughter.]

Senator MARKEY. And libraries. I think the Rockefeller family appreciates libraries.

[Laughter.]

Senator MARKEY. I think they helped to—I think they've helped to construct enough for the country. I think we know—

Ms. LORD. Thank you, Senator Markey.

Senator MARKEY.—there's a preexisting bias toward libraries.

And so, for me, Mr. Chairman, I'm so glad that I had this, you know, as the first hearing, because I don't think there's anything that either of us will ever do that really matches the impact that the E-Rate can have upon the families of every single citizen in our country.

Thank you.

The CHAIRMAN. Thank you, Senator Markey.

Do you think we've said enough nice things about each other for about—

[Laughter.]

Senator MARKEY. I'm not allowing a graciousness gap to open up, here. OK?

[Laughter.]

The CHAIRMAN. OK. All right. OK.

Let's make the final question, because you've been incredibly patient as we've wandered in and out, on—there are two things that I'd like to get comments on.

One is, I totally agree with you—and, I think, Mr. Coulter, you've made this comment; others did, also—is the whole transparency factor. People—in order to support an E-Rate 2, as I call it, people have to trust—you know, because there will be costs—it won't necessarily come from the Federal Government, et cetera; or, you know, legislated costs, that kind of thing—but—and also, it—things take time. In other words, one of the reasons that we have to get at it right now is because the payoff doesn't come for quite a while that we're training people for the future. Now, we've trained people, already, on E-Rate system, as it has been, and they've met with great success. But, what we're talking now is a whole new level.

So, I would be interested in two things from anyone who wants to answer this, provided one of them is Mr. Coulter, and that is the importance of transparency for the trust of the American people

and also for the efficacy or the willingness of people to adapt to the E-Rate Program, take advantage of it because they do trust it. That's number one.

Number two, as a businessperson, I'd like you to say a few words—I mean, we—you know, we keep reading about this hundreds of thousands or—whatever, tens of thousands, a hundred-thousand jobs that are available right now in the Silicon Valley which we can't fill because we don't have the people trained, technically, for it. And that's, you know, outrageous and enraging and all the rest of it. But, the point is, it doesn't make any difference; we've got to solve that problem.

Would—could you go a little bit into—and anybody else who wants to—into, one, the question of making it transparent so that people can't bring up little nics and nacs, which are, in fact, as Dr. Abshire has been talking about, are getting cleaned up, a lot of them, as the program goes along, because they have no choice; and, second, the cost to the American economy, to American business, of not having people available?

Mr. COULTER. So, let me start on those two.

One of the things I hope the FCC would do in the upcoming process is to turn E-Rate from, not just a process to get important money into the system, but as a process to save money. So, if schools have data, I think they can use it to go save money in the process by figuring out best practices, by figuring out who to buy from, et cetera. So, it's taking a purchasing cooperative data and making it available to everyone in a way that can push down costs. So, scale and data and technology are important to pushing down costs. E-Rate can provide scale and data. So, let's make it transparent.

We have—Education Superhighway, who we've worked with, has done a lot of work. They don't have the E-Rate data, but they've gone out and recreated it by asking at individual schools. And they found, often even within the same district, people are paying four times different for certain services because they just don't know. So, we can solve a lot of efficiency and drive a lot of costs out of the system, generally—

The CHAIRMAN. And who will make that clear to them, that they can pay the same rate?

Mr. COULTER. Well, if the information is—you know, around our companies, if someone buys something somewhere, it's immediately valuable—it's immediately available online, and everyone can see it. So, why not have an online purchasing data part of E-Rate, which will allow schools to have information they need to minimize costs?

In my day job, when I'm not working on these issues, we look to hire the people you're talking about, people who are innovative and STEM-trained. And some of the areas that educational technology have been already shown to be most productive is within STEM and math. The numbers that struck me in this process are 31, 23, 17—or 31 in math, 23 in science, 17 in reading. That is just unacceptable. And if we don't invest, it's going to get worse. So, we need to focus on that 31 and 23 and the 17, but we need to create new jobs.

You know, what gives me hope in this is today—someone challenged me, recently, to come with anything in the Internet that had been created by somebody under—over 30. Right? And I was really pretty challenged. Basically, most of the new things in the Internet are from people under 30. Those are students that were brought up in schools that you connected to the Internet. So, I don't know if there's a direct correlation, but I suspect there might be. So, if we continue to stress access to technology in our school, I think we will continue to drive innovation and a technology-enabled workforce. And there are a few things more important we can do.

The CHAIRMAN. Let me just close this by thanking you and just saying that, just before I came over here, I was at the National Youth Science Camp meeting, which, happily, is in West Virginia every year. And it takes the two top science students from each state—now, how they pick that, I do not know and I do not care—

[Laughter.]

The CHAIRMAN.—and they each come to—they all come to Washington, and they have a series of experiences here. So, we had a lunch today, and a businessperson who's an expert in cybersecurity spoke. And it was stunning for me, as it is every year, just to look at these young people—just to look at them—to listen to the questions they had to ask. One, that they were—they could just get up and ask a question so fluently, so literally, so unabashedly. Nobody was shy. They—there wasn't a decent sound system, so they just made their own sound system, causing them no problems whatsoever. And I kept saying to myself, this is the hope of America. And then I knew I was having this hearing, and it just makes this hearing so much more important, because if they're that good coming out of an E-Rate Program and a schooling system, thus far, imagine how good they might be 10–15 years from now.

So, on that lofty note, I want to genuinely thank all of you. You've been wonderful. I mean, I'd invite you home—

[Laughter.]

The CHAIRMAN.—to have dinner. But, I can't cook.

[Laughter.]

The CHAIRMAN. And I'm not going to give Dr. Abshire a hotdog.

[Laughter.]

The CHAIRMAN. So, thank you for coming.

Thank you, Senator Markey, for gracing our Commerce Committee. To be quite honest with you, that's one of the big things that will have happened to me for the next several years, is the fact that you wanted to be on this committee, and it was at the top of the list, because the person who was whipping it, who is on this committee, came up to me and I saw your ranking, and Commerce was at the top. And here you are.

And so, all of us are grateful, as we are to each of you and for all the work you do, and the people who go through it with you. Right?

So, with that, I think what I'll do is close the hearing.

[Whereupon, at 4:55 p.m., the hearing was adjourned.]

## A P P E N D I X

NATIONAL EDUCATION ASSOCIATION  
*Washington, DC, July 16, 2013*

Committee on Commerce, Science, and Transportation,  
United States Senate,  
Washington, DC.

Dear Senator:

On behalf of the three million members of the National Education Association (NEA), we offer our views of support for strengthening and expanding the E-Rate program ahead of tomorrow's Senate Commerce Committee hearing, "E-Rate 2.0: Connecting Every Child to the Transformative Power of Technology." Since its creation in 1996, the E-Rate has had overwhelming success in connecting our Nation's schools and classrooms to the Internet. The program continues to be a vital source of assistance in maintaining connectivity and enhancing learning.

NEA is a strong supporter and advocate of the E-Rate program, as it has helped bridge the digital divide for countless students by providing them access to the Internet and providing them the opportunity to develop the skills needed to compete in a digital age. The program has been successful at connecting nearly all our Nation's schools to the Internet. In fact, it has been so successful that merely accessing the Internet is not enough. Students and educators not only depend on access to the Internet, they require high-capacity broadband connectivity.

NEA believes that additional investment in the E-Rate program is needed to help bolster the broadband infrastructure of our Nation's schools. Without high-capacity broadband connectivity that can support multi-user school environments, educators and students will not be able to engage in enhanced learning, distance education and use existing applications, as well as support future applications. The E-Rate program could serve as the conduit to enhance the broadband infrastructure of our Nation's schools as it has had a good track record of providing ongoing Internet connectivity to schools.

However, it is important to note that the demand for the E-Rate program continues to outpace the discounts available. The additional investment to bolster high-capacity broadband infrastructure should not supplant current E-Rate funding. In FY 2012, program requests reached an all-time high of \$5.2 billion in discounts, roughly double the amount available. In light of education funding cuts and the damaging effects of sequestration on education budgets, the need for the E-Rate program has never been higher.

NEA believes that the time is now for critical investment in the E-Rate. Accessing the Internet is simply not enough. Our classrooms must be built upon a broadband infrastructure that not only meets current needs but also supports 21st century teaching and learning. The increasing use of technology in the classroom will transform the role of educators allowing the educational process to become even more student-centered.

Educators know that the E-Rate program is key to student success and ensuring access to technologies that better prepare our students for college and 21st century careers. We look forward to working with the Committee to strengthen this vital program.

Sincerely,

MARY KUSLER,  
*Director of Government Relations.*

VERIZON  
Basking Ridge, NJ, July 17, 2013

Hon. JOHN D. ROCKEFELLER IV,  
Chairman,  
Senate Commerce Committee,  
Washington, DC.

Hon. JOHN THUNE,  
Ranking Member,  
Senate Commerce Committee,  
Washington, DC.

Dear Chairman Rockefeller and Ranking Member Thune:

On behalf of Verizon, I write to thank you for scheduling a hearing on July 17, entitled, "*E-Rate 2.0: Connecting Every Child to the Transformative Power of Technology.*" This is a timely and important topic, and is deserving of the Committee's full attention.

We agree that the time has come to modernize the E-Rate program to make sure that its statutory goals are met, and that students have the advanced tools they need to be successful in the communications age. Providing students and teachers across the country with high-speed broadband connectivity is an essential component in ensuring America's continued global competitiveness.

ConnectED challenges the Federal Communications Commission to modernize and leverage the existing E-Rate program, so that our schools are connected with broadband speeds of no less than 100 Mbps and a target of 1 Gbps. While the details around the program still need to be developed and we recognize that many policy challenges will need to be met along the way, we applaud your leadership and the leadership of President Obama in setting the laudable goal of connecting all students with next-generation broadband in their schools.

Verizon is doing its part to prepare students for success in the 21st Century by promoting the technology transformation of the educational system. For example, the Verizon Foundation is committed to improving teaching and learning, particularly through the use of mobile technologies to support Science, Technology, Engineering and Math (STEM) education.

Last year, we also launched the Verizon Innovative learning Schools (VILS) program to provide grants to Title 1 schools for teachers' professional development. Results of the program show that the effective integration of technology in classroom curriculum, coupled with on-going training for teachers can have a positive impact on student learning.

VILS is just one of dozens of examples that show how advanced technology in the classroom can transform the learning process for students and teachers alike. By reviewing and modernizing the E-Rate program, we believe we can do even more to promote digital learning for all of our students.

We look forward to working with you on this important mission.

Sincerely,

CRAIG L. SILLIMAN,  
Senior Vice President—Public Policy.

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PREPARED STATEMENT OF JOHN D. HARRINGTON, CEO, FUNDS FOR LEARNING, LLC

Mr. Chairman and Members of the Committee, I appreciate the opportunity to submit this statement for the record as part of the Committee's hearing today entitled *E-Rate 2.0: Connecting Every Child to the Transformative Power of Technology*. I want to thank Senator Rockefeller for his leadership in making the E-Rate program a success and all the members of the Committee for the continued strong interest in and support of this Federal program that is so enormously important to our Nation's schools and libraries.

Funds For Learning, LLC (FFL) is a regulatory compliance firm that specializes in the E-Rate program. FFL has been providing services, including online management and compliance tools, to the E-Rate community since the fall of 1997, when the Federal Communication Commission (FCC) was making initial preparations to launch the program. Our primary responsibility to our clients is to ensure that they remain compliant with the rules, regulations and administrative requirements. We use our website to keep the public informed about program developments and to help promote competition for E-Rate eligible services by making it easier for service providers to access competitive bidding information on USAC's, the universal service administrator's website.

Since the program's early days, FFL has taken an active role in trying to help shape the program's policies and procedures for the better. In 2003, for example, the FCC invited the president of our firm to participate in a public forum to discuss potential rule changes to strengthen E-Rate program compliance and oversight. Also

in 2003, USAC invited another FFL officer to be a member of its Task Force on the Prevention of Waste, Fraud and Abuse. In 2011, we took the initiative to petition the FCC to direct USAC to fund more requests for internal connections support, and the FCC responded with the *Funds For Learning Order*, which directed USAC to, among other things, “make funding commitments for priority two services at the 80 percent discount level for funding year 2010.”

We, too, believe in the transformative power of technology. That is why we fully support the Chairman’s goal of bringing “the promise of next-generation broadband connectivity to more schools and libraries.” In survey results that FFL released last October, only 10 percent of schools described their current communications networks as ready for the future. Obviously, much work needs to be done.

E-Rate funds can and should be used to help our country reach this important goal. To make this possible, however, the E-Rate program must, as the Chairman has suggested, be strengthened. To strengthen it sufficiently, we believe, the FCC must take the following two steps and, equally important, take them simultaneously: (1) at least double the size of the E-Rate fund—since current demand for funding is already more than twice the amount available—and (2) equitably limit how much funding any given applicant may receive in one funding year.

More money is needed. In 1998, schools participating in the E-Rate program reported annual telecommunications and Internet expenses of \$15 per student. Now, in 2013, that number has more than tripled to greater than \$50 per student. Yet, during that same period, E-Rate funding levels have barely increased.<sup>1</sup>

Looking ahead, there is every reason to believe that schools (and libraries) will continue to increase their use of advanced communications. Schools are planning to connect more students—and more devices—with faster Internet connections, and these schools are looking to the E-Rate program for additional support.<sup>2</sup> Given the current growth in demand, and assuming the FCC continues to use a “discount threshold” system to rank funding applications, FFL estimates that 84 percent of libraries and 71 percent of schools risk being disqualified from receiving *any* E-Rate discounts by 2015. For a program that includes “Universal Service” in its title, it is unimaginable—and unacceptable—that we would continue down this current course.

More money is certainly imperative, but more money alone is not going to be enough to address this situation. We doubt that there will ever be enough E-Rate funding to satisfy what every school and library “wants.” But if the FCC, for the first time in the E-Rate program’s nearly 17-year history, requires applicants to operate under E-Rate funding budgets and stops handing them “blank E-Rate checks,” it will incentivize them to drive harder bargains with service providers for eligible services and provide the motivation they need to consider and plan their E-Rate purchases more carefully. No public or private organization, none that we know of anyway, operates without a budget or receives a blank check every year to purchase as much as it wants. But that is exactly how E-Rate applicants are treated and, as the program’s history plainly shows, that simply does not work.

Under an equitable budget system, it is true that some schools and libraries might not get what they “want,” but more than likely, and especially if the FCC makes more funding available, the vast majority of schools and libraries will get what they “need”—or at least some reasonable amount very close to that.<sup>3</sup> Under our E-Rate 2.0 “budget” proposal, which we have already shared with the FCC, and which I have attached to this statement, an estimated 87 percent of applicants would qualify in FY 2014 for total E-Rate discounts that were equal to or greater than their FY 2013 telecommunications and Internet funding requests combined. Furthermore and unlike today, 100 percent of applicants would enjoy greater freedom and flexibility to use their discounts on any service or equipment that the FCC included on its eligibility list and, in addition, have them delivered to any eligible building in their systems that they decide needs it.

Under FFL’s E-Rate 2.0 proposal, unlike under many other proposals to “fix” the E-Rate program, the FCC would not have to try to fix what many applicants, especially those who work very hard to comply with program rules, believe is not actually broken—the discount matrix or the eligible services list. Nor would there be any

<sup>1</sup> FFL has prepared a detailed analysis of the FY2013 demand for discounted telecommunications and Internet access by schools. A copy of this analysis is being submitted to the Committee along with this statement.

<sup>2</sup> 58 percent of respondents to the FFL survey believed that their telecommunication and Internet expenses would rise over the next five years. The survey results are being submitted to the Committee along with this statement.

<sup>3</sup> We have data to support this and would be pleased to share it with the Committee upon request.

need to modify in any material respect how the program operates. That being said, FFL's E-Rate 2.0 "budget" proposal has the added advantage of being eminently adaptable to other "fixes." Our solution framework and the various other proposals being discussed are neither mutually exclusive nor even slightly at odds. Any additional funding "realized" as a result of any programmatic change would easily "plug into" our proposed framework, resulting in increased annual budgets across the board.

*Under FFL's E-Rate 2.0 proposal, only the following three adjustments to the E-Rate program would be necessary:*

1. Increase annual E-Rate funding to \$4.5 billion permanently, with an ongoing adjustment for inflation. Increasing the amount of funding allows more applicants to enhance their network connectivity.
2. Restore the original technology-neutral E-Rate framework by removing the "Priority System" funding cap. Restoring technology-neutral funding priorities gives applicants the flexibility to choose the most cost-effective solutions that they conclude they need to meet their own unique, local needs.
3. Place reasonable limits on the annual amount of E-Rate discounts available to any single applicant. Placing limits on the total discounts available to individual applicants encourages thoughtful, cost-effective decisionmaking, stops large-spending applicants from creating dramatic, annual funding shortages, and helps to ensure that E-Rate discounts are applied only to what each applicant needs the most.

*More specifically, this is what FFL is proposing:*

1. *Do Not Alter the Current Discount Matrix or Eligible Services List or the Form 470, Form 471, PLA Review, or Payment Process.* Leverage applicants' existing training and experience, and avoid reinventing the wheel.
2. *Eliminate Unlimited E-Rate Discounts by Creating a Graduated Budget Matrix Based on Economic Need.* Create a graduated budget matrix that provides equitable, per student and per patron (or other variable) discount limits for schools and libraries at different discount levels. 90 percent-discount applicants would receive the highest percapita budget amounts and 20 percent-discount applicants the lowest.
3. *Tie Annual Budget Amounts to Geographic Location Too.* Develop the new budget matrix by taking into account a variety of factors, such as urban, rural, or remote rural location, and anything else that will help to foster the equitable distribution of a finite amount of funds.
4. *Guarantee an Adequate, Minimum Funding Amount to Every Applicant.* Ensure that every applicant regardless of its size and location receives a meaningful, minimum amount of funding in its annual E-Rate budget. Higher discount-rate and remote-rural applicants would receive proportionally higher minimum amounts, respectively, than lower discount rate and urban applicants.
5. *Permit applicants to allocate some or all of their annual budgets to any consortium application in which they wish to participate (except for state networks) and, for state network consortium applications, set aside a specific amount of annual funding.*
6. *Reset Budget Amounts Annually.* Every year, well before the window application period opens, the Commission would set the per school student and per library patron (or other variable) budget amount for the next funding year.
7. *Make Funding Specific, Predictable, and Sufficient.* Assure applicants that their E-Rate budgets will remain relatively constant from one year to the next, subject only to fluctuations in the size of the populations they serve and any additional funding that might become available.
8. *Permit Applicants to Set Their Own Priorities.* Permit applicants to allocate their annual E-Rate budget entirely as they see fit among eligible services in any category and to any of the eligible buildings in their school districts and library systems—regardless of what any particular site's discount rate may be—as was the Program's intent originally. Note: site specific services would continue to receive discounts at whatever the specific site's discount rate might be, 90 percent, 80 percent, 70 percent, and so on. Thus money spent to buy eligible services for a 90 percent school will stretch an applicant's budget much farther than money spent to buy the same services for a 60 percent school. Note further: these are the kinds of decisions that should, and under this framework would be, made locally.

**Benefits of FFL's Proposed E-Rate 2.0 Framework**

The FFL proposal is a data-driven, yet practical solution, based on a recommendation of the 2003 USAC Waste, Fraud, and Abuse Task Force. Placing a limit on the discounts received by any one applicant is a minimal change to the existing system, but this minor alteration will produce the following benefits:

- Increases accountability, flexibility, and predictability
- Builds on successful aspects of current E-Rate Program
- Creates predictable and more reliable annual funding commitments
- Enables USAC to issue funding decisions more quickly
- Promotes efficient use and equitable distribution of E-Rate funding
- Encourages technology planning and prioritization
- Enables applicants to set their own priorities
- Avoids "one-size-fits-all" technology mandates
- Provides all applicants access to some support
- Maintains a sliding scale of support for all applicants, with the highest discounts and most support going to applicants with the highest documented need.
- Encourages accurate funding requests by applicants
- Reduces waste and abuse
- Eliminates need for the much-maligned and seemingly ineffective 2-in-5 rule
- Enables applicants to set their local priorities
- Reduces excessive and/or frivolous funding requests
- Reduces or removes incentives to replace equipment too soon or to gold plate networks
- Eliminates incentives to game the current funding priority system
- Protects against "mega" funding requests
- Limits waste/fraud/abuse potential per entity
- Accommodates future increase(s) to fund without retooling the program
- Works with all other changes being discussed in the E-Rate community
- Reduces or eliminates the need for other programmatic changes
- Could facilitate individual applicant "rollover" one year to next and/or multi-year funding commitments
- Allows for the addition of new services to the eligible services list without "breaking the bank"

Respectfully submitted,

JOHN D. HARRINGTON,  
*Chief Executive Officer,*  
 Funds For Learning, LLC.

## ATTACHMENTS

## Excerpt from USAC's 2003 Waste, Fraud and Abuse Task Force Recommendation

**b. The Task Force recommends that the Commission consider imposing a ceiling on the amount of funding that an applicant can request.**

A ceiling would limit those applications that appear to be seeking disproportionately large funding requests. It is believed that this, along with other Task Force recommendations, would help ensure that applicants are submitting the most cost-effective funding requests. Further, a formula that produces a modest reduction in such requests is likely to promote greater competition in the program as a whole by expanding the base of applicants that could qualify for Priority Two support.

Applicants would be advised that both their Priority One and Priority Two funding requests are subject to a ceiling and would have to decide how to make best use of their available funding. By endorsing this concept, the Task Force is *not* supporting the idea of turning the E-rate program into an entitlement program, or allocating the available funds among all participating applicants.

In the brief amount of time available, the Task Force explored a handful of possible formula models for establishing this kind of ceiling. These models included formulas based on the number of students and/or library patrons, based on the number of sites, and a formula that would take the applicant's discount rate into consideration. The Task Force also tested models in which the ceiling would apply to an applicant's combined funding requests for Priority One and Priority Two services, and separate ceilings for the two kinds of services. While reaching no conclusion on which approach was better, the Task Force believes that the ceiling concept should be applied to both service priorities.

A ceiling must also be implemented in such a way that it does not favor particular kinds of applicants. For instance, some models might tend to favor large applicants, while others might tend to favor small applicants. The Task Force did not have time to fully test all of these ideas and recommends that the Commission test multiple models before choosing a particular one. The Task Force is happy to share with the Commission the work it has already done in this area.

The Task Force does agree that any formula ultimately adopted by the Commission should be simple for the SLD to administer and easy for applicants to understand. Any formula should be based upon data that are readily available and grounded in a policy that is sound and logically defensible. The Task Force believes it should be possible to integrate a formula into the Form 471, based on information that applicants are already required to submit. Ideally, this would not impose additional work on applicants. It will be important to ensure that a ceiling formula addresses the question of how to manage the requests of schools and libraries that may also be members of consortia.

The Task Force acknowledges that any formula for setting a ceiling may ultimately curtail some funding requests. Nevertheless, it believes that as long as the E-rate funding pool is not large enough to meet the funding requests of all eligible applicants, the imposition of a properly constructed ceiling on funding requests would encourage applicants to create more cost-effective plans for ensuring access.

# The Funds For Learning® E-rate 2.0 Proposal

July 17, 2013



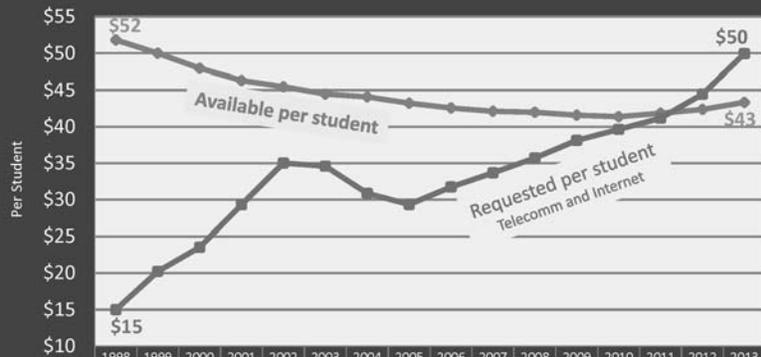
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## Per Student E-rate Funding Available vs Requested (Telecomm and Internet)



Includes consortia demand; Available amount calculated after subtracting all library demand



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Cap	\$52	\$50	\$48	\$46	\$45	\$44	\$44	\$43	\$43	\$42	\$42	\$42	\$41	\$42	\$42	\$43
Demand	\$15	\$20	\$24	\$29	\$35	\$35	\$31	\$29	\$32	\$34	\$36	\$38	\$40	\$41	\$44	\$50

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## Telecomm and Internet Requests by School Location



FY2013 telecommunications and Internet funding requests, excluding state networks, regional consortia and library demand.

Location Type	Applicants	Site Count	Enrollment	Pre-Discount	Requested	Per Student	
						Pre-Disc.	Request
11-City: Large	2,360	14,938	7,314,406	\$496,515,170	\$404,642,429	\$67.88	\$55.32
12-City: Mid-size	1,300	7,818	3,863,058	\$191,278,583	\$140,087,957	\$49.51	\$36.26
13-City: Small	945	8,117	4,000,965	\$190,484,418	\$143,307,487	\$47.61	\$35.82
21-Suburb: Large	4,309	28,084	16,810,880	\$685,277,547	\$458,444,057	\$40.76	\$27.27
22-Suburb: Mid-size	410	3,044	1,525,243	\$59,742,449	\$40,902,894	\$39.17	\$26.82
23-Suburb: Small	268	1,952	918,171	\$42,636,492	\$29,797,227	\$46.44	\$32.45
31-Town: Fringe	365	1,912	830,037	\$37,538,570	\$26,176,728	\$45.23	\$31.54
32-Town: Distant	1,506	8,426	3,106,730	\$183,452,063	\$142,910,822	\$59.05	\$46.00
33-Town: Remote	1,099	5,761	2,029,667	\$115,925,257	\$92,511,672	\$57.12	\$45.58
41-Rural: Fringe	3,159	13,247	6,150,741	\$310,859,884	\$221,470,850	\$50.54	\$36.01
42-Rural: Distant	3,129	10,789	3,288,047	\$214,884,515	\$164,541,586	\$65.35	\$50.04
43-Rural: Remote	2,283	6,366	1,175,940	\$151,442,409	\$124,936,467	\$128.78	\$106.24
Other: Rural	124	273	63,928	\$4,383,130	\$3,452,962	\$68.56	\$54.01
Other: Urban	154	719	176,128	\$11,495,105	\$9,453,061	\$65.27	\$53.67
NYCBOE	1	1,601	968,530	\$272,249,225	\$225,966,857	\$281.10	\$233.31
<b>Total</b>	<b>21,412</b>	<b>113,047</b>	<b>52,222,471</b>	<b>\$2,968,164,817</b>	<b>\$2,228,603,056</b>	<b>Avg \$56.84</b>	<b>\$42.68</b>

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## E-rate's Unsustainable Path



- No internal connections for any applicants
- Inadequate support for telecomm/Internet
- Funding Year 2014: 70% P1 discount threshold
  - › No support for 45% of libraries and 47% of schools
- Funding Year 2015: 80% P1 discount threshold
  - › No support for 84% of libraries and 71% of schools
- Going forward, political support wanes as E-rate funding disappears for most applicants

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## President Calls for Reform



*“In a country where we expect free Wi-Fi with our coffee, why shouldn't we have it in our schools?”*

-- President Barack Obama (June 6, 2013)

- ConnectED: restore U.S. educational leadership
- Modernize and further leverage E-rate program
- Connect 99% of students within 5 years
  - › Broadband connections (100 Mbps up to 1 Gbps)
  - › High speed wireless access in buildings

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## Answering the President's Call



- FCC preparing to implement Obama's vision
  - › Additional E-rate funding -- 3 year surge?
  - › New efficiencies within the E-rate program
  - › Other changes
- E-rate 2.0 proposal: achieving Obama's goals
  - › Ensure all schools and libraries benefit from E-rate
  - › Allow applicants to set local funding priorities
  - › Restore support for infrastructure (e.g. wireless)
  - › Encourage cost-effective technology choices

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## ConnectED Cost



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## School and Library Buildings

Number of sites listed on E-rate applications (2013)



Building Type	E-rate Discount			TOTAL
	20% - 59%	60% - 79%	80% - 90%	
K-12 school buildings	14,283	38,680	68,021	120,984
Pre-K/Headstart locations	445	1,221	5,798	7,464
Stand-alone admin buildings	697	3,241	3,354	7,292
Public library buildings	718	3,701	6,608	11,027
<b>Total</b>	<b>16,143</b>	<b>46,843</b>	<b>83,781</b>	<b>146,767</b>

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- 146,767 unique sites listed on applications
- 57% qualify for 80% or higher E-rate discount rate

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## ConnectED Costs: Broadband

Estimated national cost based on various rates



100 Mbps	Total Annual Cost	E-rate Requests	Per Student Request*
\$1,500/month	\$3,184,200,000	\$2,300,041,800	\$40.82
\$2,000/month	\$4,139,460,000	\$2,990,054,340	\$53.07
\$2,500/month	\$5,094,720,000	\$3,680,066,880	\$65.31

1 Gbps	Total Annual Cost	E-rate Requests	Per Student Request*
\$6,000/month	\$12,099,960,000	\$8,740,158,840	\$155.41
\$8,000/month	\$17,831,520,000	\$12,880,234,080	\$229.02
\$10,000/month	\$23,563,080,000	\$17,020,309,320	\$302.63

\*excludes library demand

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- Each line shows the annual cost to connect every school site in America based on various cost and bandwidth models

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## ConnectED Costs: On-Campus



Estimated Internal Connections One-Time Expenses

Building Type	Building Count	Per Building Expense	Total Expense	E-rate Request
K-12 school buildings	120,984	\$87,398	\$10,573,759,632	\$7,587,152,351
Pre-K/Headstart locations	7,464	\$10,574	\$78,924,336	\$62,476,373
Stand-alone admin buildings	7,292	\$10,574	\$77,105,608	\$-
Public library buildings	11,027	\$10,574	\$116,599,498	\$85,207,830
	<b>146,767</b>	<b>Total</b>	<b>\$10,846,389,074</b>	<b>\$7,734,836,554</b>

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- Average "per building" FY2013 internal connections project was \$87,398 per school building and \$10,574 per library building.
- Extending this average cost to all buildings, and using the FY2013 discount rate of each building, the total internal connections demand is estimated at roughly \$7.73 billion.

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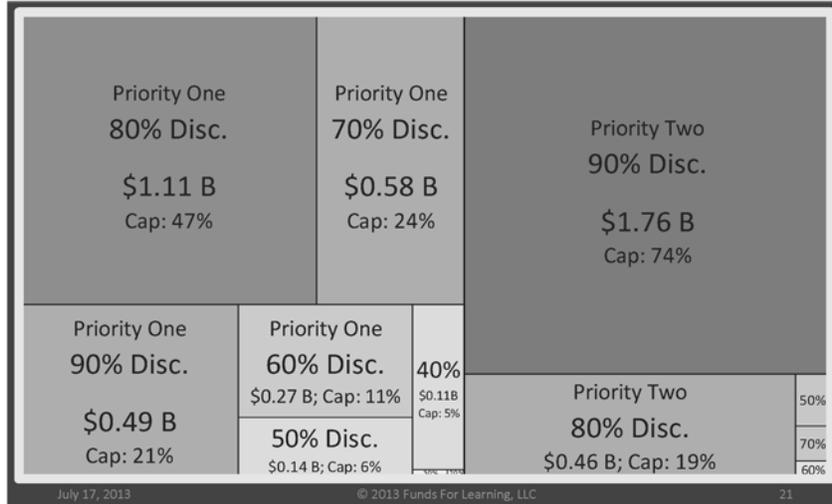
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## E-rate Program At a Crossroads

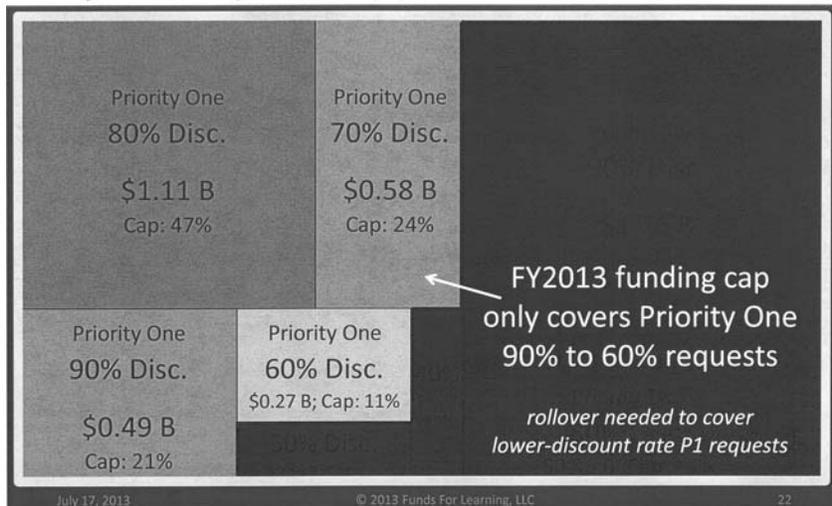
## E-rate Straining Under Demand

- **No longer a technology neutral program**
  - › Priority system broken – no internal connections
    - Eliminates lease vs. purchase cost-benefit analysis
    - Encourages more expensive Priority 1 solutions
  - › Creates environment for gaming the system
  - › Entire cap can be spent with no contract or tech plan
- **Discount threshold eliminates discount matrix**
  - › No longer a sliding scale funding mechanism
  - › All or nothing funding for a select few

## FY2013 E-rate Demand \$4.99 Billion By Priority and Applicant Discount



## FY2013 E-rate Demand \$4.99 Billion By Priority and Applicant Discount



## Aggressive Applicants Dominate



- No incentive for accurate funding requests
- Highest discount rate schools take all they want, leaving nothing for other applicants
- “Big spenders” request majority of funding
  - › Inefficient applicants rewarded with big dollars
  - › 30% of demand: \$600+/student
    - 738 applicants; <5% of all students
    - NYC \$626/student (13.6% of demand)
- **NOTE: high discount  $\neq$  Big Spenders**
  - › Most high discount schools <\$200/student

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## Proposed Solution Framework



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## E-rate 2.0 Proposal Overview



- Increase cap to \$4.5 billion/year
- Promote equitable distribution of funding
  - › Allow applicants to set their own priorities
  - › Discounts used for any service category, any site
  - › Offer all applicants access to support every year
- Maintain (no change)
  - › Graduated discount rate system
  - › Current ESL/470/471/PIA/payment process
- Eliminate current Priority Cap system
- Establish flexible discount budget system

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## Existing E-rate System + Budgets



- Flexible discount budget for applicants
  - › Per student (schools); Per patron (libraries)
  - › Tied to available USF funding
  - › Rates published before filing window
- Tie budget to applicant discount rates
  - › Highest budgets to highest disc rate applicants
  - › Budget floors set for small and rural applicants
- Works at any/all funding cap levels

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## Proposal Details



- Schools set their local priorities
  - › Requests total no more than budget ceiling
  - › Applicants may allocate budget to consortia
- Discount matrix and ESL can stay as-is
- Eliminates need for 2-in-5 rule
- High cost locations have higher minimum
- Works at any funding cap level (i.e. \$2.4B)

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## Per Student Budget Calculation



- School district calculates discount rate (as before)
- Ceiling calculated by multiplying per student factor by discount rate by enrollment

$$\text{Discount Ceiling} = \text{Pre-Discount Per Student Rate (Set by FCC)} \times \text{Discount Rate} \times \text{Enroll}$$

- Example: \$115 pre-discount target by FCC
  - › 80% school district
  - › Multiplied by \$115 = \$92 / student max discount

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## Budget Floor for Small Schools



- FCC sets pre-discount budget floor
  - › Min. amount before budget ceiling is activated
  - › Protects small schools
- School district calculates discount rate (as before)
- Floor calculated by multiplying pre-discount budget floor by discount rate of applicant
- Doubled for sites classified as high cost

$$\text{Budget Floor} = \text{Pre-discount Floor (Set by FCC)} \times \text{Discount Rate} \times \text{High Cost Multiplier}$$

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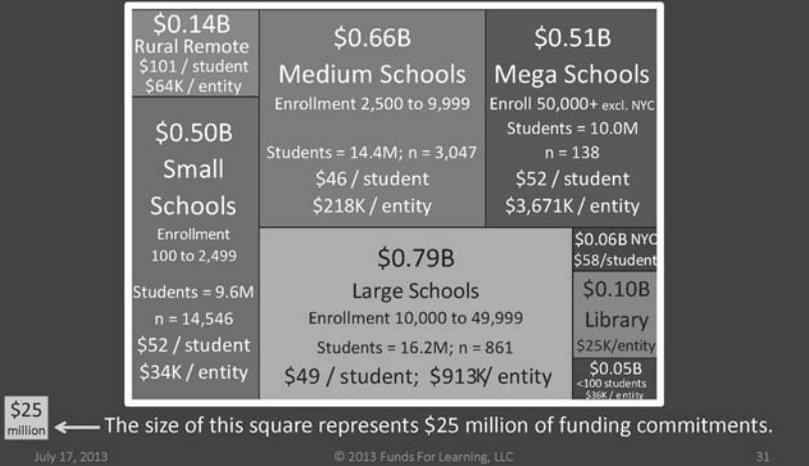
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Estimated Result  
of Budget System  
Based on E-rate 2.0 Proposal

## Results of Funds For Learning® Proposal Option #1: \$2.80B Current cap + rollover



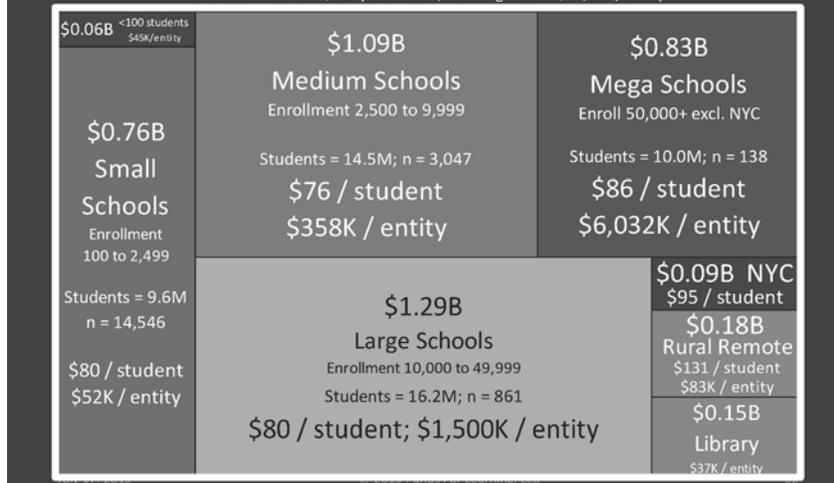
Per Student Factor = \$70 per student; Funding floor = \$34,000 / entity



## Results of Funds For Learning® Proposal Option #2: \$4.46B



Per Student Factor = \$115 per student; Funding floor = \$40,000 / entity



## Benefits of Budget Ceiling



- Encourages efficient use of funds
- Produces more predictable projects and services
- Allows funding to be released more quickly
- Reduces excessive and/or frivolous \$ requests
- Diminishes or removes incentives to
  - › Replace equipment before end of life
  - › Gold plate networks and game the P1/P2 system
- Protects against “mega” requests
- Limits waste/fraud/abuse potential per entity

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## Budget System Calculation

### Step-by-step



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## Per Student Budget Calculation



- FCC sets per student pre-discount amount
- School district calculates discount rate (as before)
- Budget calculated by multiplying per student factor by discount rate by enrollment

$$\text{Discount Budget} = \text{Pre-Discount Per Student Rate (Set by FCC)} \times \text{Discount Rate} \times \text{Enroll}$$

## Budget Calculation Process



$$\text{Discount Budget} = \text{Pre-Discount Per Student Rate (Set by FCC)} \times \text{Discount Rate} \times \text{Enroll}$$

↗ \$70

Annual limit set by the FCC.  
The current funding cap  
Would support this figure.

## Budget Calculation Process



$$\text{Discount Budget} = \text{Pre-Discount Per Student Rate (Set by FCC)} \times \text{Discount Rate} \times \text{Enroll}$$

$$\$70 \times 75\%$$

↗  
Your shared discount rate.  
(Calculated in same manner as before.)

## Budget Calculation Process



$$\text{Discount Budget} = \text{Pre-Discount Per Student Rate (Set by FCC)} \times \text{Discount Rate} \times \text{Enroll}$$

$$\$70 \times 75\% \times 10,000$$

↗  
Your total enrollment

## Budget Calculation Process



$$\begin{aligned} \text{Discount Budget} &= \text{Pre-Discount Per Student Rate (Set by FCC)} \times \text{Discount Rate} \times \text{Enroll} \\ &= \$70 \times 75\% \times 10,000 \\ \text{Discount Budget} &= \$525,000 \end{aligned}$$

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## Budgets Vary by Discount Rate



Discount Rate	Discount Budget
$\$70 \times 45\% \times 10,000$	$= \$315,000$
↑	
$\$70 \times 75\% \times 10,000$	$= \$525,000$
↓	
$\$70 \times 90\% \times 10,000$	$= \$630,000$

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## Budgets Vary by Enrollment



	Enrollment	Discount Budget
$\$70 \times 75\% \times$	$1,000 =$	$\$52,500$



$\$70 \times 75\% \times$	$10,000 =$	$\$525,000$
---------------------------	------------	-------------



$\$70 \times 75\% \times$	$100,000 =$	$\$5,250,000$
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## Budgets Vary with E-rate Cap



Per Student  
Limit

Discount Budget

$\$70 \times 75\% \times$	$10,000 =$	$\$525,000$
---------------------------	------------	-------------



$\$95 \times 75\% \times$	$10,000 =$	$\$725,000$
---------------------------	------------	-------------

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## Sample Budget Calculation #1

Urban School District



- Pre-Discount Student Rate Ceiling: \$115
- Pre-Discount Per Applicant Floor: \$40,000
- Applicant: Enrollment = 4,000; Discount = 80%

$$\text{Ceiling} = \overset{\text{Pre-Discount}}{\underset{\text{Per Student Rate}}{\$115}} \times \overset{\text{Applicant}}{\underset{\text{Discount Rate}}{80\%}} \times \overset{\text{Applicant}}{\underset{\text{Enrollment}}{4,000}} = \$368,000$$

$$\text{Floor} = \overset{\text{Pre-Discount}}{\underset{\text{Applicant Floor}}{\$40,000}} \times \overset{\text{Applicant}}{\underset{\text{Discount Rate}}{80\%}} \times \overset{\text{Rural Remote}}{\underset{\text{Multiplier}}{1}} = \$32,000$$

Max of Ceiling and Floor calculations

$$\text{Discount Budget} = \$368,000$$

## Sample Budget Calculation #2

Remote Rural School



- Pre-Discount Student Rate Ceiling: \$115
- Pre-Discount Per Applicant Floor: \$40,000
- Applicant: Enrollment = 125; Discount = 90%

$$\text{Ceiling} = \overset{\text{Pre-Discount}}{\underset{\text{Per Student Rate}}{\$115}} \times \overset{\text{Applicant}}{\underset{\text{Discount Rate}}{90\%}} \times \overset{\text{Applicant}}{\underset{\text{Enrollment}}{125}} = \$12,936$$

$$\text{Floor} = \overset{\text{Pre-Discount}}{\underset{\text{Applicant Floor}}{\$40,000}} \times \overset{\text{Applicant}}{\underset{\text{Discount Rate}}{90\%}} \times \overset{\text{Rural Remote}}{\underset{\text{Multiplier}}{2}} = \$72,000$$

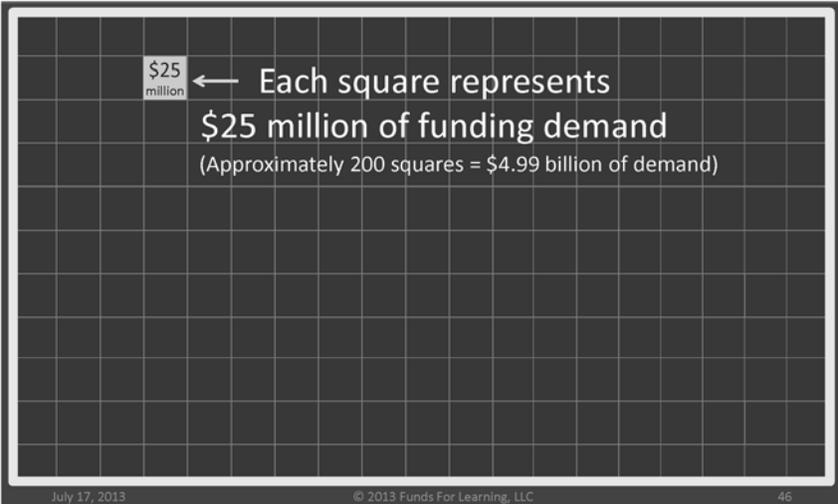
Max of Ceiling and Floor calculations

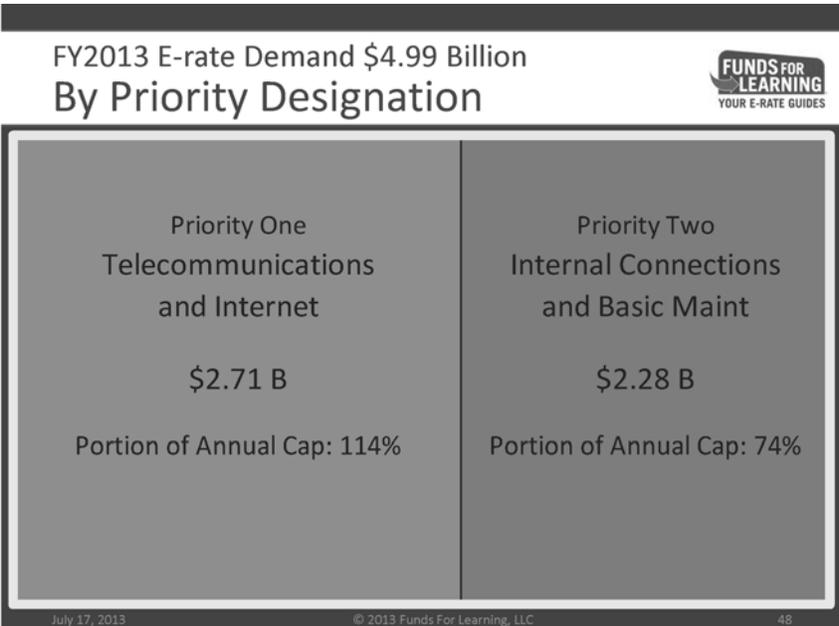
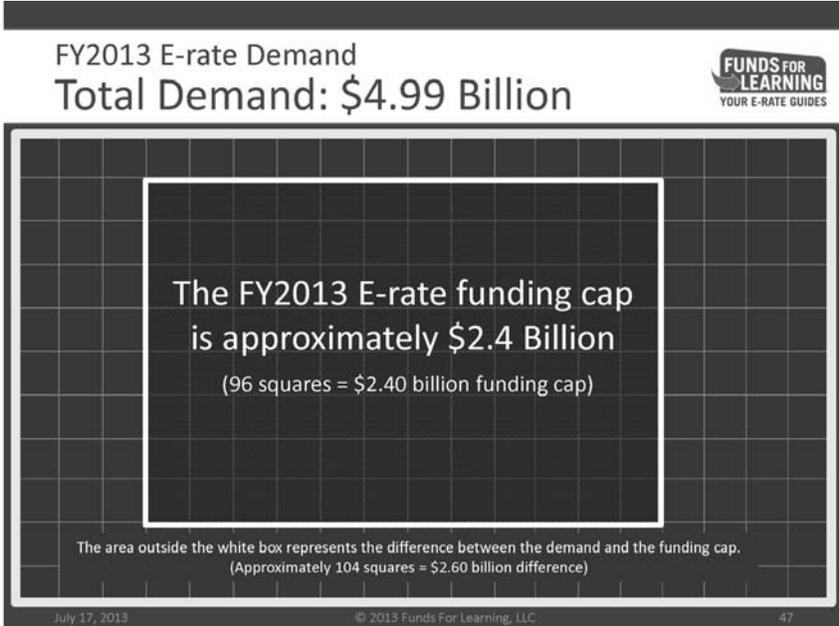
$$\text{Discount Budget} = \$72,000$$

# Understanding the FY2013 E-rate Fund Demand

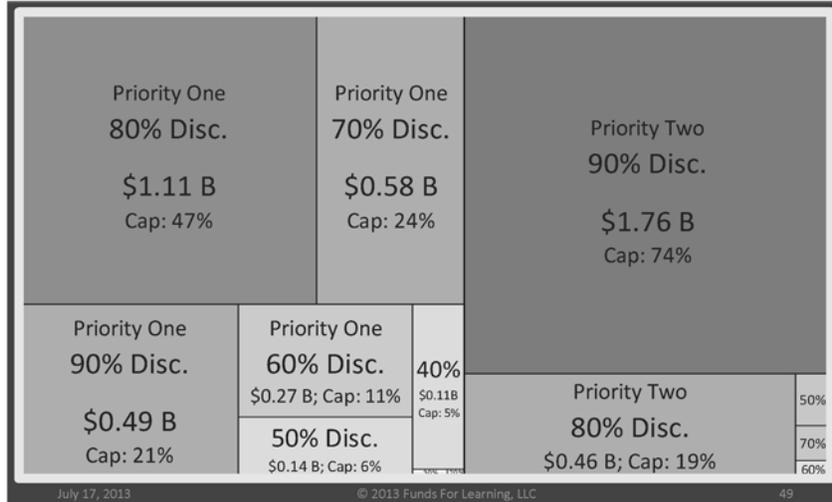


FY2013 E-rate Demand  
Total Demand: \$4.99B

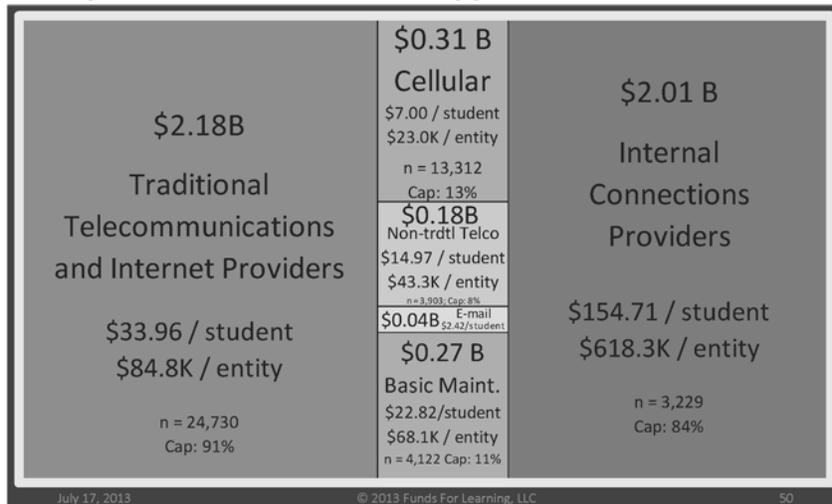




## FY2013 E-rate Demand \$4.99 Billion By Priority and Applicant Discount



## FY2013 E-rate Demand \$4.99 Billion By Service Provider Type



## FY2013 E-rate Demand \$4.99 Billion By Amount Requested Per Student



<p><b>\$0.61B</b> NYC Board of Ed \$626/student 83% Disc. School</p> <p>n = 1; Cap: 25% \$605,746K / entity</p>	<p><b>\$0.70B</b> \$601 or more Per Student</p> <p>81% - 90% Disc. Schools</p> <p>n = 737; Cap: 30% \$955K / entity</p>	<p><b>\$0.76B</b> \$200 to \$600 Per Student</p> <p>81% - 90% Disc. Schools</p> <p>n = 1,689; Cap: 32% \$448K / entity</p>	<p><b>\$0.37B</b> \$200 or more Per Student</p> <p>80% or Lower Disc. Schools</p> <p>n = 844 Cap: 16% \$442K / entity</p>	<p><b>\$0.25B</b> State Consortium</p> <p>n = 38 \$6,594K/ entity</p> <p>Cap: 11%</p>
<p><b>\$1.02B</b> \$199 or Less Per Student 80% or Lower Disc. Schools</p> <p>n = 12,666; Cap: 43% \$80K / entity</p>		<p><b>\$0.96B</b> \$199 or Less Per Student 81% - 90% Disc. Schools</p> <p>n = 2,656; Cap: 40% \$360K / entity</p>		<p><b>\$0.16B</b> Rural Remote</p> <p>Enroll = 1.3M n = 2,132 \$118/student \$75K / entity Cap: 7%</p> <p><b>\$0.11B</b> Library</p> <p>n = 4,023 \$27K / entity Cap: 5%</p>

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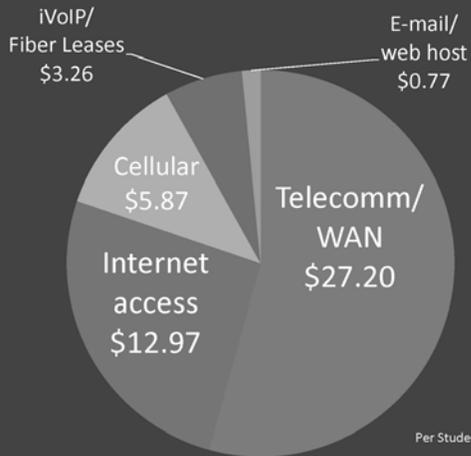
## FY2013 E-rate Demand \$4.99 Billion By School District Size



<p><b>\$0.61B</b> NYC Board of Ed Enrollment 967,159</p> <p>Enroll = 1.0M; n = 1 \$626 / student \$605,746K / entity Cap: 25%</p>	<p><b>\$1.1B</b> Small Schools Enrollment 100 to 2,499</p> <p>Enroll = 9.6M; n = 14,546 \$114 / student \$75K / entity Cap: 46%</p>	<p><b>\$0.60B</b> Mega Schools Enroll 50,000+ excl. NYC</p> <p>Enroll = 9.7M n = 138 \$62 / student \$4,368K / entity Cap: 25%</p>	<p><b>\$0.25B</b> State Consortium</p> <p>n = 38 \$6,594K/ entity</p> <p>Cap: 11%</p>	
<p><b>\$1.14B</b> Large Schools Enrollment 10,000 to 49,999</p> <p>Enroll = 16.2M; n = 861 \$70 / student \$1,319K / entity Cap = 48%</p>		<p><b>\$0.97B</b> Medium Schools Enrollment 2,500 to 9,999</p> <p>Enroll = 14.4M; n = 3,047 \$67 / student \$319K / entity Cap = 41%</p>		<p><b>\$0.16B</b> Rural Remote</p> <p>Enroll = 1.3M n = 2,132 \$118/student \$75K / entity Cap: 7%</p> <p><b>\$0.11B</b> Library</p> <p>n = 4,023 \$27K / entity Cap: 5%</p>

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## FY2013 Telecomm and Internet demand \$50 per Student Requested



- \$50/student demand exceeds \$45/student funding cap
- Total demand = \$5.57/student per month (pre-discount)

Includes consortia demand;  
Per Student amount calculated after subtracting library demand.

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## Alternative Solutions

Most could work in conjunction with  
E-rate 2.0 proposed budget system



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## Eligible Services Changes



- **Rationale**
  - › Set min and/or max levels of technology support
  - › Stop funding out dated services (e.g. POTS)
  - › Stop “gold plating” (e.g. excess Internet bandwidth)
- **Weakness**
  - › Detailed definitions require on-going adjustment
  - › New standards add complexity to application review
  - › Opens door to gaming system. For example, if 100 MB connections were allowed, but Gigabit connections were not, an applicant might lease ten 100 MB lines.

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## Discount Matrix Changes



- **Rationale**
  - › Reduce the demand by decreasing discount rates.
  - › This will also encourage better bargain shopping.
- **Weakness**
  - › Discount rates cut in half to meet current demand
  - › Does not address insufficient E-rate funding or inadequate priority system
  - › Offers no protection against mega funding requests
  - › Hardest on poorest communities. For example,
    - 90% disc. => 80% disc.: *applicant payment +200% (double)*
    - 20% disc. => 10% disc.: *applicant payment +12%*
  - › Majority of 90% schools are not “big spenders”

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## Purchasing Exchanges



- Rationale
  - › Require schools to purchase goods and services via a cooperative buying exchange.
  - › Volume discounts and centralized decision making will yield better pricing and choices.
- Weakness
  - › Most already have access to state master contracts
  - › Consortium applications currently allowed
  - › Increasing demand driven primarily by additional services (i.e. higher bandwidth), not higher pricing
  - › Technology needs vary dramatically among schools

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### RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. AMY KLOBUCHAR TO SHERYL R. ABSHIRE

*Question 1. Rural Service.* As a library specialist and veteran who e-mailed me from Hibbing, Minnesota this week pointed out, the role of libraries is more than just a resource with books, they are a resource for services and information that help keep our communities strong, vibrant and connected. This is extremely true in rural areas where “anchor institutions” like schools, libraries and health clinics are the first places to get new broadband services, which tends to lead to better commercial services being available to residents. Ms. Abshire—Can you share how E-Rate in the past has improved the expansion of connections within communities and how you envision modernization would link up communities in the future?

Answer. Increased connectivity to the schools in Calcasieu Parish has provided a benefit to the entire community. Various initiatives that have provided last-mile buildout have supported the ability to access higher-speed connections both for the schools and the community at large.

*Question 2. STEM—Schools.* I am a strong supporter of increasing technology in the classroom. If we want our students to go on to be the next scientists, engineers, and innovators of tomorrow, they need *early* exposure to advanced technology in the classroom today. Ms. Abshire—Can you talk about how investments in broadband infrastructure and innovative programs can help expand our students’ exposure to cutting-edge technology and training?

Answer. Increased investment in broadband infrastructure is absolutely critical to supporting access to cutting-edge technology and training programs. High speed broadband connections can support virtual fieldtrips, learning videos such as Khan Academy, interactive science experiments, and much more. Schools have even conducted live forums with astronauts at the International Space Station.

*Question 2a. Ms. Abshire—*What type of impact does access to hands on interactive learning through connected devices have on student interest in STEM subjects?

Answer. Access to hands on interactive learning through connected devices and high speed broadband connectivity engages students in collaborative, project-based learning in ways that were not possible just a few years ago. Additionally, with high-speed broadband connectivity students in rural areas whose schools may not offer an advanced science or math course now have the opportunity to engage in

interactive online learning that will prepare them to pursue STEM majors and eventually STEM careers.

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RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARK PRYOR TO  
SHERYL R. ABSHIRE

*Question 1.* I have heard from Arkansas teachers that the E-Rate program has complex procedures and reporting requirements. Has this been your experience? How would you like to see the E-Rate application process simplified?

Answer. The E-Rate application process has been modernized significantly since the program's inception in 1998. When the E-Rate program began, it was a paper application based program. Last year, when Calcasieu Parish filed its application, we did not use any paper—our application was filed online. Many applicants have followed suit and are filing their applications online as well, although the paper filing option remains if applicants wish to utilize that option. Over the years, the Universal Service Administrative Company (USAC) has made great progress in continuously improving the online application process. For example, application processes that used to take myself and my administrative assistant two weeks to accomplish, now take approximately 4 hours. This is not to say that further improvement regarding the application process cannot and should not be made and I support continued efforts to simplify and streamline the application process while maintaining program integrity. For example, I have supported the concept of an Evergreen 470 application, which would allow for multi-year applications for services that are in a multi-year contract. Additionally, encouraging—but not requiring consortia applications—and making further improvements to the applicant online experience could further reduce burden to applicants.

*Question 2.* In your testimony, you said the increased demand, coupled with the cap on E-Rate's funds, will lead to a de-facto elimination of Priority 2 funding as those requests are not fulfilled until Priority 1 commitments have been funded. In addition to more E-Rate funding, how would you envision modernizing the Priority 1/Priority 2 funding mechanism?

Answer. The central issue for E-Rate truly is the funding shortage. Demand for bandwidth in schools has drastically changed since 1998 with the increased use of digital tools, online learning and communication, devices, and online assessments that can provide individualized feedback and personalize learning. The current demand figure is likely tamped down demand as many districts below the 90 percent discount level no longer even apply for Priority 2 (internal connections) funding since they are unlikely to receive such funds. This is why I believe we need a permanent increase in the E-Rate cap that at least meets current program demand and remains focused on the core mission of the program. Although not perfect, the Priority 1/Priority 2 system provides an important data point to track demand for E-Rate services and helps USAC continue to ensure the integrity of the program and that all applicants receive at least some support.

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RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARK WARNER TO  
SHERYL R. ABSHIRE

*Question 1.* Mr. Coulter's testimony notes that "five years ago, the national implementation of educational technology in a large-scale fashion would have been prohibitively expensive with \$1,000 work-stations, shrink-wrapped sub-par software and torn up walls to wire school buildings. Today, thanks to the plummeting costs of tablet computers, innovative cloud-based software and enterprise Wi-Fi technology, implementation is affordable and achievable." He also acknowledged that "E-Rate currently supports operating expenditures but does not incentivize long-term investment in fiber." What do you recommend we do to better focus E-Rate on long-term investments?

Answer. In Calcasieu Parish, we have relied on strong leadership to conduct appropriate needs assessment and technology planning so that we make prudent investments for our technology needs of today and our needs in the future. In the future, the use of multi-year applications and consortia applications may even further improve the efficiency and long term functioning of the E-Rate program.

While I am aware of proposals to prioritize one technology over another and understand that there may be some long term value in doing so, I would urge policy-makers to consider two of the bedrock core values of E-Rate before establishing new priorities: (1) the program has always been technologically neutral and has never picked technology winners or losers; and (2) the program has always been locally

driven, allowing applicants to choose services and technologies that make the best sense for their needs and budgets. Moreover, I would urge policymakers to consider carefully the economic ramifications on the program overall and on applicants individually of prioritizing potentially expensive technologies over more economical ones.

*Question 1a.* It seems to me that some of the E-rate eligible services, such as paging, are outdated. Should the list of eligible services be revisited? If so, are there any services that you believe should be removed? Are there any that you believe are missing from the list?

Answer. While I do believe that some careful pruning of the list may be in order, I would urge the FCC to be very careful not to eliminate services that remain valuable despite their age and that help provide some form and substance to the increased bandwidth that all applicants seek. I am mindful of my district's own experiences after Hurricane Rita when E-Rate supported infrastructure and e-mail systems allowed Calcasieu Parish to stay connected—to learning and each other. Talk of eliminating support for relatively inexpensive services, like e-mail and collaboration tools, all of which facilitate parents, teachers and students communicating and collaborating, strike me as penny wise and pound foolish.

*Question 1b.* Is it possible to incentivize long-term investments without increasing the overall cost of the E-Rate program?

Answer. It is critical that the long-term sustainability and health of the E-Rate program be a top priority. While investment in fiber can be the best and cost-effective solution for high-speed broadband connectivity for some districts, it is also important that all schools—small, big, urban, suburban, and rural—retain the flexibility they need to make the technology decisions that work best for their circumstances and that the program stay true to its statutory mandate to set rules that are competitively (and technologically) neutral.

*Question 1c.* How could E-rate be modified to enable the deployment of enterprise Wi-Fi? Might this help to lower overall costs or to provide services that currently fall beyond the funding cap?

Answer. There is no question that wireless access in our Nation's schools is rapidly growing in importance. For instance, the Calcasieu Parish School network currently supports 35,000 network devices over a Wide Area Network (WAN) connection that delivers a 100 mbps connection. Additionally, the network contains 3,000 wireless access points which have become increasingly important as Bring Your Own Device (BYOD) programs and 1:1 device initiatives continue to be implemented to enhance the digital learning experience. It may make sense for the Commission to consider moving wireless access point eligibility from Priority 2 to Priority 1 in order to allow applicants greater opportunity to improve their existing wireless access. However, the Commission should consider the impact that such a move would have on available funds.

*Question 2.* There is very little data available on the capacity and speed of current school networks. Would it be beneficial to require schools who apply for E-rate funding to provide data on the speed and capacity of their networks? If not, why not?

Answer. Data is crucial to ensure the continued longevity and success of the E-Rate program and to ensure that we are providing access to educational opportunity for students no matter what part of the country they live in or where they attend school. Specifically, data regarding speed and capacity of applicants' broadband networks would inform the creation of reasonable and flexible bandwidth goals or targets for the E-Rate program as a whole. At the same time, any data collection must minimize the burden on applicants and be in sync with the overall goal of streamlining the administration of the E-Rate program.

*Question 2a.* Should a minimum bandwidth or speed level be implemented? If so, what should this level be based on (*i.e.*, number of users/school, demand for bandwidth)?

Answer. Bandwidth targets should be an important aspect of any E-Rate modernization effort. It is no longer sufficient to note the existence of the connection itself as the future of digital learning depends on the depth of the connection. As schools continue to integrate digital content, devices, online learning and communication portals, and online assessments, high-bandwidth connections will be critical. Any goals or targets, though, need to be based on demand and data and must take into account the varying needs of rural, urban, and suburban schools and libraries rather than a one-size-fits-all approach. My district of Calcasieu Parish Schools covers 1,036 square miles in southwest Louisiana and includes urban, suburban and deeply rural areas, all of which have varying needs that should be determined at the local level. Additionally, I am leery of any goals that become mandates, where applicants are denied additional funding upon reaching such goals or re-

quired to spend their own money to meet goals that do not necessarily reflect their own needs.

*Question 2b.* How can this data be plugged into the National Broadband Map?

Answer. The National Broadband Map is an important initiative that provides data regarding the level and type of high-speed Internet services that are available and in use across the country. Currently, one can search by various categories, such as congressional districts, and see a wide variety of information including broadband speeds and subscription levels for homes, businesses, K–12 schools and libraries, and more. One can also search for community anchor institutions within 25 miles of a particular address and find the type of technology and subscribed speed if such data is available. Additional readily available and searchable information regarding current broadband capacity of schools and libraries would further the goals of the National Broadband Map and universal service.

*Question 3.* In the past, E-Rate funded connections have been audited to ensure that only school/library traffic was riding on the subsidized connection, which resulted in high usage during the typical school day and unused capacity during evenings, weekends, and school vacations. Should E-Rate 2.0 include provisions that could support home-based broadband connectivity for students? If not, why not?

Answer. As digital learning continues to expand at school, access to the Internet at home is increasingly important for students to stay connected, conduct research, and complete homework assignments. However, the E-Rate program's central purpose is ensure that schools and libraries have access to advanced telecommunications and information services and there are limited resources available to accomplish that goal. Although I support efforts to increase at home broadband access, demand for currently eligible E-Rate services for 2013 was \$4.986 billion dollars, or more than double the \$2.25 billion annual cap that was set for the program back in 1998. Demand for bandwidth in schools has drastically changed since 1998 with the increased use of digital tools, online learning and communication, devices, and online assessments that can provide individualized feedback and personalize learning. The current demand figure is likely tamped down demand as many districts below the 90 percent discount level no longer even apply for Priority 2 (internal connections) funding since they are unlikely to receive such funds. Even with the inflation adjustment and roll-over funds, there may not be enough funds to fund Priority 2 projects at the 90 percent discount level. This is why I believe we need a permanent increase in the E-Rate cap that at least meets current program demand and remains focused on the core mission of the program.

*Question 3a.* Do you believe E-Rate funded connections could be leveraged during these “down” periods to provide for load balancing and added technology availability for the campus/community? If so, do you have any suggestions regarding how this type of function could be utilized without a large increase in costs or in concerns about the accountability of the program?

Answer. In 2010, the FCC made permanent a rule that allows schools—if they so choose—to open their doors after hours so that the community at large can utilize the schools broadband connections that are supported by the E-Rate program. Schools around the country have leveraged this opportunity to provide a place for students to complete assignments, provide digital literacy classes and other community services, and provide access to the online world that hosts government services, job applications, and distance education. Under this rule, E-Rate supported services must still be used primarily for educational purposes and students must have first priority in the use of E-Rate supported services, use of E-Rate supported services by the community at large may only occur after school hours on school premises, and schools may not request more E-Rate support than is needed to support educational purposes for the student population. This rule change struck the appropriate balance between ensuring the statutory objective of the E-Rate program—that schools and libraries have access to advanced telecommunications and information services for educational purposes—and the important aim of facilitating access to those services to the community at large during nights, weekends, and school vacations. This careful balance ensures that the program and its resources are prudently allocated first to the school for the benefit of its students and that program accountability and integrity is maintained.

*Question 4.* On June 6, 2013, the Administration unveiled a new initiative called ConnectED, which intends to connect 99 percent of America's students to the Internet through high-speed broadband and high-speed wireless within 5 years. Do you have any recommendations for the FCC or Congress in terms of how E-Rate can be better aligned to support curriculum or technology training goals?

Answer. E-Rate has been incredibly successful in providing nearly all classrooms with a basic connection to the Internet. In the future, the main obstacle to continue

success is the severe funding shortage that currently exists in the E-Rate program. This is why I am advocating for a permanent increase to the E-Rate cap that at least meets current demand. The current cap was set back in 1998, before tablets, smartphones, and many of the digital learning opportunities of today existed. In order to support the use of these digital learning tools and to provide students with the 21st century skills they will need to succeed in our global economy, schools will need high-speed broadband connectivity moving forward.

*Question 4a.* Could Elementary and Secondary Act (ESEA) Title II funds, typically allocated for teacher training, be used in a different manner to ensure teachers are trained to integrate educational technology into their instruction?

Answer. Ongoing, embedded teacher training—or professional development/professional learning—is critical for digital learning to be successful in the classroom. Technology professional development supports teachers in learning new ways to use technology to redesign curriculum, individualize instruction, increase student engagement, incorporate technology into the classroom, and utilize online assessment data to personalize learning. The current Title IIA, much like the E-Rate, is undergoing a funding crisis as it continues to absorb sequestration cuts. Thus, it is hard to repurpose funding from a pool that is already spoken for and is shrinking.

As an alternative, I support funding the existing Title IID or currently unpassed legislation to revamp it—The Enhancing Education Through Technology Act of 2013 (S. 1087)/The Transforming Technology through Technology Act (HR 521). The current program and both bills include a strong emphasis on technology professional development. In the past, when districts used to receive EETT funding, they were required to spend at least 25 percent of their grants on professional development—however; many districts reportedly allocated significantly higher percentages of their grant funds towards professional development activities. New education technology legislation—with a focus on education technology professional development—is a critical partner to E-Rate’s connectivity support.

*Question 4b.* Is Title I participation the “right” basis for subsidy calculations or should it be based on technology need and the actual dollars necessary to reach a desired speed/capacity level and sustain it over time?

Answer. The E-Rate discount matrix—which allocates a discount for E-Rate eligible services based on the percentage of students who qualify for free-and-reduced-lunch—has allowed all schools across the country to connect to the Internet and build their network infrastructure. The program has always focused on ensuring that no matter how low-income your students or how rural or remote your location, E-Rate support would help connect your classrooms and libraries. No matter what the Commission decides, I believe truly that poverty and rurality must remain a significant factor in calculating support.

In terms of reaching national targets, accounting for bandwidth targets may make sense. However, significant data collection to determine existing levels and determine appropriate targets would be required before changing the formula.

*Question 4c.* How do we effectively harness the opportunities enabled by technology to train or retrain individuals to enter sectors that will experience high growth?

Answer. Comprehensive technology planning, leadership, ongoing professional development for educators, and a wide array of digital learning opportunities for students supported by robust connectivity will provide students with the skills they need to succeed in 21st century careers.

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RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARK PRYOR TO  
LINDA H. LORD

*Question 1.* During the E-Rate hearing, we were told that schools apply for far more E-Rate funds than are available. Speaking as the State Librarian, are libraries facing a similar gap between demand and availability? Are they receiving any Priority 2 funding? What other considerations should be taken into account for libraries?

Answer. Libraries face the same issues as schools in the lack of adequate funding to meet applicant demand for Internet services. In reality most libraries that fall under the 80 percent discount band no longer apply for Priority 2 funding since there is not enough funding to fulfill the applicant requests below even the mid-80 percent range. In fact in Funding Year 2013, applicant demand for Priority 1 services alone eclipsed the total amount of funds available. In 2013 applicants requested \$2.00 for every \$1.00 available. Libraries across the country have seen a dramatic rise in Internet use and in providing services that require high bandwidth connec-

tions. In 2012, 62 percent of libraries reported they were the only source of free public access to computers and the Internet (in Arkansas it is 58 percent). This is especially important for rural communities where the number rises to 70 percent. With so many critical life tasks only online, the public library is a lifeline for many communities and the residents they serve.

We expect the demand for high-capacity applications and services to continue and libraries are feeling a crunch similar to that faced by schools. While library bandwidth speeds are improving, only about 9 percent reported that they had Internet speeds of 100Mbps or greater (only 5 percent of rural libraries). This is simply unsustainable given the reliance of communities across the country on their public library.

One idea is to enable libraries to own their own wide area networks (WANs) where it is the most cost effective solution. This will help libraries plan for long-term cost savings. Amortizing the cost of network deployment over 4–5 years will help keep the annual cost lower and may encourage more investment, especially in rural areas that need greater bandwidth even when costs tend to be higher.

The following information is from the state E-Rate coordinator in Arkansas.

“Arkansas has 222 public libraries and 58 percent participate in the E-Rate program. While the vast majority of libraries technically receive broadband Internet access, they may be getting only 1.5 Mbps for the entire library.

“For FY 2013, 130 of the 222 Arkansas public libraries applied for E-Rate. Of the applicant libraries, 38 (29 percent) were at the 90 percent discount level. Eighty-two applicant libraries (63 percent) qualified for an 80 percent discount. Only ten applicant libraries (8 percent) were below the 80 percent discount level. If all 222 Arkansas public libraries applied, I believe that the same discount percentage distribution would occur.

“Since FY 2010, only five libraries have applied for P2, and none have received the funding. All five libraries were at the 80 percent discount level. In FY 2011 and FY 2012, P2 funding was not available at the 80 percent discount level, resulting in denials for Baxter County Library and Central Arkansas Library System. In FY 2010, Columbia County Library System cancelled their P2 application during review due to the very long and tedious PIA [Program Integrity Assurance] review process. Columbia County Library determined that pursuing P2 funding was a negative return on their investment. It required too much time to navigate the application review process when weighed against of the amount of money requested. Columbia County Library’s experience illustrates perfectly why many Arkansas public libraries do not apply for P2. The P2 application and review process is too much work, especially if the discount percentage rarely drops below 90 percent. The delay in P2 funding is also a problem for potential applicants. The poorest libraries need to know if they will receive P2 funding before they start large internal connections projects. They cannot afford the cost of the projects without E-Rate support.

The difficult, multi-step application process stops a number of libraries from applying for E-Rate discounts. The most rural and economically challenged libraries do not have enough staff to devote to the E-Rate application filing process. If the application process is simplified and streamlined, I feel that more Arkansas public libraries will apply for E-Rate.”

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. AMY KLOBUCHAR TO  
LINDA H. LORD

*Question 1. Rural Service.* As a library specialist and veteran who e-mailed me from Hibbing, Minnesota this week pointed out, the role of libraries is more than just a resource with books, they are a resource for services and information that help keep our communities strong, vibrant and connected. This is extremely true in rural areas where “anchor institutions” like schools, libraries and health clinics are the first places to get new broadband services, which tends to lead to better commercial services being available to residents. Ms. Lord—Can you share how E-Rate in the past has improved the expansion of connections within communities and how you envision modernization would link up communities in the future?

*Answer.* Generally, when an anchor institution, like a library, is connected to broadband that paves the way for further broadband build-out in the community which ultimately benefits the entire community. In a rural state like Maine our small communities are the backbone of our economy and the need for connectivity that supports our small businesses and entrepreneurs is great. It is also critically important that our rural residents can connect to services that may not be readily

available in more remote areas. Our libraries are the lifeline for our rural communities. In one village, we had a gentleman who is a video producer and uses the library to upload video files to send to his clients all over the world because his Internet at home is not fast enough to allow for such large uploads. In Maine this story is not uncommon, with many libraries reporting that home businesses stay alive by using the library Wi-Fi connection. At the state library we provide our patrons with Skype for connecting to family and friends and our video conferencing service is tremendously popular. My example of school students exploring a Smithsonian program virtually will become more commonplace as technologies advance. I envision a growing need for such high-capacity services. Libraries will continue to be an important hub in rural communities.

*Question 2. Jobs and Employment.* Minnesota has an unemployment rate of 5.3 percent—this is two points below the national average. However, we also know that many veterans and new graduates in my state and around the country continue to have issues securing good jobs either in their home towns or wherever they chose to live. Ms. Lord—What do you see as both the role of libraries in assisting those in these demographic groups, as well as others, with job seeking resources? What do you view as the future of libraries in partnerships to accommodate job training courses either at the facilities offering computer training courses, or accommodating more online education opportunities?

Answer. Librarians now consider the provision of public Internet services to job seekers the most important service they provide to their communities. Ninety percent of libraries provide access to jobs databases, a number which has been steadily growing in recent years. The majority of libraries also provide civil service examination materials. They also provide software and other resources so that patrons can create resumes and other necessary materials for gaining employment. Patrons develop and expand digital literacy skills, search for and apply for jobs online, and complete professional certifications and continuing education courses using the public access computers and library Internet or Wi-Fi with their own devices. Along with specific resources for job seekers, 90 percent of libraries offer some type of formal or informal technology training. Often these classes and supports take the form of developing skills needed for today's workforce.

According to a 2010 report from the Institute of Museum and Library Services, 30 million library users went to the library specifically for employment related activities like searching and applying for a job, building a resume, and interviewing. Out of these visits, about 16 percent of the people were eventually hired. Many libraries partner with local workforce agencies to help extend their career and employment services in what are known as One-Stop Career Centers. The vital role libraries have in promoting workforce development was formally recognized in 2010 by a partnership between IMLS and the Department of Labor Employment and Training Administration. The partnership particularly recognizes not only the Internet access, but also the role of the librarian who serves as an "information navigator." Other libraries focus on small business development, providing tools for entrepreneurs to start a business or to further market a budding one.

Libraries are dedicated to addressing the needs of specific populations in their communities and routinely structure programs that are tailored to seniors, non-English speakers, youth, as well as Veterans. As I mentioned in my testimony, Maine has a videoconferencing service that we have used recently with the lawyers in libraries program for a session devoted to Veterans' benefits. An attorney specializing in Veteran's benefits was "live" in the host library and the session was available to any patron of the seven participating libraries. Beyond this valuable service that allows our rural communities to gain access to legal advice on topics critically important, I would like to share a few more Maine examples of work we do to support our Veterans. We know that Veterans often have significant challenges in securing employment and a number of our libraries tailor their workforce programs to focus on Veterans. The Augusta Career Center recently had a workshop for Veterans that walked the participants through the resources available through the state library's Information Commons, specifically focusing on employment skills and resources. Equally important to library services are programs that encourage lifelong learning as we see this as foundational to being prepared for future work and life opportunities. A creative program that supports this concept was held in the Camden Public Library. The library just finished a 10-week writer's group series called "Veteran's for Peace". The workshop was run by a Veteran who was also a retired writing teacher. I heard that those who attended appreciated the opportunity to talk and write about their war experiences with a group that understood them and their background. I know that similar examples are replicated in libraries across the country.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARK WARNER TO  
LINDA H. LORD

*Question 1.* Mr. Coulter's testimony notes that "five years ago, the national implementation of educational technology in a large-scale fashion would have been prohibitively expensive with \$1,000 work-stations, shrink-wrapped sub-par software and torn up walls to wire school buildings. Today, thanks to the plummeting costs of tablet computers, innovative cloud-based software and enterprise Wi-Fi technology, implementation is affordable and achievable." He also acknowledged that "E-Rate currently supports operating expenditures but does not incentivize long-term investment in fiber." What do you recommend we do to better focus E-Rate on long-term investments?

Answer. Libraries and their connectivity needs vary state by state and community-by-community so it is very important to promote solutions that are flexible enough to meet local needs. But I can tell you that, when a library adds incremental capacity, it often discovers that its broadband usage surges to the new maximum capacity immediately by patrons using bandwidth-intensive applications. There is no "quick fix" and libraries need to plan their broadband for the long-term. Generally fiber is going to be the best long-term investment (where it is economical and not cost prohibitive because once installed it is relatively easy to expand capacity to meet growth in demand). Enabling the ownership of wide area networks (WANs) by E-Rate applicants where it is the most cost effective solution will help applicants think about long-term cost savings (such as a 4–5 year return on initial investment). Amortizing the cost of network deployment over 4–5 years will help keep the annual cost lower and may encourage more investment, especially in rural areas that need greater bandwidth even though costs tend to be higher.

*Question 1a.* It seems to me that some of the E-Rate eligible services, such as paging, are outdated. Should the list of eligible services be revisited? If so, are there any services that you believe should be removed? Are there any that you believe are missing from the list?

Answer. We have an important opportunity to focus on moving libraries from simple connectivity to high-capacity broadband. In my role as chair of ALA's E-Rate Task Force, I can tell you that we are looking carefully at legacy services that may not directly support broadband connectivity, such as Plain Old Telephone Service (POTS). While many small libraries apply only for POTS and there are areas where alternatives are either unavailable or cost prohibitive, it is vitally important that libraries seek ways to increase their broadband connectivity. We do believe that it will be critical to develop a phase-out process of such legacy services so that applicants can transition as smoothly and cost-effectively as possible. We are also reviewing the eligible services list to make sure libraries are able to receive discounts on services that are necessary for broadband connectivity.

*Question 1b.* Is it possible to incentivize long-term investments without increasing the overall cost of the E-Rate program?

Answer. Incentivizing long-term investments (such as construction costs for fiber builds amortized over several years) does not necessarily end up costing the program more, and in the case of WAN ownership likely will result in savings. Spending wisely is a good start and should be a focus of the program for both applicants and providers. However, savings through prudent purchasing will not solve the chronic underfunding of the program when applicant demand already hovers at double the funds available.

*Question 1c.* How could E-Rate be modified to enable the deployment of enterprise Wi-Fi? Might this help to lower overall costs or to provide services that currently fall beyond the funding cap?

Answer. It is possible that providing greater funding for Wi-Fi service inside the building may reduce the need to purchase other more expensive wireless services. This is an issue that the FCC is currently exploring in its E-Rate reform proceeding.

*Question 2.* There is very little data available on the capacity and speed of current school networks. Would it be beneficial to require schools who apply for E-Rate funding to provide data on the speed and capacity of their networks? If not, why not?

Answer. Because I can only speak from a library perspective, I cannot speak to whether or not schools should be subject to this requirement. I will only point out that the ALA has conducted several surveys of the broadband capabilities of libraries, which are available at [www.plinternetsurvey.org](http://www.plinternetsurvey.org).

*Question 2a.* Should a minimum bandwidth or speed level be implemented? If so, what should this level be based on (*i.e.*, number of users/school, demand for bandwidth)?

Answer. One success of the program is that it has always been based on the needs of the applicant. We want to encourage libraries to be forward thinking and plan for future bandwidth needs and goals can be aspirational in that regard. ALA is looking at several options for setting a library bandwidth target that take into account the diverse nature of libraries in different rural and urban settings, with different services areas, and that accounts of desktop computers as well as patron and library mobile devices. Rather than a mandated bandwidth speed, I think it more productive to determine targets with benchmarks along the way that encourage applicants to make decisions based on projecting future connectivity needs while also acknowledging current concerns like the cost of fiber in some areas.

*Question 2b.* How can this data be plugged into the National Broadband Map?

Answer. ALA has worked with NTIA to improve the data for libraries, and I would encourage the FCC to add any new data elements to the map that are related to libraries and schools so that the public can have access to accurate and current broadband availability information.

*Question 3.* In the past, E-Rate funded connections have been audited to ensure that only school/library traffic was riding on the subsidized connection, which resulted in high usage during the typical school day and unused capacity during evenings, weekends, and school vacations. Should E-Rate 2.0 include provisions that could support home-based broadband connectivity for students? If not, why not?

Answer. Because the program is so underfunded and cannot meet current demand from applicants for services currently eligible, I would be extremely reluctant to support new programs, however important they might be. E-Rate is fundamentally about connecting libraries and schools, and I would like the focus to remain on this so that both can continue to provide the services they do for K12 students and the general public.

*Question 3a.* Do you believe E-Rate funded connections could be leveraged during these “down” periods to provide for load balancing and added technology availability for the campus/community? If so, do you have any suggestions regarding how this type of function could be utilized without a large increase in costs or in concerns about the accountability of the program?

Answer. Schools can currently allow the public to use their E-Rate supported Internet after hours and of course libraries are the “after school hours” facility. At this time I believe that we should be primarily concerned about addressing the funding shortfall and the additional burden on the already oversubscribed program. There are likely to be many issues with oversight and reporting that would have to be weighed before initiating such a program within E-Rate.

*Question 4.* On June 6, 2013, the Administration unveiled a new initiative called ConnectED, which intends to connect 99 percent of America’s students to the Internet through high-speed broadband and high-speed wireless within 5 years. Do you have any recommendations for the FCC or Congress in terms of how E-Rate can be better aligned to support curriculum or technology training goals?

Answer. The E-Rate program is fundamentally about connecting libraries and schools with telecommunications and broadband services. I do not believe that educational or training benchmarks and goals should be hinged to the E-Rate program. If libraries and schools have the bandwidth they need to support educational opportunity for patrons and students, they will be best equipped to incorporate the best technologies into the curriculum and give our students and the general public the technology skills they need to be productive.

*Question 4a.* Could Elementary and Secondary Act (ESEA) Title II funds, typically allocated for teacher training, be used in a different manner to ensure teachers are trained to integrate educational technology into their instruction?

Answer. Yes, school librarians should be included as eligible to participate in ESEA funded training. In many schools today, school librarians are key to creating opportunities for teachers’ meaningful use of technology, as well as increasing teachers’ capacity for integrating the use of technology tools into specific learning tasks and curricula. These librarians are integral to the creation of digital media and content for both student and teacher use in and out of the classroom and school building. By including school librarians in training opportunities supported by ESEA funds, they will be better equipped to develop appropriate uses of technology tools that build on educational standards resulting in more students attaining their educational goals. Furthermore, school librarians with proper training will also be able to work with other school professionals to integrate educational technology into the classroom.

*Question 4b.* Is Title 1 participation the “right” basis for subsidy calculations or should it be based on technology need and the actual dollars necessary to reach a desired speed/capacity level and sustain it over time?

Answer. The American Library Association is currently investigating the best poverty calculation tool that most accurately reflects the poverty level of the library service area. At the same time the E-Rate program, because it is a discount program, allows applicants to base their requests for services on their local technology needs and through the competitive bidding process applicants must be judicious in selecting the most cost effective solutions.

*Question 4c.* How do we effectively harness the opportunities enabled by technology to train or retrain individuals to enter sectors that will experience high growth?

Answer. Librarians report that supporting job seekers, including training for the 21st century workforce is the most important service they provide their communities. There is a great example in Carson City, Nevada that highlights what can be possible with partnerships and a drive to use technology to innovate and revitalize workforce opportunities. The public library has set up a 4,000-square-foot branch in a downtown storefront. The branch anchors the *Business Resource Information Center* (BRIC), a catalyst for a major economic renewal in the state capital. The library branch helps entrepreneurs with market research, business planning classes, computers, and electronic resources such as sophisticated business-focused databases. The library is part of the *Knowledge + Discovery Center* that has state-of-the-art digital media labs to train students in high-tech skills and a business incubation facility to encourage more entrepreneurs to build on what are currently six acres of parking lots.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. MARK PRYOR TO  
PATRICK FINN

*Question.* In your testimony, you said that E-Rates rules and funding decisions between Priority 1 and Priority 2 services are outdated. If this distinction is fully eliminated, is there a danger that, while some schools will receive support for their internal connections, others will not receive support for basic Internet access? How do you envision removing the Priority 1/Priority 2 distinction?

Answer. Networks operate as a whole and so it is just as important to have internal connections as it is to have Internet access. The current Priority system often leads to many schools only receiving E-Rate funding for Internet access and nothing for internal connections. Indeed, if nothing is changed, it is likely that there will be no funding for any school for internal connections in the future. We must migrate to a system where both aspects of connecting students and teachers are equally funded. By removing the Priority system, all eligible requests will be treated the same, with the exception of the overall school discount level. Between making the program more efficient and providing the necessary funds, the E-Rate should be able to support both aspects of networking in all schools.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. AMY KLOBUCHAR TO  
PATRICK FINN

*Question.* Rural Service. As a library specialist and veteran who e-mailed me from Hibbing, Minnesota this week pointed out, the role of libraries is more than just a resource with books, they are a resource for services and information that help keep our communities strong, vibrant and connected. This is extremely true in rural areas where “anchor institutions” like schools, libraries and health clinics are the first places to get new broadband services, which tends to lead to better commercial services being available to residents. Mr. Finn—In modernizing the E-Rate program, could we expect to see additional deployment and improvement to broadband services in rural areas for other businesses and consumers?

Answer. Libraries are a critical community resource and can often be the only way that people without Internet access at home can connect. Strengthening library networks is just as important as schools. As the E-Rate program is modernized and most schools and libraries are connected with very high speed connections, the infrastructure capacity that is brought to a location to connect the school or library will also be available to other businesses and consumers. Having a crucial first large scale customer in a particular location can be the impetus for the investment of a fiber or other high speed connection to a community.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARK WARNER TO  
PATRICK FINN

*Question 1.* Mr. Coulter's testimony notes that "five years ago, the national implementation of educational technology in a large-scale fashion would have been prohibitively expensive with \$1,000 work-stations, shrink-wrapped sub-par software and torn up walls to wire school buildings. Today, thanks to the plummeting costs of tablet computers, innovative cloud-based software and enterprise Wi-Fi technology, implementation is affordable and achievable." He also acknowledged that "E-Rate currently supports operating expenditures but does not incentivize long-term investment in fiber." What do you recommend we do to better focus E-Rate on long-term investments?

*Question 1a.* It seems to me that some of the E-rate eligible services, such as paging, are outdated. Should the list of eligible services be revisited? If so, are there any services that you believe should be removed? Are there any that you believe are missing from the list?

*Question 1b.* Is it possible to incentivize long-term investments without increasing the overall cost of the E-Rate program?

*Question 1c.* How could E-rate be modified to enable the deployment of enterprise Wi-Fi? Might this help to lower overall costs or to provide services that currently fall beyond the funding cap?

Answer. Schools need to deploy modern networks that are capable of meeting the needs of current educational applications and materials. The E-Rate should be focused on supporting services and internal connections that meet that need. Outdated services should be removed from the program and replaced by more cost effective applications. Technology like Wi-Fi are already used extensively in schools and will certainly be the backbone of most internal networking in the schools. Wi-Fi is the most efficient method of connecting devices in classrooms and will allow the most widespread access to the overall capacity of connectivity that is brought to schools. Even with the use of the most efficient technology, it is still necessary to fund the program at levels to support today's technology, rather than funding levels that were set for 1998 technology.

*Question 2.* There is very little data available on the capacity and speed of current school networks. Would it be beneficial to require schools who apply for E-rate funding to provide data on the speed and capacity of their networks? If not, why not?

*Question 2a.* Should a minimum bandwidth or speed level be implemented? If so, what should this level be based on (*i.e.*, number of users/school, demand for bandwidth)?

*Question 2b.* How can this data be plugged into the National Broadband Map?

Answer. Data relating to the speed of school networks can be very useful in determining whether we are adequately meeting the educational needs of our students. This data could be collected easily without a meaningful increase in the administrative burden to E-Rate applicants.

Minimum bandwidth levels should be adopted to ensure that all students have the opportunity to benefit from modern education methods. Cisco has just released a White Paper that discusses bandwidth levels in depth. A copy of the paper is attached with this response.

*Question 3.* In the past, E-Rate funded connections have been audited to ensure that only school/library traffic was riding on the subsidized connection, which resulted in high usage during the typical school day and unused capacity during evenings, weekends, and school vacations. Should E-Rate 2.0 include provisions that could support home-based broadband connectivity for students? If not, why not?

*Question 3a.* Do you believe E-Rate funded connections could be leveraged during these "down" periods to provide for load balancing and added technology availability for the campus/community? If so, do you have any suggestions regarding how this type of function could be utilized without a large increase in costs or in concerns about the accountability of the program?

Answer. The use of networking technology in education does not stop with the school day, so it is important the school networks are built to support remote use by students. If properly implemented, school networks will see significant afternoon and evening traffic due to student use, but it certainly makes sense for any excess capacity to be made available for public use in a manner similar to public libraries.

*Question 4.* On June 6, 2013, the Administration unveiled a new initiative called ConnectED, which intends to connect 99 percent of America's students to the Internet through high-speed broadband and high-speed wireless within 5 years. Do you

have any recommendations for the FCC or Congress in terms of how E-Rate can be better aligned to support curriculum or technology training goals?

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*Question 4b.* Is Title I participation the “right” basis for subsidy calculations or should it be based on technology need and the actual dollars necessary to reach a desired speed/capacity level and sustain it over time?

*Question 4c.* How do we effectively harness the opportunities enabled by technology to train or retrain individuals to enter sectors that will experience high growth?

*Answer.* In the areas in which Cisco has expertise on networking and education, we have provided our recommendations on how best to modernize the E-Rate system in our White Paper which is attached to this response.



## High-Speed Broadband in Every Classroom: The Promise of a Modernized E-Rate Program



A white paper outlining Cisco's recommendations on how to modernize the existing E-Rate Program to put high-speed broadband into the hands of every student in America.

September 2013

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## Executive Summary

### Overview



The United States educational system is in the midst of transformational change due to widespread adoption of technologies, including video, mobile devices, and cloud services. Given the enormous potential of these technologies to improve educational outcomes, increase access to information and collaboration, and reduce costs, schools and libraries across the nation want to do more, not less, with technology.

This is particularly relevant in light of the national imperatives to ensure that American students remain competitive in the global marketplace and to meet the public policy goal of increasing the number of graduates in science, technology, engineering, and math (STEM) fields. Other nations are making major investments in digital education. If the U.S. does not make commensurate investments, it risks falling behind.

The foundation of funding for digital education in America is the E-Rate Program, which was authorized by Congress in 1996 and implemented by the Federal Communications Commission (FCC) in 1998. Since the program's inception, more than 100,000 schools and libraries have been connected to the Internet, and the program has been widely hailed as a great success.

Yet the accelerating pace of technological change has placed enormous stress on the program. Today, 80 percent of schools and libraries believe their bandwidth does not meet their current needs. Furthermore, in many schools in America, connectivity to students and teachers is inadequate, often less than one megabit per second. In too many cases, the promise of digital education to every student in America remains that - a promise, and not reality.

The good news is that there is consensus that the E-Rate Program remains essential and simply needs to be modernized to keep up with the times. President Barack Obama announced his ConnectED initiative to update the program and increase funding for E-Rate. The Senate Commerce Committee recently held a hearing on E-Rate, in which senators on both sides of the political aisle expressed strong support for the program. And the FCC has initiated a formal proceeding to consider ways to improve and streamline the program.

Cisco, the worldwide leader in networking, has 15 years of experience implementing technology solutions at schools and libraries as part of the E-Rate Program. As part of the process to modernize E-Rate, Cisco has undertaken a comprehensive assessment of its experience with the program with three goals in mind:

- Identifying success stories and best practices for bringing technology into schools and libraries
- Making concrete recommendations for how the program can be modernized and streamlined based on real-world technology implementations

- Recommending a minimum bandwidth speed for school districts, schools, and individual classrooms to ensure that they are able to handle most of their technology needs

#### How Technology Is Transforming Education

Fundamental changes in the way that teachers teach and students learn are underway. Some schools and districts are abandoning print textbooks for their digital counterparts. Other schools are flipping traditional models of learning - where students watch lectures at home and do collaborative study in the classroom. And still others are expanding the four walls of the classroom to connect with students, teachers, and subject matter experts across town, across the country, or across the world. Today, 78 percent of students and 83 percent of faculty and staff bring a personal device to class and use the campus network for Internet access.<sup>1</sup>

These changes are made possible by advances in computing, mobile devices, storage, local networks, applications software, and Internet access, which have created a tipping point in education.

The millennial generation of students - those born after 1982 - is increasingly driving the demand for technologies that increase engagement and the ability to work together in groups. These students expect simple, wireless Internet access, the ability to easily connect and communicate over the Internet with other students and faculty members, on-demand video, and the infusion of other technologies into their classes.

Other nations are making aggressive investments in digital learning and technology in education. In South Korea, for instance, all schools are connected to the Internet with high-speed connections; all teachers are trained in digital learning, and printed textbooks will be phased out by 2016. If the United States does not make major investments in digital education, it will leave our students at a competitive disadvantage in the global marketplace.

One of the keys to providing the skills necessary to help our students compete is providing quality Internet access to our students. The good news is that many of the technologies required have matured in ease of use, functionality, and reliability. However, significant challenges remain, particularly in easy integration to ensure maximum utility and a consistent, high-quality user experience. To accomplish this, Cisco recommends an end-to-end architectural approach, supported by appropriate service offerings. This is how businesses, governments, universities, and other industries are managing their connectivity today; so too should schools and libraries.

In this paper, Cisco identifies ten case studies that highlight how the adoption of technologies can improve educational outcomes, promote collaboration in schools and districts, reduce expenses, and improve safety and security at school facilities. Case studies include:

- Mooresville Graded School District, North Carolina: Adoption of Technology Improves Academic Performance
- Paradise Valley Unified School District, Arizona: Cost-Effectively Connecting Remote Classrooms
- Katy Independent School District, Texas: Wireless Mobility Push Leads to Surging Levels of Student Engagement and Higher Test Scores
- Farmington Public Schools, Michigan: Wireless Mobility Enables Anytime, Anywhere Teaching
- Fresno Unified School District, CA: Collaboration Improves Test Scores
- Jefferson Parish Public School System, Louisiana: Technology Initiative Leads to Improved Student Test Scores
- Indianapolis Public Schools, Indiana: Cost-Savings Through the Cloud
- Charles County Public Schools, Maryland: Technology-Based Curriculum Improves State Ranking

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- Warren County Public Schools, Virginia: IP Video Surveillance System Improves School Safety, Reduces Vandalism and Loitering
  - Kent School District, WA: The Value of Maintenance

#### Five Recommendations for Modernizing and Streamlining E-Rate

Cisco's experience working with the educational community to provide next-generation learning opportunities has provided it with important insights into both the successes of the E-Rate Program and improvements that are necessary to allow the program to continue to achieve its goals in the new learning environment. Following are five recommendations for modernizing and streamlining the program.

**First, E-Rate must be adequately funded to support the technology-intensive needs of educators in the Internet age.** As schools' and libraries' technology needs have grown, E-Rate funding has not kept pace. Funding requests outstrip the funding cap nearly every year - usually by more than 100 percent. Under current prioritization rules, requests for services exceed the funding cap, leaving infrastructure requests unfunded. Schools and libraries cannot prepare students to be competitive in a knowledge-based, next-generation connected workplace with 20<sup>th</sup> century technology. Therefore, the FCC should ensure that funding is sufficient, as originally required by the statute. This should begin with an inquiry into the services and equipment that need to be funded, and a candid assessment of the costs to deploy those services and equipment in the nation's schools over a reasonable time horizon. Only through this process can the FCC determine an appropriate level of funding for the E-Rate Program.

**Second, the FCC should support cost-effective networks that operate as a cohesive whole, providing capacity for the future and long-term efficiencies.** Today's connected learning environment depends on delivering multimedia information to classrooms, students, and faculty, and doing so across a range of devices to different buildings and student homes. These capabilities require school districts and individual schools to provide a high-bandwidth, high-performance network at all times. This also requires comprehensive, business-grade broadband and network solutions to enable these capabilities.

In short, today's connected learning environment cannot be provisioned with an Internet connection and simple inside wiring alone. Schools need sufficiently robust broadband connectivity in and out of the school and sufficient broadband connectivity **within** the school. But a modern network must also include network management and maintenance, safety and security solutions, access- and distribution-layer infrastructure, wireless availability and access points, video endpoints, local caching, cloud services, and mobile access solutions for students and faculty working on educational projects outside of the school.

As complexity of networks increases, management and maintenance of the network become increasingly important. For all practical purposes, maintenance becomes part of a well-maintained network from an end-user perspective. Every part of the network is mission-critical, so it is necessary to ensure that the entire network is fully functional. As school networks and data centers evolve to support learning and professional development programs, campus safety technologies, and mission-critical business processes, the consequences and costs of downtime increase dramatically, and delays in resolving issues can bring educational activities to a standstill. This white paper offers several technical recommendations to provide faster broadband to districts, schools and classrooms.

**Third, the FCC should eliminate the prioritization of services over networks.** In order to promote the efficient use of E-Rate support, the FCC should eliminate the current rule that creates an artificial funding priority for telecommunications or Internet access services over the networks used to provide those services (called the

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Priority 1/Priority 2 distinction). Cisco has seen firsthand how the current rule leads educators to structure their funding requests (and, ultimately, their purchasing decisions) in inefficient ways in order to increase their likelihood of being funded. In practice, this means that schools over-order voice and broadband access services, and neglect the internal networks that are used to distribute those services among schools within a district and among classrooms within a school. In Cisco's experience, this is a significant factor contributing to most schools' complaints that they lack adequate broadband capacity.

**Fourth, the FCC should simplify participation in the program.** Cisco's work with the educational community has revealed that many schools and libraries are daunted by the administrative application process to obtain E-Rate funding. Schools that take the time to parse the complex rules - or that can afford to hire E-Rate consultants to do so - fare better than schools that do not, irrespective of their relative need for support. This can lead to undesirable outcomes in the allocation of support among schools. The E-Rate Program would be both fairer and more efficient if the administrative process were simpler.

**Fifth, the FCC needs to set bold goals to address future bandwidth needs.** In a few short years, every school in America will require connections of at least 1 Gigabit per second, and larger schools will require speeds faster than that. As technology advances and schools use applications such as high-definition video more intensively, they will need to grow their capacity over time. The E-Rate Program should set bold goals for current and future connectivity to ensure that schools can meet future demands for Internet access. Students and teachers should be able to download most files, conduct Internet research, engage in collaborative group projects, and handle most classroom tasks. The density of devices and users per square foot in schools today is among the highest found in any work environment. Neither hotels and enterprise business environments, nor restaurants and hospitals see this level of demand on their networks. Given this density, a major focus of the E-Rate Program should be to increase the actual bandwidth that students and teachers experience.

Therefore, Cisco recommends that by 2014, all schools in America have Internet access of 1 Gbps per 2,000 students (or 0.5 Mbps per student) and by 2018 increase that number four-fold, to 4 Gbps per 2,000 students (or 2 Mbps per student). In addition, Cisco recommends that in geographies in which last-mile fiber infrastructure is already built, schools should double the goals to 2 Gbps per 2,000 students in 2014 and 8 Gbps per 2,000 students by 2018.

Each school is different, and speeds are only one measure of how robust a network is. So, district administrators should also consider how much connectivity is reaching students and teachers in the classroom so that students and teachers can conduct typical network activities with minimal disruptions or lag times. For internal district and school networks Cisco recommends bandwidth at five times the Internet access speeds. This translates into 5 Gbps per 2,000 students in 2014 and 20 Gbps per 2,000 students by 2018. In geographies where last-mile fiber infrastructure is already built, the goals should be doubled (10 Gbps per 2,000 students in 2014 and 40 Gbps per 2,000 students by 2018).

#### Conclusion

Cisco has a proven [commitment to education](#) and has been a leader in developing creative and effective public-private partnerships. We care deeply about students and educators, and we have made, and continue to make, major investments of time and resources to improve education in the U.S. and globally.

When it comes to E-Rate, we have a major opportunity to use the massive acceleration of technology currently taking place to transform teaching and learning. We hope that policymakers take advantage of this opportunity, and we stand ready to help in any way possible.

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Part 1: The Need for Quality Internet Access to Students and Teachers



The way that students are being taught and the way they learn is fundamentally changing. Print textbooks are being abandoned for their digital counterparts. More and more schools are flipping the traditional educational model, having students watch lectures at home and then collaborate in the classroom. Other innovative schools and teachers are expanding the four walls of the classroom to connect with students across town, across the country, or across the world. Advances in computing, mobile devices, storage, local networks, applications software and Internet access, make this all possible and have created a tipping point in education.

These changes have significant impact on schools' and districts' requirements for high-speed Internet services. In a growing number of schools, this revolution is improving educational outcomes, improving test scores, and increasing student engagement. Now is the time to think about and plan for how these transformative technologies can become pervasive across the country.

For most of the 20<sup>th</sup> century, the United States led the world in educational achievement and attainment. Through the federal E-Rate Program, the nation pioneered connecting schools to the Internet. But the United States now risks falling behind and squandering this early lead.

Other nations are moving forward with dizzying speed, aggressively investing in digital learning and technology education. In South Korea, all schools are connected to the Internet with high-speed connections, and all teachers are trained in digital learning. Printed textbooks will be phased out by 2016. One hundred percent of Singaporean schools are wired for broadband; one hundred percent of South Korean teachers are technology-trained; Turkey is seeking to supply 10 million tablets to its students by 2015; next year, the Thailand government will distribute handheld computers to 13 million students.<sup>2</sup>

If the United States does not make major investments in digital education, it will leave our students at a competitive disadvantage in the global marketplace. The durability of American competitiveness will be tied to our ability to produce graduates with the technology skills the global economy demands.<sup>3</sup>

One of the keys to equipping students with the skills they need is by providing quality Internet access. The good news is that many of the technologies required have matured in terms of ease of use, functionality, and reliability. Significant challenges remain, however, particularly in the area of integration to ensure maximum utility and a consistently high-quality user experience. To address this challenge, Cisco advocates an end-to-end, architectural systems-level approach supported by appropriate service offerings. This is how businesses, governments, universities, and other industries are managing their connectivity today; schools and libraries should do the same.

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While high-speed broadband availability and Internet access bandwidth continue to be the biggest challenge in many parts of the country, there are other aspects of an end-to-end system that require equal attention and appropriate funding. In locations where ultra-high-speed connections are in place, we often see lack of appropriate in-school network infrastructure, resulting in inefficient use of the available bandwidth.

The local wireless (Wi-Fi) network is fundamentally critical. Even with a 100 Mbps Internet connection, an overcrowded wireless network can result in users seeing a loss of performance down to Kbps levels. We often see wireless density (device per square foot), especially in high schools, *surpass* those of corporate offices and hotels. The impact: a school might provide high-speed Internet access, but students' and teachers' Internet connections are agonizingly slow and inefficient.

*Sheryl Abshire, Chief Technology Officer of Calcasieu Parish Public Schools in Lake Charles, Louisiana, stated in her testimony before the Senate Commerce Committee hearing on E-Rate that there is "unbelievable demand for online educational resources and the need to communicate. Overall, on any given day, peak usage of our network's infrastructure reaches 90 to 95 percent of its capacity with over 9000 users accessing the network at the same time."*

As the use of cloud services increases, local school networks become as critical as any other part of the end-to-end infrastructure, including those of the Internet service provider and the cloud data centers. If a switch that is not well-maintained and has no redundancy fails during a test, then there is no access, no matter how robust the Internet bandwidth is.

Technology is changing the traditional classroom and at a rapid pace. One example is the flipped-learning concept, where students preview video and other content in advance of coming to class. In this and other emerging models, the ability to access educational content, collaborate with peers, and get help from experts is more important when the student is at home or in transit. Mobility outside the school, home Internet access, and content provider cloud service all become part of the end-to-end system.

*Linda H. Lord, Maine State Librarian, stated at the U.S. Senate Commerce Committee hearing on E-Rate 2.0, "We use videoconferencing technology to connect rural Mainers with volunteer attorneys in our Lawyers in Libraries program. We offer clinics in real time on various legal topics like filing taxes, renter's rights and responsibilities, and debt counseling to any public library patron... [but] Inadequate bandwidth limits a library's ability to effectively provide new Internet services, such as interactive online homework help or videoconferencing, let alone the full spate of emerging technology-enabled services, some of which we have not yet imagined, but for which we need to be prepared."*

And finally, while network infrastructure is the foundation, the need for robust specialized hardware that brings out the network value in ways not possible through general-purpose computers and tablets cannot be ignored. In particular, video conferencing systems and dedicated video conferencing endpoints are central to new teaching and learning models.

The ultimate criteria for success should be what the users - faculty, staff, and students - experience based on the entire system's performance, and not on the capabilities of any one piece of the technology seen in isolation.

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## Part 2: Cisco Connected Learning Experience

The power of technology to help engage students, increase retention, and improve learning is significant. Several major trends are increasingly driving important changes in education:

- Globalization, technology, and demography are creating an increasing demand for new forms of continuous learning throughout life.
- Millennial students are demanding new technology-enabled models for engagement.
- New patterns of working and living are increasing the demand for specialized skills and knowledge.
- More people than ever need to have advanced capabilities for critical thinking, collaboration, and problem-solving.
- Technology skills related to STEM are valued more than ever.

These trends are having a dramatic impact on education and the delivery model. Trying to meet the demand of students with a range of learning requirements, soaring costs and decreasing budgets, the ability to provide advanced research capabilities, and concerns in some parts of the world for safe learning environments are all very real challenges currently facing modern education systems.

Schools need the foundation of a next-generation learning model that helps students master the skills and knowledge needed to succeed in a global economy.

The explosion of mobile devices, video, and new applications for communications and collaboration requires a safe, secure, wired and wireless infrastructure that is flexible enough to meet future growth requirements.

In addition to a powerful network infrastructure, schools increasingly require a broad set of network-centric solutions that connect and engage students; improve teaching and learning; increase administration and management efficiency; enhance campus safety; and expand research capabilities.

As networks become more complex and mission-critical for learning, schools will increasingly need service offerings that range from basic maintenance to professional services, and support networks that can deliver their desired learning outcomes.

### Teaching and Learning Portfolio - Creating True, Digital Learning for Students

In the 21<sup>st</sup> century, schools must be able to expand access to quality education, reach new learners beyond classroom walls, increase student engagement, and prepare them to take on the challenges of a rapidly changing world.

That's why it's so critical to modernize the E-Rate Program, particularly in a way that takes into consideration the requirements for a broad and deep portfolio of intelligent, network-centric solutions. Solutions include video, collaboration, and anytime, anywhere access to instructional content, tools, and services to meet educators' most pressing imperatives for improving student outcomes. In Cisco's experience, schools are looking for technologies that allow them to:

- Deliver a media-rich, robust digital learning experiences for students
- Prepare students for a global environment
- Level the playing field for rural students
- Improve professional development to increase skills of teachers
- Enable online learning
- Support collaboration with teachers across districts, states, and nations

Over the last 15 years, Cisco has worked hand-in-hand with schools and districts to meet the needs of their students and teachers, often with dramatic impact on student outcomes, as well as cost reductions.

Following are a few of the most notable stories.

#### Mooreville Graded School District: Adoption of Technology Improves Academic Performance

In the 1980s and 1990s the [Mooreville Graded School District](#) (MGSD) in North Carolina was one of the state's top-performing districts. More recently however, the composite student pass rate had dipped significantly. Superintendent Dr. Mark Edwards determined that a capable network infrastructure was necessary to improve the performance of the school district.

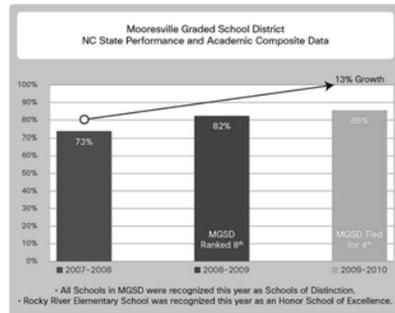
MGSD installed an IP infrastructure based on Cisco Catalyst<sup>®</sup> Switches. For wireless access, the district installed an 802.11n wireless network with access points in each classroom. This helped to ensure that teachers and students had reliable, real-time access to rich multimedia content. According to Superintendent Edwards and his staff, "[making] appropriate investments in computing infrastructure is as important as investing in wiring or lighting."

Mooreville's digital conversion has been a highly successful part of the district's turnaround efforts. Once in the 60-percent level of competency in all subject areas, students in the district now perform well above 85 percent (see Figure 1).

##### Mooreville Results

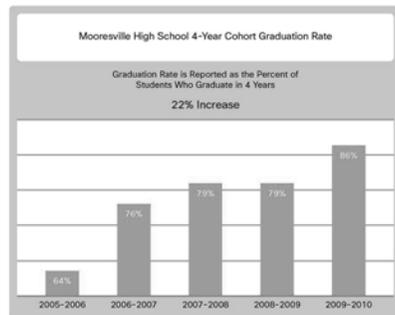
- Increased level of competency in all areas from 60 percent to over 85 percent
- Increased graduation rate by 22 percent
- Decreased dropout rates and suspensions

**Figure 1.** MGSD Academic Performance Improvement



MGSD's technology infusion has had a dramatic impact. Out of the 115 school districts in North Carolina, Mooreville was one of only six to make all adequate yearly progress (AYP) targets during the 2009 - 2010 school year, and it had the highest number of targets met. In addition, from the 2005 to the 2009, graduation rates increased 22 percent (see Figure 2).

**Figure 2.** MGSD's 22 Percent Improvement in Graduation Rates



*"We've seen significant gains in achievement in every grade level, every content area, and by every data point imaginable - from state assessments to SAT and ACT scores, graduation rates, rates in reduction of dropouts, and the reductions in disciplinary suspensions," says Edwards. "We've had over 1000 visitors this year, and everyone has been compelled by our achievement data."*

**Paradise Valley Unified School District: Cost-Effectively Connecting Remote Classrooms**

Paradise Valley Unified School District (PVUSD) in Arizona spans approximately 98 square miles in the northeastern area of Phoenix, Arizona. Over 33,000 students and approximately 3,000 staff, which include teachers, staff, and administrators, are spread throughout 32 elementary schools, seven middle schools, five high schools, and a variety of specialty schools.

To ensure that all students in the far-flung district are connected to the Internet, the district upgraded its core infrastructure. It also put in place a microwave Wireless Wide Area Network (WWAN), which provides high-quality service through a district-wide telecommunications convergence on Voice over Internet Protocol (VoIP) system. The unique broadcast saves the district approximately \$550,000 annually and has enabled it to create cost-effective, remote classrooms and access greater content for its students through lessons that have been recorded and made available online.

Additionally, pvONLINE, the district's Internet-based educational program, uses Cisco TelePresence video conferencing to provide online tutoring, conferencing, and evaluation sessions. pvONLINE teacher Kim Stringer says, "It truly feels like I am standing next to my students in a classroom. Not only are they very impressed with the technology, but they are really comfortable learning in that environment. As a teacher, this is the most important aspect to me."

Through TelePresence technology and the National LambdaRail (NLR) and Internet 2 networks, PVUSD was the first K12 school district on the Research & Education Telepresence Exchange. PVUSD has connected with and has ongoing relationships with other educational institutions including: Harvard University, the University of Wisconsin-Madison, the Technical University of Košice in Slovakia, Arizona State University, University of Denver, Grand Canyon University and University of Arizona. These connections are leading to recruitment efforts, guest lectures, joint assessment of student projects, professional development, collaborative team teaching, and more.

Dr. Jim Lee, superintendent for PVUSD, says, "TelePresence allows our students to communicate, create, and collaborate with some of the best minds and institutions in the world. These applications are consistent with our mission of cultivating world-class thinkers and developing global mindedness in our students. It is helping us redefine the meaning of rigor, relevance, and relationships in the educational landscape for this new generation of learners."

<p><b>Paradise Valley Results</b></p> <ul style="list-style-type: none"> <li>• Saving \$550,000 annually with wireless WAN</li> <li>• Delivering cost-effective remote classes and access to greater expertise</li> <li>• Connecting with higher education institutions from across the nation and globe</li> </ul>
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**Katy Independent School District: Wireless Mobility Push Leads to Surging Levels of Student Engagement and Higher Test Scores**

Katy Independent School District (KISD) in Texas has transformed learning with mobile devices. Discipline issues have been reduced, and test scores have improved. KISD encompasses 181 square miles in east Texas bordering Houston's energy corridor. The district's 56 schools serve more than 63,000 students, nearly 40 percent of who are low-income and at-risk.

In 2008, as the economic downturn continued to constrain funding for education, Lenny Schad, who was then the Chief Information Officer for KISD, and his fellow administrators took a serious look at curriculum delivery in KISD. "We decided that we had to fundamentally change the way we teach; the old methods were no longer working," Schad recalls. "We made the decision to launch a three-year program that would transform instruction, improve engagement, and breathe new life into the curriculum through technology."

<p><b>Katy ISD Results</b></p> <ul style="list-style-type: none"> <li>• Discipline issues decreased; test scores increased in all subject areas</li> <li>• Performance on math tests increased from 70<sup>th</sup> to 90<sup>th</sup> percentile</li> </ul>
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In the first phase of the program, KISD acquired 150 HTC smartphones, donated by Verizon, which became the program's core technology. The phones - which became known as Mobile Learning Devices (MLDs) - did not offer calling or texting capabilities. Instead, students used the devices, which featured large screen sizes and easy-to-read text, to do Internet searches and use applications to complete assignments.

The district also enlisted the aid of a group of tech-savvy teachers to create a Web 2.0 toolbox. Vetted by the district's instructional technology and curriculum teams to ensure alignment, the toolbox consisted of such applications as Edmodo, Color Notes, Discovery Education, Quia, and others that foster collaboration between teachers and students.

In the second year of the pilot program, KISD distributed Android smartphones to 10 new schools and 1,500 fifth-graders. Once again, teachers and administrators witnessed surging levels of engagement and achievement among students who had access to the technology tools. In some instances, performance on math tests increased from the 70<sup>th</sup> to 90<sup>th</sup> percentile, with similar results in all subject areas.

"There wasn't one teacher who didn't see improvements in engagement and test scores," Schad says. "We heard so many testimonials from teachers who said, 'I've been teaching for 20 years, and I've never seen anything like this.' The creativity these tools allowed was just amazing. Plus, the MLDs really reinforced the notion of differentiated learning. By giving students the options of using pencil, paper, podcasts and so forth, we were allowing them to tap into their individual learning preferences."

KISD Director of Technology Operations Lonnie Owens has witnessed his district's technology initiative from start to finish. "Discipline issues went down, and test scores went up, so we viewed it as a success. But the pilot also demonstrated that we had found a sustainable model. We could get our students connected to the Internet without significantly impacting our budget."

At the start of the 2011 - 2012 school year, the Katy district launched the third phase of its technology transformation: the installation of a wireless network on every campus, and the rollout of a new Bring Your Own Device (BYOD) model. To support the project, KISD's core network was upgraded from 1 to 10 Gigabit Ethernet, and new Cisco wireless access points were deployed district-wide.

With thousands of new users signing onto the wireless network every day, using a variety of mobile devices that support rich digital media, network performance and reliability are crucial. But the opportunities of this district-wide technology deployment far outweigh the potential challenges.

#### **Farmington Public Schools: Wireless Mobility Enables Anytime, Anywhere Teaching**

[Farmington Public Schools](#) (FPS) in Michigan has also increased the use of mobility and enabled a BYOD program that provides greater bandwidth and new cost savings.

One of the district's goals was to integrate digital learning tools into education. Previously, the school district had adopted a technology policy that did not allow portable devices to be incorporated into the curriculum. "We simply had to change this policy to accommodate new types of student learning and provide learners with specialized devices," says Michael Johnston, FPS Director of Information Technology.

<p>Farmington Public Schools Results</p> <ul style="list-style-type: none"> <li>• Staff can support 1,000 faculty members and 12,000 students simultaneously with no strain on service</li> </ul>
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Johnston began to evaluate wireless network solutions based on their ability to monitor user activity. FPS needed to identify holes in service and areas in need of upgrades. With the BYOD movement growing in K-12 school districts across the nation, FPS saw an opportunity to see how many teachers and students wanted to use their own mobile devices.

After a swift but detailed review, FPS adopted a Cisco 802.11n wireless platform to meet its needs in mobility. In 2009, the IT department started to place the new wireless platform across 21 buildings in the FPS school system.

Part of FPS' goal was to prepare the school district for a more immersive BYOD environment. Over the next few years, the IT department team anticipated that students would bring up to three mobile devices into the school district at a time.

In 2011, the IT department performed additional access point deployments to increase the reach of the wireless network. These supplemental boosts to the wireless network and IT infrastructure provided an unparalleled level of service for the FPS community. "These technologies enabled us to expand in transformational ways to help support our students and our teachers," said Johnston.

Enhanced support for mobility has created a secure wireless network for FPS and allowed different types of learners to engage in next-generation learning. By taking advantage of the wireless network to support innovative teaching and learning practices, FPS has attained an enormous return on investment without additional state funding.

With the integration of BYOD, the number of mobile devices requiring support from each IT staff member has greatly increased. However, the IT department is not adding new staff to support the rise in user access. "Previously, we needed the IT department to concentrate on servicing our 1,000 faculty members," says Johnston. "With our new wireless network, our staff can assist our faculty and 12,000 students simultaneously with no strain in service, which supports FPS in more meaningful ways."

#### **Fresno Unified School District: Collaboration Improves Student Scores**

California's [Fresno Unified School District](#) recently achieved significant gains in math achievement for grades K-6. The superintendent attributes the fast pace of success to a unique collaboration with California's Long Beach Unified School District using Cisco TelePresence technology. The districts have much in common, including tight budgets, high poverty rates among student families, and a strong commitment to improving student math scores.

<p><b>Fresno Unified Results</b></p> <ul style="list-style-type: none"> <li>• 2000 more students scored at proficient or advanced levels in mathematics</li> </ul>
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Fresno Unified Superintendent Michael Hanson and Long Beach Unified Superintendent Chris Steinhauser shared ideas when they saw each other at conferences, but realized that an effective partnership would require more frequent collaboration. Traveling the 250 miles to each other's districts was not an option because of time and budget constraints, and telephone conversations were not enough to support strategic discussions.

The districts found their solution by implementing immersive video. Each district has a telepresence system, which provides a live, face-to-face experience over the network.

In the spring of 2009, Long Beach Unified sent a group of math teachers to Fresno. The Fresno teachers and their counterparts from Long Beach joined a telepresence session with other Long Beach teachers to talk about a common assessment framework. "In one day we completed a project that would have taken months without this technology," Steinhauser says, noting that the two districts are "accomplishing more, faster, and at lower cost."

The results were swift and impressive, as 2,000 more elementary school students in the Fresno Unified School District scored at a proficient or advanced level in mathematics than in the previous year. "That's 2,000 lives, futures, and sets of promises that we now have to hold as they move through the system," Hanson says.

Now Fresno Unified is looking forward to replicating its math gains in middle school and connecting with other districts in the state.

#### **Jefferson Parish Public School System: Technology Initiative Leads to Improved Student Test Scores**

Jefferson Parish Public School System (JPPSS) is one of the largest districts in Louisiana and among the 100 largest in the United States, with 87 schools and approximately 44,000 students. Prior to 2006, administrators and teachers within the JPPSS district were authorized to purchase technology with their individual school budgets. This approach created a lack of standardization, with different schools purchasing different types of technologies.

This changed in 2006 with grants from the Cisco 21<sup>st</sup> Century Schools Initiative (21S). By providing technology, training, and staff support to select school districts in Louisiana and Mississippi, the 21S initiative is creating replicable models of education transformation.

As part of the program, participants identified baseline equipment that would be available in each classroom: a laptop for the teacher, a ceiling-mounted projector, and audio speakers. Interactive whiteboards would also be installed in approximately 40 percent of the classrooms in each school. The whiteboards would be distributed to select teachers based on grant applications in which they described their vision of a 21<sup>st</sup> century classroom.

Dr. Diane Roussel, former Superintendent of the JPPSS, said, "We've seen an acceleration we could not have achieved with traditional teaching methods." As a part of the Cisco 21S initiative, between 2005 and 2009, the results were impressive, including higher scores on a range of standardized tests such as the Louisiana Early Entrance Program (LEAP) and Graduation Exit Examination (GEE).

##### Jefferson Parish Results

- More students performed at basic or above on LEAP and GEE
- 10<sup>th</sup> and 11<sup>th</sup> grade students increased average GEE scores in math and science by 6 percent
- 4<sup>th</sup> grade students improved LEAP English and science scores by 7 percent
- 8<sup>th</sup> grade students increased LEAP math and English scores by 16 percent and 12 percent, respectively

#### **Charles County Public Schools: Technology-Based Curriculum Improves State Ranking**

Charles County Public Schools (CCPS) in Maryland implemented Cisco network architecture to deliver voice, wireless, security, and video. It also reduced costs by \$170,000 while improving teacher and administrative productivity.

In 1996, Jim Richmond became the school system's superintendent and embarked on an aggressive campaign to provide Charles County students with a world-class education that challenges each to achieve his or her potential.

Richmond teamed with the Charles County Commissioners' Office and technology industry leaders such as Cisco to implement his vision. With Cisco solutions, CCPS has revolutionized how technology is used to provide services that improve every facet of running a school district: from building maintenance to motivating 5,000 students to voluntarily attend summer school.

CCPS created a Connected Learning environment, taking advantage of networking technology to deliver dramatically enhanced educational, managerial, and administrative services district-wide. The district deployed a network infrastructure to deliver a network platform that enables a wide range of services.

##### CCSP Results

- Reduced costs by \$170,000 by deploying voice over the network
- Enabled students to achieve academic excellence
- Improved teacher and administrative productivity

The network connects all CCPS locations with high-bandwidth links, of up to 2 Gbps. It enables reliable, high-performing applications, such as voice and video, and on-demand services. The district also deployed its own Storage Area Network (SAN), capable of hosting more than 12 terabytes (2,000 gigabytes) of data in-house. This framework provides a unified platform that enables the district to quickly deliver a rich portfolio of services to teachers, principals, administrators, facilities workers, and security staff.

By eliminating the majority of the district's analog phone lines and deploying voice services over the network, CCPS saved approximately \$170,000 in the first year. The network enables CCPS to deliver many times the number of services that it could previously and still operate within budget.

CCPS' emphasis on a technology-based curriculum has enabled it to move textbooks online and develop complementary materials that enable teachers to better align coursework with federal No Child Left Behind Act and Maryland state mandate. In 1996, CCPS ranked 22<sup>nd</sup> out of 24 jurisdictions academically and today it ranks 11<sup>th</sup> overall. Five CCPS high schools rank in the top 1,200 U.S. high schools, and the district offers many advanced placement classes. Extensive summer programs also attract students who come to school voluntarily.

#### **Administration and Management Portfolio - Making the Most of Investments to Meet Immediate Demands and to Provide Flexibility for Future Growth**

We have learned from schools that administrative and management tools are critical to creating true, connected learning environments. These tools simplify operations, contain costs, and enable real-time communications and collaboration across districts, campuses, and the world.

Within the ConnectED context, Cisco solutions can help:

- Increase cost effectiveness of purchases made using E-Rate support
- Meet goals at the lowest possible cost
- Ensure efficiency of the program

Cisco education customers have been implementing technologies in ways that help them to take full advantage of their investments in technology. These technologies have helped schools to streamline communications, realize scale, and save time and money.

#### **Indianapolis Public Schools: Cost Savings Through the Cloud**

[Indianapolis Public Schools](#) (IPS) has achieved cost savings while scaling to meet its computing demands. Based in the state's capital, IPS is the largest school district in the state of Indiana. Its 33,000 students are enrolled in 64 schools, from elementary to high schools. In addition to student computer labs, the IPS data center supports more than 2,400 teachers and 4,000 staff members.

The principal goal of the IT staff is to provide students and staff with access to the computing resources and applications that they need to achieve educational objectives. Yet, with 300 physical servers supporting up to 35,000 active users on any given day, and with state budgets getting tighter and tighter, IPS was running low on the resources and space required to accommodate its rapidly evolving needs. Vital departments such as school police were using outdated equipment. And with many of the district's servers underutilized, IPS was unable to harness the full potential of its own computing power, and faced the need to improve the ratio of student-to-computer accessibility.

IPS Results
• Reduced physical servers from 300 to 17
• Saved \$1.1 million in hardware costs and services
• Cut cabling costs by up to 90 percent
• Lowered energy bills

"Not all of our elementary schools had the technology capabilities necessary to support online testing...which required a more robust infrastructure across the entire district," says Wayne Hawkins, technology systems officer at IPS. IPS recognized that, to meet these challenges, the district would need to implement desktop virtualization, consolidate its data center infrastructure, improve server utilization, and extend technology access to more classrooms.

After testing a number of solutions, IPS decided to implement desktop virtualization solutions.

As a result, IPS has achieved major efficiencies across its IT infrastructure, saving the district an estimated \$1.1 million in hardware costs and services. "With virtualization, we reduced our physical servers from 300 to 17," says Hawkins. "Considering our budgetary restraints, that's a major victory. We also cut our cabling costs by up to 90 percent compared to other solutions by using [Cisco] UCS®. And, of course, we now have lower energy bills due to reductions in hardware."

With desktop virtualization, IPS has achieved an even more dramatic return on investment due to its simplified desktop IT management, as well as reductions in licensing fees.

Significant savings also stem from reduced support and maintenance requirements. "I'm using fewer contractors on some of my server environments, so I'm probably saving \$50,000 a year on that alone," says Bowens. "In addition, we're seeing tremendous time savings for our full-time staff. Before, if we wanted to roll out an application, it would take hours. Now we can do it in minutes."

#### **Campus Safety Portfolio - Keeping Kids Safe and Secure**

In light of recent tragic events, safety on campuses across the country is top of mind for K-12 school leaders. Schools need intelligent, network-centric solutions, including physical and network security, unified communications, emergency response, and mobility and wireless to meet their most pressing imperatives for improving campus safety and security. Cisco is partnering with schools to help address these issues.

The ability to integrate disparate systems and build a single network infrastructure enables more effective emergency response, improved communication, reduced costs, and centralized management and monitoring. All of these result in safer and more secure campuses.

#### **Warren County Public Schools: IP Video Surveillance System Improves School Safety, Reduces Vandalism and Loitering**

To improve security, [Warren County Public Schools](#) (WCPS) in Virginia installed IP-based video surveillance across its campuses. Spanning a total of 219 square miles, Warren County is located in rural northwest Virginia between the Blue Ridge Mountains and the intersection of the north and south forks of the Shenandoah River.

WCPS consists of five elementary schools, one middle school, and two high schools. To help ensure its 5,300 students receive an education in a safe and secure environment, WCPS officials made the decision to install a new video surveillance system at each location.

##### **Warren County Results**

- Used existing network to create unified surveillance system that can be managed from any computer connected to the network
- Security officers can now monitor all points of entry into schools
- Reduced speeding tickets, vandalism, and loitering

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Although its two high schools had existing pan-tilt-zoom cameras in place, school officials identified significant gaps in coverage, which left some security concerns unaddressed. The existing cameras did not have the functionality to capture incidents that could occur in some hallways and building entrances and exits. As for the elementary and middle schools, no cameras were in place, and school officials felt it was a necessity to deploy a solution to assist with monitoring traffic in and out of the buildings.

WCPS developed a two-phased approach to implement a new IP video surveillance solution at each of its elementary, middle, and high school locations. In the first phase, the existing cameras at both high schools were replaced. New cameras were also installed at the five elementary schools in locations where students, community members, and parents enter and exit buildings. As result of the success at these schools, during phase two, WCPS deployed an additional 100 cameras at the newly renovated middle school.

Taking advantage of the existing Cisco network allowed Warren County to create a unified surveillance system that can be managed from any computer connected to its network, depending on the access credentials of the user. Today, office administrators and security personnel with the proper access credentials can view all footage obtained by the fixed cameras through a single, unified management interface.

Warren County has positively enhanced its student safety and security. Resource and security officers can monitor all points of entry into the schools, thus eliminating the number of intruders on school property. In addition, the deployment of the cameras reduced speeding in student parking lots, vandalism of school property, and loitering.

"The new system has increased safety across the county, keeping people from doing things they shouldn't be doing. The community ... is aware of the cameras, preventing negative behavior on school grounds," says Melody Sheppard, WCPS IT Director.

For the first time, WCPS owns its video surveillance system, creating a long-term reduction in maintenance and resourcing fees. School officials no longer need to rely on outside technicians to replace or install new cameras; they are able to easily add cameras to the existing system when they feel it is appropriate or necessary. And, because the system is IP-based, it will be viable well into the future. School officials will not need to allocate funds toward replacing antiquated equipment on an annual basis. Rather, they can put that money toward other programs for students.

#### **Services for K-12 Schools - Supporting the Management and Maintenance of Technology**

To accomplish and sustain the goals of Connected Learning, schools must have reliable networks that are sufficient to support the educational applications that make Connected Learning so effective. Complex networks in schools require services to maintain their reliability, just like business networks. E-Rate modernization needs to include a model of service and maintenance that will empower our schools to envision and plan for next-generation learning, enable learning transformation, and optimize education solutions. Together with our partners, Cisco helps education institutions improve productivity and streamline day-to-day management of their communications infrastructure.

The critical impact of a reliable, well maintained network based on educational outcomes is clearly articulated in the Project RED Report, "The Technology Factor: Nine Keys to Student Achievement and Cost-Effectiveness" (2010).

A reliable network is essential in any digital learning environment... It is important that long periods of downtime are rare.

...If technology does not work reliably, teachers and students will not use it. And if technology is not being used, it cannot contribute to student improvement. Providing informal technical support to students is estimated to be 10 percent of teacher time, which is taken out of instructional time. More teacher time on tasks equals better results. School administrators interviewed by the Project RED team believe that a reliability rate of 99.9 percent is required before schools can move from print to digital materials.

...As schools make the switch from print to digital media, the speed of the Internet connection takes center stage. Many factors drive bandwidth needs, including the number of computers, usage patterns in the classroom, the types of materials accessed (e.g., email or video), and the intensity of access (e.g., a course or a Google search).

Schools today are, by and large, under-provisioned, and the educational impact of insufficient bandwidth can be significant. If a student spends an hour a day on the Internet, with sufficient bandwidth the unproductive wait time could be reduced as much as 50 percent. Ten minutes saved during the school day is equivalent to five extra school days a year, and 30 minutes saved is equivalent to 15 days. Doubling the bandwidth costs roughly \$12 per student per year. Providing five more instructional days would cost roughly \$222 per student per year.<sup>4</sup>

As complexity of networks increases, management and maintenance of the network become increasingly important. Maintenance becomes part of a well-maintained network from an end-user perspective. Every part of the network is mission-critical, so it is necessary to ensure that the entire network is fully functional.

Maintenance includes keeping all devices up to date with software upgrades, patches, call center support, and other online tools. Many school districts, operating under limited resources, do not have large IT staffs to handle maintenance issues with their networks. Maintenance service contracts offer these schools the best method to ensure the reliability of their networks without significantly adding to their own staff costs.

#### **Kent School District: The Value of Maintenance**

Kent School District (KSD) in the state of Washington has a long tradition of innovation. With 27,000 students at 40 schools and 3,200 employees, the district depends on its network to enrich its learning environment and help instructors and administrators work more effectively.

The district wanted to prepare its network for applications such as VoIP, IP video surveillance, wireless networking, and virtualized applications. Although it had a high-speed WAN, limited bandwidth to the desktop hampered network performance. Kent needed a consistent, uniform network solution that improved availability and reliability.

The Kent School District upgraded its network to provide the network performance, availability, and flexibility required for media-rich applications. The upgrade also included Cisco Unified Communications, which delivers clear phone communication and messaging to all campus sites, and a Cisco Unified Wireless Network.

Knowing how important network performance would be to the ongoing success of this technology implementation, Kent School District purchased a Cisco maintenance contract, which provides around-the-clock access to a team of highly skilled engineers, online technical resources, operating system upgrades, and advanced hardware replacement to help keep its network running optimally. Thuan Nguyen, KSD director of information technology, said, "When we have a network issue, we count on the four-hour response time to have the problem resolved."

"The wireless technology has dramatically changed the way computers are utilized in the classroom," says Nguyen. "We no longer need dedicated costly labs or regimented student lab time. Now, teachers have the flexibility to integrate technology into their lesson plans. This is an important step to fully integrating technology into the classroom in a way that prepares students for the increasing use of technology in the real world."

In addition to providing new capabilities, the Kent School District wireless network is also much more accessible and easy to use than the district's previous wireless solutions. "Things like power and network ports are no longer major considerations for the teaching staff," says Nguyen. "The teachers and students can focus on teaching and learning instead of how to make the technology work."

## Part 3: Recommendations on Bandwidth Targets and Metrics

**Per-Student Bandwidth**

Cisco supports the concept of per-school and per-student bandwidth target goals which emphasize that the real measure of success is the quality of student and teacher experiences based on the performance of the end-to-end network (including internal school networks) and not just the size of the school Internet connection. Our recommendation for **Internet access** bandwidth target goals per-student and equivalent of that for school and district sizes is captured in Table 1.

**Table 1. Recommended Internet Bandwidth Targets**

Internet Access Bandwidth Recommendations	Year 2014 Ideal Target (Mbps)	Year 2014 Minimum Target (Mbps)	Year 2018 Ideal Target (Mbps)
Per Student	0.5	0.2	2
For a School with 1,000 Students	500 (0.5 Gbps)	200 (0.2 Gbps)	2,000 (2 Gbps)
For a very small district (2,000 Students)	1,000 (1 Gbps)	400 (0.4 Gbps)	4,000 (4 Gbps)
For a Medium-to-Small District (30,000 Students)	15,000 (15 Gbps)	6,000 (6 Gbps)	60,000 (60 Gbps)
For a Very Large District (160,000 Students)	80,000 (80 Gbps)	32,000 (32 Gbps)	320,000 (320 Gbps)

Source for District Size: National Center for Education Statistics, 2006-2007

We further recommend that in certain geographies where the fiber infrastructure, including the last mile and lateral fiber, is already built, the ideal target should be 1 Mbps per student for 2014 and 4 Mbps per student for 2018. For a school size of 1,000 students this translates into 1 Gbps in 2014 and 4 Gbps in 2018.

Our recommendation for bandwidth per student to content sources within a school or district (e.g., servers in a school or district data center) is five times greater than the numbers listed in Table 1, as shown in Table 2. This translates to an ideal target of 2.5 Mbps per student, a minimum target of 1 Mbps by 2014, and an ideal target of 10 Mbps by 2018. Note that these numbers are for the purpose of per-student bandwidth consumption and are only one factor in the design of the school and district networks. To avoid bottlenecks in these networks, all network applications and traffic, as well as technologies for more efficient use of the bandwidth, should be factored into their architectures and designs (more on this topic later in this section and in Part 4).

**Table 2. Recommended Internal WAN (District Network) Bandwidth Targets**

Internal WAN Bandwidth Recommendations	Year 2014 Ideal Target (Mbps)	Year 2014 Minimum Target (Mbps)	Year 2018 Ideal Target (Mbps)
Per Student	2.5	1.0	10
For a School with 1,000 Students	2,500 (2.5 Gbps)	1,000 (1 Gbps)	10,000 (10 Gbps)

The numbers provided are driven by a number of assumptions and based on our experiences with bandwidth consumption and traffic patterns, especially with high-bandwidth applications such as video (described in the next section). Networks are a dynamic environment, with loads that vary widely within even a few milliseconds. Each student should have available a minimum target bandwidth for their device, despite what other students may concurrently be using of the network resources. The key assumptions are related to source of content (over the Internet, from servers inside a school, or from a district data center) and the concurrency rate of high-bandwidth applications use. It has been seen that all students in a single classroom may click "go" or "send" at the same time, as requested by the teacher for an application that accesses the network at the same moment. Therefore, the concurrent use in a school (especially in smaller schools) is higher than statistical assumptions about burst loads made in general network designs.

Internet service providers usually do not give a guarantee that a consumer target service bandwidth will be available at all times because of varying network loads; however, they design their networks to avoid over-congestion based upon their knowledge of user patterns, customer counts, and growth. In schools, we have known student and teacher user patterns, where the burst load can be high. Schools need to be able to ensure fairness and limit any devices that are using an unusual amount of bandwidth. School districts need to have tools to identify classroom-critical applications and services. These tools identify non-academic traffic and apply network policies to limit these traffic flows. Dynamic and intelligent traffic controls are critically needed.

#### Requirements of High-Bandwidth Applications

Table 3 shows how much bandwidth is used by sample, individual video sessions over the network. These are the same, whether from a desktop computer, laptop, tablet, or smartphone.

**Table 3. Video Bandwidth Requirements**

	Mbps Per Person or Multi-Party Session	2014 Estimated Wireless Capacity Per Access Point for 802.11n @ 240Mbps, 25 students, with 40 Devices	2018 Estimated Wireless Capacity Per Access Point, 802.11ac @ 400 Mbps, for 25 students Using 40 Devices
SD Video on Demand (Watch Pre-Recorded Video)	.4 Mbps	6 Mbps	10 Mbps
HD Video on Demand	.8 Mbps	6 Mbps	10 Mbps
Two-Way Video Conferencing, SD	.5 Mbps	6 Mbps	10 Mbps
Two-Way Video Conferencing, HD	1.5 Mbps	6 Mbps	10 Mbps
Five-Site Multi-Party SD Video Conference	2.5 Mbps (aggregate)	(on wired network)	(on wired network)
Five-Site Multi-Party HD Video Conference	7.5 Mbps (aggregate)	(on wired network)	(on wired network)

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Video on Demand (VoD) is a one-way pre-recorded video that can be viewed by students from anywhere - from a dedicated video site (such as TeacherTube), or from inside a learning application that branches out to play video remotely. High-definition (HD) video improves the resolution of the material by about four times over standard definition (SD).

Two-way video conferencing is a live video conversation between individuals at different physical locations. This could be a subject-matter expert brought into a classroom to interact with the entire class, or a parent at home who has questions for the teacher about their student's quiz results.

A multi-party video conference involves three or more participants in a video call, who join just as they would an audio bridge. Examples of multi-party conferences include teacher training, where the instructor at a university hosts live sessions with four to five teachers in multiple districts to share expertise and experiences. Users at the network location where the video bridge is located will see all of the video streams simultaneously. Therefore, network bandwidth is highest at this concentration point, and it must have capacity to support high bandwidth. Otherwise, the multi-party conference will fail.

The wireless capacities shown in Table 3 help to avoid the situation where student wireless bandwidth and throughput are not sufficient to support coursework and exploratory knowledge needs. One-to-one student-to-device schools, where each student is using a tablet or laptop, creates very high-density classrooms and require considerable amounts of bandwidth and throughput. Schools may see 25 - 40 active wireless devices per classroom on a network, with all devices actively requesting bandwidth on the wireless network and Internet access at the same time. Starting with the focus on the student experience, the classroom wireless infrastructure must be able to support this demand.

Note the focus on **throughput**, not **coverage**. During first-generation deployments of wireless technology in schools, many focused on coverage. If a wireless access point signal could be reached from a classroom, the classroom was considered to be sufficiently covered. As students were then asked to access coursework and use wireless devices for different activities, the students were obtaining only a small fraction of the bandwidth they required, and they were spending the majority of the class time waiting for web pages to load. This is because the bottleneck is in the classroom wireless throughput, not coverage.

To achieve a desired level of Wi-Fi service in a classroom or school, the school must be assessed and audited for wireless coverage and throughput. This can be done by a Wi-Fi professional who understands the potential load on the network, physical nature of the building, and the performance capabilities of the wireless access points proposed. There are many low-end wireless access points available in the market today, but as explained, the classroom environment is extremely dense with 25 - 30 devices within back-to-back areas of 600 square feet each.

Table 3's wireless capacity columns show sample maximum bandwidth that a device would see in the classroom. The assumption is that the wireless devices and the Wi-Fi access point have support for two or three spatial streams. The Wi-Fi access point is capable of providing 240 Mbps of throughput to all wireless devices combined, using the 802.11n Wi-Fi standard. Comparing columns 2 and 3, we see that for the video applications shown, this amount of throughput is sufficient for all students to perform their tasks simultaneously.

This table only shows video application bandwidth and does not attempt to estimate other high-bandwidth applications, such as large file downloads, application installations, operating system upgrades, data backups, etc. The throughput figure assumes a well-designed wireless spectrum layout for the school with minimal channel interference.

As schools move into the future, wireless demand is projected to increase. It is likely that students at times will have more than one wireless device active in the classroom. This is leading to a 1:2 student-to-device ratio or greater, especially in higher grade levels.

Table 4 shows how network speeds affect efficiency and performance in the classroom. While today's Internet service providers offer individual home access download speeds starting at 2 to 5 Mbps, going up through 100 Mbps and higher, students in classrooms today may see 0.1 Mbps or lower. This is due to many factors, but the end result is the same - very long download times that negatively impact student access to information.

**Table 4. Download and Upload Time for Various Per-Student Bandwidth Offerings**

Per-Student Internet Bandwidth Offered	0.1 Mbps (100 Kbps)	0.5 Mbps (500 Kbps)	1 Mbps	8 Mbps
<b>File Transfer</b>				
10 MB	13 min 58 sec	2 min 48 sec	1 min 23 sec	10 sec
100 MB	2 hrs 20 min	27 min 57 sec	13 min 58 sec	1 min 44 sec
500 MB	11 hrs 39 min	2 hrs 20 min	1 hrs 10 min	8 min 44 sec
<b>Video on Demand</b>				
SD, 2 Minutes	8 min 23 sec	1 min 40 sec	50 sec	6 sec
SD, 10 Minutes	41 min 56 sec	3 min 21 sec	4 min 11 sec	31 sec
HD, 2 Minutes	16 min 46 sec	3 min 21 sec	1 min 40 sec	12 sec
HD, 10 Minutes	1 hr 24 min	16 min 46 sec	8 min 23 sec	1 min
<b>Two-Way Video Conferencing</b>				
Standard Definition (SD)	0.5 Mbps	0.5 Mbps	0.5 Mbps	0.5 Mbps
High Definition (HD)	1.5 Mbps	1.5 Mbps	1.5 Mbps	1.5 Mbps

The samples in the first column represent typical student activities in the classroom. The columns to the right represent broadband (effective bandwidth) offered to the student. Results noted in red do not meet the application requirements, and would likely be viewed by teachers as ineffective and unacceptable.

The fifth column in Table 4 shows an example of an 8 Mbps broadband download bandwidth from a sample 4G LTE provider. This data is offered to indicate what some students and teachers might see outside the school, at home, or on the road from their 4G tablet or smartphone for consumer applications, and not necessarily school learning applications. This is not a suitable solution for broad school environments for several reasons, including concentrated high-demand density with simultaneous access, cost, security, building construction density, signal interference or blockage, and asymmetrical bandwidth. However, this table provides an example of broadband speed offered today outside the school, including at home, and at a level to which students have become accustomed.

One example of the negative impact of insufficient bandwidth offered is when the student or classroom is asked to watch a two-minute VoD. Using the available bandwidth in the first column of Table 4, the video requires 16 minutes to download. This is completely ineffective.

Table 4 information can be used in combination with the right-most column of Table 3 to gain a high-level view about how desired student technology results are tied to the end-to-end network architecture and design throughout the school.

### School and District Network Sizing to Achieve Bandwidth Targets

Table 5 shows sample network sizes to deliver recommended per-student bandwidth targets. These figures and underlying assumptions that support them have been derived from our experience in delivering expected bandwidth to the right place in the network, at the right time, to achieve the desired user experience. These assumptions are used to determine sample in-building wireless and video infrastructure requirements as well as inter-building (within a school campus or district) bandwidth needs.

**Table 5. Sample Network Size Requirements to Achieve Year 2014 Recommended Bandwidth Targets**

Sample District and School Network Requirements	Number of Routers and Switches	Number of Wireless Access Points (802.11n)	Number of Video Endpoints
<b>Very Small Size (2,000 Students)</b>			
1 High School, 400 students	1/5	36	16
2 Middle Schools, 800 students	2/10	72	32
2 Elementary Schools, 800 students	2/10	72	32
<b>Total</b>	<b>5/25</b>	<b>180</b>	<b>80</b>
<b>Medium - Small Size (30,000 Students)</b>			
10 High Schools, 6,000 students	10/100	460	260
17 Middle Schools, 10,200 students	17/170	782	442
26 Elementary Schools, 13,800 students	23/230	1,058	598
<b>Total</b>	<b>50/500</b>	<b>2,300</b>	<b>1,300</b>
<b>Very Large Size (160,000 Students)</b>			
50 High Schools, 35,000 students	50/500	2,350	1,350
75 Middle Schools, 52,500 students	75/750	3,525	2,025
105 Elementary Schools, 73,500 students	105/1,050	4,935	2,835
<b>Total</b>	<b>230/2,300</b>	<b>10,810</b>	<b>6,210</b>

Source for District Size: National Center for Education Statistics, 2006-2007

Wi-Fi access inside the classroom and school is where much of the bandwidth growth is occurring, thanks to the rapid increase in wireless devices and 1:1 student-to-device ratio. We target minimum, total end-device throughput for Wi-Fi that will support the highest bandwidth inter- or outside-building bandwidth per student. We set this at a minimum of 240 Mbps actual throughput performance with correctly designed spectrum allocation, assuming 40 students per classroom at 6 Mbps each, and allowing headroom for larger classrooms.

Based on assumptions made we show the number of routers and switches per building and the number of wireless access points to cover the school effectively. For wireless, this includes one access point with actual throughput described above per classroom, plus an estimation for common areas. This means a physical video endpoint is used in the classroom for a variety of purposes for students and teachers, with one video endpoint per classroom.

**Note:** The figures in Table 5 are provided only as samples and for a general understanding of what it might take to sufficiently build school and district networks to support the desired bandwidth. Actual network designs would be based on a number of different requirements which may vary greatly from district to district and even between schools in the same district. Factors such as the building layout, building construction, district geography, and more would dictate the actual network design.

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### Effective Use of Bandwidth

Raw bandwidth provided by underlying physical connections, while being a fundamental factor in delivering the desired user experience, is by no means the only factor. There are a number of technologies that can enable more effective use of available bandwidth by students and teachers. These include content pre-positioning and caching, traffic priority differentiation, applications acceleration, and optimization, and others. They are discussed in Part 4 of this paper.

Adding more bandwidth to solve a network problem doesn't necessarily work. The following example best illustrates this. We worked with a school in the northeastern U.S. that had a Cisco wireless deployment. Students at the school used the guest wireless access in order to take online assessments. To ensure that there was no tampering of results, one condition of these online tests was to reset the assessment if the computer disconnected from the network. Due to bandwidth limitations, students were forced to restart their exams numerous times.

In order to get more visibility into their network, school network administrators used network performance monitoring tools. They discovered that 90 percent of the 50 Mbps Internet connection was being used to stream video from a popular video streaming company. The school network administrators tried to solve the problem by increasing the school's bandwidth connection to 100 Mbps. Still, the students experienced connectivity issues with their assessments. Even with the larger size, video streaming continued to use up 90 percent of the bandwidth due to the application's adaptive bandwidth functionality. Knowing that video is a very useful student tool, the school needed to implement traffic prioritization for important traffic, such as assessments, and police the non-priority traffic, such as video streaming.

Lack of bandwidth through wireless access points in classrooms, or through access or distribution switches, could have further impacted student and teacher network experiences. This case stresses the importance of the end-to-end network architecture and design.

### Metrics and Measurements

We recommend a systematic and uniform national-level approach in network performance metrics and measurements. The approach would include definition of metrics, development and use of data collection tools, data analysis, and open publishing of the results. This will allow sufficient tracking of the progress toward bandwidth target goals while allowing schools and districts to make network architecture and design decisions on how to best implement the target goals based on their requirements and local and regional opportunities.

While there are many performance measurement tools currently in use (some of which we cover in Part 5) there must be a unified strategy in defining what and how data needs to be collected and what tool sets are most appropriate. The data analysis is perhaps the most challenging piece to ensure accurate reflection of what students and teachers experience. And publishing the data has to be done carefully to ensure safeguards for protection of privacy.

There are a few precedents that could be used as guidance here. In our view, the best one is The Cooperative Association for Internet Data Analysis (CAIDA) from the University of California San Diego (<http://www.caida.org/home/>). It grew out of the NSFnet program in the 1990s and became the leading Internet measurement expertise entity that tracked the rapid growth of various protocols and applications as the Internet grew and evolved.

CAIDA investigates practical and theoretical aspects of the Internet in order to:

- Provide macroscopic insights into Internet infrastructure, behavior, usage, and evolution
- Foster a collaborative environment in which data can be acquired, analyzed, and (as appropriate) shared
- Improve the integrity of the field of Internet science
- Inform science, technology, and communications public policies

Such an organization can help guide schools and districts with best practices on design and implementation of measurement tools and infrastructure, an otherwise fairly complex task for schools to oversee on their own.

Part 4: Recommendations on Network Architectures and Technologies



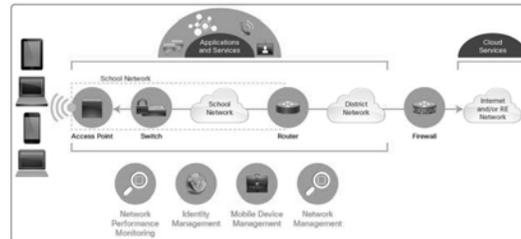
What technologies are recommended for the baseline school environment for next-generation connected learning? The focus here is to show the criticality of all the parts of a network coming together to function as a **whole** network. The goal is to prevent solving a problem in one part of the network, while simply the moving the bandwidth or lack of service bottleneck to a different part, with the same observed poor experience. For example, if a school's network infrastructure is aging, or access points are not capable of supporting the throughput needed to support an entire classroom, increasing the school's outside bandwidth to the Internet would simply move the bottleneck from outside of the school network to inside. It is imperative that a school's network infrastructure be able to support the next-generation teaching and learning tools available to students.

As we saw in the video streaming example in Part 3, the video streaming application continued to use up 90 percent of the bandwidth even after the school doubled its Internet connection. Oftentimes, students experience network issues in large classrooms and auditoriums where either access point density is not appropriate for the amount of wireless users, or access point throughput (bandwidth) is not high enough to support new the users' applications and learning tools.

Figure 3 shows the end-to-end network diagram. On the left, a student or teacher connects to the school wireless network using either a personal or school-issued device. The wireless access point is connected to a switch, which connects to other routers and switches to create the school network. This school network connects to a district network. (Note: Certain schools do not connect to a district network and thus, connect directly to the Internet).

The district network connects the various schools in a district together, and provides these schools with a connection to the Internet and a research and education (R&E) network.

Figure 3. End-to-End Network



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Let's take a closer look at the specific areas of the end-to-end network.

- WAN - Between schools and Internet
- LAN - Internal connections inside the school, connecting students and classrooms
- Ride-over applications such as voice and video
- Network management, performance monitoring, content filtering, security

#### **Wide Area Network (WAN) - Between Schools and Internet**

##### ***WAN, Fiber Connections, State R&E Networks***

WAN refers to network connections that send traffic outside of school premises. This can be divided into three different segments - district network, R&E network, or Internet.

The **district network** connects the schools in a district together. Often, there is a direct link between a school and the district network core. The district network then provides each school district cloud applications (in other words, applications to district network members), such as voice, video, storage. It also provides a connection to the outside-of-the-district world, such as an R&E network (more on these below), or the Internet.

By offering applications to the schools through the district network, each school is able to save financial resources as infrastructure for the various applications and Internet connections are shared by each school. Traffic to the Internet may be reduced as the higher-speed, local district connections are used for more applications. For example, if video lectures are stored inside the district network as opposed to on the Internet, when classrooms stream video, that video would be downloaded over the district network. These videos would not impact the more expensive Internet connection.

State and national R&E networks allow districts and schools to connect to other schools and districts, universities, and research institutions through high-bandwidth connections, offloading bandwidth requirements from a district's general Internet connection.

Similar to district networks, R&E networks may also offer services to schools, such as multipoint video bridges, allowing schools to use R&E infrastructure and bandwidth for high-definition calling. This can eliminate the need for individual schools to purchase all necessary infrastructure. Certain R&E networks may also provide a connection to the general Internet, allowing districts to have one connection to an R&E network, which then provides a connection to both national networks, and to a commercial provider for general Internet access.

If available and feasible, using fiber media for the last mile and lateral connections is always preferred over other physical media types as it would provide the most flexibility for future growth. This is usually a long-term decision with higher upfront costs, special attention should be given to selecting fiber routes and colocation facilities where the fiber would terminate. The ideal colocation facilities would be carrier-neutral "carrier hotels" or exchange points where schools can purchase Internet access and other telecommunication services. R&E network operators have extensive knowledge in this space that could be leveraged by schools and districts.

**Recommendation: Fiber provides significant connectivity and flexibility, so schools should pursue opportunities to use fiber when available for connections between buildings, to allow for practically unlimited bandwidth as needs increase over time.**

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### **WAN Optimization and Acceleration**

School internal WAN environments can be optimized, reducing load on WAN links and allowing more applications to be supported. This is accomplished through advanced traffic categorization, prioritization, optimization (including compression), and pre-positioning of content.

Network caching stores frequently accessed information in a location close to the requester. A web cache stores web pages and content on a storage device that is physically or logically closer to the user. For example, this could take place within the school building rather than across the WAN at the district core.

Pre-positioning of video or other content can be especially helpful in reducing WAN costs. Video content can be positioned ahead of time in local building caches so that when dozens of students watch the video during a particular day, none of the video streaming impacts the WAN. It is all stored locally and plays back within the building. Additionally, this pre-positioning is done from a central location, covering many remote school buildings at once, and can be scheduled overnight while students are not using the building WAN network. The storage itself can be located in the same network router equipment that is used to connect to the WAN, eliminating additional footprint and power consumption.

This allows students to take advantage of the much faster internal network and not compete for the more expensive WAN connection leaving the school. It helps to ensure a better experience for students and teachers, as class time would not be wasted while students wait to access lecture content.

**Recommendation: Schools should deploy WAN acceleration devices to manage and reduce the increasing amount of bandwidth usage between schools inside the district.**

### **LAN - Internal Connections Inside the School - Connecting Students and Classrooms**

The school LAN (also referred to as the internal connection) is critical for delivering educational applications end to end. The foundation of sound network architecture, especially for large schools, consists of the three network layers: core, distribution, and access. Each of these layers provides a distinct purpose in the architecture, described below.

**District core:** The district core provides the backbone for the entire school district and delivers fault-tolerant, high-speed services throughout the district.

**Distribution:** This serves as the major communication point between the district and schools, mapping directly to the technology services being offered. This is the point where policies are created and managed to facilitate the distribution of services to the schools; importantly, these policies must ensure the most efficient transport path to maintain high availability and resiliency across the entire district. Security policies are enforced here, and transport paths are optimized based on the type of service requested.

**Access (building infrastructure):** The access layer is where devices and peripherals connect to the network. For example, access points for wireless services, video surveillance cameras, line-powered bells and alarms, desktop computing, servers, IP phones, and digital building controls connect to the access layer. The access layer is where the actual classrooms within schools attach to the network to gain connectivity to the district's technology services.

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The fundamental building blocks for connections inside and outside schools are routers and switches. These specialized hardware devices must be robust and be deployed in a redundant fashion to ensure that educators and students can depend upon the network running 24 hours a day, seven days a week. The hardware must support traffic prioritization, policing functionality, and security policies, and have the throughput required by school and student applications.

In summary, all of the elements in the core, distribution, and access layers create the fundamental data plane upon which everyone in the district can depend. These must work together and be easy to manage, with robust features, to support the information infrastructure of the school.

**Recommendation: Schools should considering deploying solid network architecture across their districts, using the core-distribution-access model to ensure that students have consistent reliable access to information anywhere without network failures or outages.**

#### ***Wireless Availability and Access Points***

As earlier indicated, the massive explosion of devices is driving the need for robust, secure, and reliable wireless networks. In schools, wireless technology allows freedom of movement for students and educators. When designed and implemented correctly, the ongoing improvements in Wi-Fi technology and spectrum use enable wireless technology to offer exceptional performance in dense user locations common to learning environments, such as classrooms and auditoriums. In terms of performance, new wireless environments now rival the wired environments of a few years ago.

However, it is common to see school wireless environments that perform poorly - where students and educators are unable to log into the network during class, or the wireless throughput is too slow to be productive in learning. Complaints such as, "I know the material is out there...I just can't get to it because the wireless is too slow. There are too many people on the network!" is too often heard in schools today. This is because Wi-Fi is a shared environment, where everyone in a given area is sharing the same spectrum and throughput capability. To address these issues, wireless networks must be designed with knowledgeable expertise to deliver the performance required for highly-dense educational environments. At the same time, the network must be robust enough to avoid interference from other sources, be easy to manage, and ensure security of information in transit.

The density of devices and users per square foot in schools today is among the highest found in any work environment. Neither hotels and enterprise business environments, nor restaurants and hospitals see this level of demand on their networks: 25 laptops or tablets, 10 to 20 additional iPods or smartphones, with all users requesting individual learning videos and other digital assets in 1,000 square-foot rooms, all at the same time. Add school auditoriums, and one sees additional high-density environments, but on a larger scale.

To be effective for students and educators, Wi-Fi environments in schools must be capable of supporting the load that students and educators put on them. This requires detailed specification of expectations, plus proven design and implementation practices. In addition to supporting heavy load, schools often have rogue access points that are plugged in by someone trying to extend or "improve" the network. These can cause a security breach; access point systems are capable today of actively sensing rogue access points and containing them, effectively telling Wi-Fi clients not to use them, while the location of the rogue access point is placed on a map. School technology staff can then be alerted to locate and remove it.

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The classroom is no longer bounded by four walls. Wireless hotspots can be made available to students after hours, allowing them to access course work and research for their homework. These hotspots could also be used to augment the local curriculum, especially in areas where there are no resources to teach specific subjects or advanced placement (AP) classes.

With the proper network capabilities and design, wireless community hotspots can be created and managed in the same school environment. These Wi-Fi-enabled areas could be used for continuing education participants, online job applications, or even job interviews using video. This capability would allow the school to open its doors to community participants who have wireless devices but are in need of wireless Internet service. This could be the school's media center, or it could be another area such as a cafeteria or media center that provides seating for guests. Patrons who do not have these devices would be able to use time on school desktop computers.

However, a valid concern by schools is that while the school network is secure from the outside, this opens up the school network to unaffiliated guest users who access the school network from the inside. This is where features above basic wireless spectrum coverage are critical. This service requires a sound, secure network infrastructure where community guest wireless access is provided separately and securely over the same equipment, with access only to the outside Internet and not to any local school resources. Designated devices such as printers could be provided with the same access for these guests.

**Recommendation: Schools should consider using sound wireless design principles and expertise to create a wireless network that operates well at all times under heavy loads. Schools deploy wireless access points with maximum throughput to support high, mobile device density and demand, especially in 1:1 student-to-device environments. Active rogue access point detection and containment is important for schools to maintain a secure wireless network.**

#### **Ride-Over Applications**

##### ***Video Endpoints***

Video conferencing empowers students and teachers. Video is increasingly being used to engage students, provide access to outside experts, and to connect students and teachers across geographic boundaries. By opening registration of more specialized or advanced courses to students across different schools, districts have the ability to offer courses not previously available, increase enrollment, and benefit students with a broader array of course choices.

Video is used today to bring remote subject matter experts into the classroom, or to take students on a virtual field trip to a museum or research center, allowing students to learn about and experience different locations around the world. Video is also used for student tutoring and for students to connect with one another and their teachers.

Teachers also use video conferencing for professional development, allowing them to attend remote lectures related to their fields of expertise, or to advances in technology in the classroom. The same video conferencing endpoint can also facilitate parent/teacher engagement.

When deploying video, schools may choose to have dedicated, standalone hardware endpoints. Others may choose software endpoints, where the software client is an application on a classroom computer. Hardware endpoints are easier to use and have more flexibility when sharing presentations or content. Software endpoints allow the use of the classroom computer for multiple uses. However, other applications running on the network may impact the performance of a video call.

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Districts should ensure that video endpoints are standards-based, allowing interoperability with the thousands of other video endpoints in use at other schools and libraries around the world. Teachers should be able to dial from one endpoint to any other video endpoint at any given point in time, thereby increasing their overall investments in video technologies.

In implementing video conferencing, it is critical to provide Quality of Service (QoS) on a school's network to ensure priority for video calls over other types of traffic, such as file transfers, that are less impacted by bandwidth starvation, jitter, or delay. Concurrent video sessions will also compete with other applications for the WAN connection bandwidth. If multipoint video calls are required, the location of the Multipoint Conferencing Unit (MCU) must be considered, as each remote participant will send their video to the MCU. Options could be to host MCU on school premises, on a school's district network, or on the Research and Education network. As mentioned earlier, schools may use an MCU over the Internet; however, the district's WAN connection to the Internet will instead be utilized and must have capacity to support it.

Video can also create a more equitable learning environment. School districts often cannot afford to offer advanced placement courses in all locations where there is student demand. With a well-provisioned network providing a great interactive video experience, students can attend advanced placement courses remotely, expanding educational opportunities for all students.

While live video is an important component in the learning process, there is an entire video lifecycle that extends beyond it. This includes recording live lectures and student content. It involves transcoding and encoding video for the type of device that is playing it. Such video must be stored, yet available quickly when requested. Video distribution can more effectively preserve bandwidth across the WAN.

**Recommendation: Schools use hardware video endpoints to bring outside resources into the learning environment. QoS capability in the school's network is required to ensure that video quality is satisfactory from end to end. R&E networks should be used by schools to reach multipoint conferencing bridges and higher bandwidth for video.**

#### ***Transition Voice to Broadband***

Legacy voice services may come with a high operating expense. Schools can take advantage of their internal infrastructure and WAN connections to transition the PSTN lines to IP. Not only can this save the school operating expenses, it also allows the schools to use new functionality, such as instant messaging, visual voicemail, mobility, and video.

IP telephony facilitates integration of voice in other applications. For example, a user may be able to access their office phone number through their computer, or through an application on a mobile device. Voice can be integrated into an instant messaging application, allowing users to escalate an IM conversation into a voice call by the click of a button. There is no need to look up a phone number.

There are several ways to implement voice, either on-premise in the district network core, or hosted in a reliable offsite location with a communications service provider. It is important to understand two aspects of a voice call: call control (call setup and routing information) and call media (actual voice conversation).

In the on-premises model, all infrastructure is hosted on the school network and is usually supported by school network staff or a communications services operations company. On-campus traffic remains on the internal network, and off-campus traffic is sent out through a WAN broadband connection.

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In the hosted environment, applications are delivered within a highly secure, cloud-ready, virtualized platform under a centralized management system. The benefit to the school is to trade the capital and management expense of on-premise equipment for the hosted services cost. The school manages the physical endpoints (phones and communications applications on computers or mobile devices). However, all of the configuration is done in the off-site location. Call-control voice traffic is sent out through the WAN broadband connection. However, call media traffic only goes out to the WAN if the call participants are outside of the school network. For this type of service, it is critical that a backup path to traditional phone services is available for situations where the WAN broadband connection is not available, including emergency situations for E911 calls.

**Recommendation: Schools should take advantage of the IP LAN (internal connections) for voice and data services, rather than host separate legacy environments. Schools consider offsite, hosted voice solutions that use broadband connections, and host redundant, voice backup support.**

#### ***Mobility Outside School and Home Access***

Mobility is increasingly important, not only across school districts and campuses, but also when students are away from school, at home, in the library, or anywhere else they would like to access learning. Two trends are prevalent here: enhanced mobility and online learning. Students expect to get to their online coursework from the same mobile device at home, at a friend's house, or at a coffee shop, as they do at school. School administrators expect the same secure access to be in place while students and staff are accessing school resources from any location.

To enable this, students and faculty members must have remote access to the school or cloud network, and the bandwidth to support online learning activity from these locations. When students and educators are at school, their online resources, such as stored video, may be located on the school network for fast local access, removing packets from the Internet connection. However, when these same students and teachers go home to access the same videos, packets go back on the school Internet connection, since the students are accessing video stored at the school.

In new flipped learning environments, this can require a significant amount of "afternoon-evening" school Internet bandwidth, where students watch the majority of streaming video content at home, and much less at school.

In other flipped learning environments that have the video stored in the (Internet) cloud, this effect on school Internet bandwidth is reduced since students and educators access the cloud directly from home.

Over the past 10 years, availability of broadband access to U.S. homes has increased significantly, with the cost per megabit decreasing and the amount of bandwidth offered increasing. At the same time, attractive new services such as video streaming and two-way video can consume higher bandwidth very quickly. This means that with the use of expected technology for instruction, schools are in a position to recommend minimum bandwidth required for home access to parents and students, and to design their school and cloud networks to ensure that traffic loads are handled effectively.

**Recommendation: As schools increase their use of one-to-one, student-to-device environments, they should increase the amount of bandwidth coming into the school. The goal is to ensure that the simultaneous remote usage by students and teachers does not overwhelm school bandwidth. Schools provide remote Internet access minimum requirements for students in coursework that requires device use at home.**

### **Cloud Services**

How can schools enhance the learning experience while reducing costs and expanding access to quality learning experiences for students? One way is by providing on-demand access to educational content, resources, and services, on any device, whenever and wherever teachers and students happen to be. Cloud-based services combine powerful computing, networking, storage, management tools, and applications to make it easier than ever to bridge the in-school and online learning worlds with secure, on-demand services.

Cloud services can have many shapes and forms in terms of private, public, hybrid, and community clouds. However, any shift to cloud services changes bandwidth loads on the network, as services are moved from a local environment to a remote cloud environment. A distinction of cloud services is that the school trades capital expense of the specific pieces of equipment infrastructure for a cloud-based operational expense, where physical equipment management is taken care of by a cloud operations organization. However, the Internet bandwidth connection will be significantly impacted. For example, if a school uses multipoint resources on the Internet for video conferencing, each video stream will traverse the school's Internet connection simultaneously, competing for bandwidth, even if the call is only between classrooms in the same school, or in the same district.

**Recommendation: As schools enable courseware and other educational cloud services for students, they should increase Internet and R&E network bandwidth into the school to avoid these connections becoming overwhelmed with traffic and associated loss of productivity.**

### **School Safety**

A transition has occurred over the last 10 years, moving analog video surveillance systems to digital storage. At the same time, the transport of the video signal and camera control has moved from analog CATV cabling to IP. This gives schools a capital and operational cost savings, integrating video surveillance infrastructure into the single IP infrastructure.

As schools evaluate their physical security needs, there are many systems that can utilize this same infrastructure. Video surveillance cameras, door alarms, remote entry systems, bells, and dedicated emergency phones are examples. Some of these systems use Wi-Fi for areas that may be difficult to reach with existing wiring. Schools are able to view live or recorded video remotely, which can be critical in emergency situations.

**Recommendation: Schools should determine their physical security policies and as appropriate, integrate digital video surveillance and storage technology across a single IP infrastructure, spanning across multiple buildings in the district.**

### **Network Management, Performance Monitoring, Network Security**

#### **Network and Performance Management with Monitoring**

After the school network has been designed, planned, installed, and is operational, the next step is for students and teachers to place loads on the network. Devices from all over the school - wired and wireless, inside and outside - are actively using the network for all kinds of time-sensitive and productive use. Then someone (or many people) is not able to access their applications, or get their device onto the wireless network, or have the video call with the guest speaker. "The network is slow" or "the network is down" are common complaints. Why is the problem happening? What changed to cause the problem, when it was working fine yesterday? Did someone change something? Is it a user or application issue, or is it the network?

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The key to unlocking these answers is simple: visibility. When schools have visibility, they can find the answer to almost any network problem, and quickly begin to find the solution. When they do not have visibility, they begin to guess as to what the problem is, and may never successfully find the answer.

Network and performance management with monitoring is about visibility. Schools need visibility to be able to solve network problems. Visibility saves staff time, catches problems, and fixes them before anyone notices. It makes students and teachers more productive. However, visibility is usually the first item on the list to be dropped when making choices about priorities.

Visibility is obtained with tools. Without the proper tools, there is very little visibility. There are many capabilities that these tools provide. School technology staff is able to analyze usage on the network device by device, tracking down exactly where the problem exists along the many paths across the network. Faulty equipment gives notifications of malfunction, but there must be an analysis tool to receive and interpret it. Traffic utilization data can be gathered to analyze user trends, identify which segments of the network are over-utilized, while other segments are underutilized. The tools can identify malicious or wasted traffic, helping the administrator find devices which should be blocked.

Network performance tools give visibility into whether schools are receiving the bandwidth that was supposed to be delivered when the network was designed. These tools place intentional load on the network, then measure how the network responds to the load.

As an example, network performance tools provided the visibility to help administrators determine that it was video streaming that took up 90 percent of the WAN bandwidth. Without the tools to provide visibility, they may have never found the source of the problem. Visibility allowed them to understand that they needed to configure and implement traffic policing for video streaming traffic.

**Recommendation: Schools should implement network management and visibility tools as they deploy and operate networks for student learning. Network performance tools can be used to measure actual bandwidth and throughput capabilities from the student to the learning applications, and ensure that goals are being met. Schools should receive support for implementing and using these tools.**

#### ***Policy Management***

The Children's Internet Protection Act (CIPA) was enacted by Congress in 2000 to address concerns about children's access to obscene or harmful content over the Internet. In early 2001, the FCC issued rules implementing CIPA and provided updates to those rules in 2011 to provide network content filtering devices.

Children are naturally curious. It is important to protect children from adult and inappropriate content on the Internet. Content filtering should be enabled on school networks to prevent students from accessing inappropriate material, as well as to protect them from malicious sites or people. Content filtering can take on several different forms, from blocking specific types of websites and applications, to blocking content of certain types of ratings. However, a big challenge with deploying effective content filtering is the constant and ever-changing nature of uncontrolled content on the Internet. While the unacceptable content may not change, the online form that it takes (such as web 2.0) can change with new technologies and make it difficult to identify. The other challenge is the opposite: to block content which may appear unacceptable, but is acceptable.

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New content filtering solutions are available that go beyond basic URL filtering, to do real-time categorization of previously unseen content. These are important to improve detection across the dynamic nature of Internet media. But how does a school handle students who take school equipment home (such as tablets) and have access to inappropriate content there? Or to a coffee shop or library with free Wi-Fi? Or a neighbor's house to study? There are solutions to these concerns that can be deployed, such as virtual private network (VPN) environments that require mobile devices to be able to access the Internet only back through the school content filtering system, no matter where they are located.

Cisco believes that a holistic solution for monitoring and enforcing security across all communication channels, for different categories of users, is vital to ensure the integrity of a school's policies.

**Recommendation: Schools should deploy content filtering technologies with dynamic real-time categorization of material, to help enforce school policies. Schools should integrate their content filtering solutions within the entire framework of network security policies for the school environment.**

#### ***Network Security***

Online learning happens both on and off campus. Providing a safe and secure learning environment, irrespective of where the student is located, is a goal of many schools. However, security of mobile and home access to the school network is critical. Just as businesses require VPN access with their employees to ensure confidentiality of information, students and educators may be exchanging confidential information from remote locations. Sometimes it is about more than confidential information; it is about sending all traffic back to the school for security policy assessment before it goes to the Internet (VPN).

Passwords are often the weakest link when trying to ensure that user authentication is correct. Students can be very clever in trying to break into secured school systems. Schools may consider more advanced techniques, such as two-factor authentication for some of their most secure applications. This typically requires the user to present something that they know (e.g. password) plus something that they have (e.g. generated token, USB token, mobile device).

It is critical that these requirements are clearly understood and implemented with scale in mind since there could be hundreds or thousands of students and educators accessing the network at the same time, especially when students are home during after-school hours.

**Recommendation: Schools should analyze their network security policies and deploy solutions that ensure that these policies are enforced at all times. Network security solutions should be flexible to allow different user groups (students, faculty, administrators, guests) to be able access only the information that is permitted for their user group.**

## Part 5: Summary Recommendations



Cisco's experience working with the educational community to provide next-generation learning opportunities has provided it with important insights into both the successes of the E-Rate Program and the improvements that are necessary to allow the program to continue to achieve its goals in the new learning environment. First, E-Rate must be adequately funded to support the technology-intensive needs of educators in the Internet age. Second, it should support cost-effective networks that operate as a cohesive whole, providing capacity for the future and long-term efficiencies. To do so, the FCC should stop prioritizing funding for services over funding for networks, which creates perverse incentives for educators to structure their funding requests in inefficient ways to increase support. The administrative processes of the program also should be simplified to increase participation and fairness in distribution of funds.

**Provide Sufficient Funding**

As discussed elsewhere in this paper, education today depends on creating a rich, connected learning experience for students, including support for bandwidth-hungry applications such as access to multimedia content and telepresence. Schools and libraries need access to significant bandwidth to enable a connected learning environment and experience for students, faculty, and staff - likely even more bandwidth than the FCC predicts.

As noted above, schools today have the densest broadband needs of any users - more than businesses, hotels, hospitals, or entertainment venues. Schools need sufficient infrastructure for networks to enable learning applications, including routers and wireless access points, and resources to keep these high-capacity networks running. Schools' and libraries' broadband and technology needs are, therefore, as great as or greater than comparably sized businesses. Schools need access to business-grade services and technology.

As schools' and libraries' technology needs have grown, E-Rate funding has not kept pace. Funding requests outstrip the funding cap nearly every year - usually by more than 100 percent. Under current prioritization rules, requests for services exceed the funding cap, leaving infrastructure requests unfunded. As a result, American students risk falling further behind the students of other countries, where governments have made connected learning a priority. Schools and libraries cannot prepare students to be competitive in a knowledge-based, connected next-generation workplace with 20<sup>th</sup> century technology.

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The FCC should ensure that funding is sufficient, as originally required by the Telecommunications Act. This should begin with an inquiry into the services and equipment that need to be funded, and a candid assessment of the costs to deploy those services and equipment in American schools over a reasonable time horizon. Only through this process can the FCC determine an appropriate level of funding for the E-Rate Program.

E-Rate funding levels must ensure the program's long-term financial security. This requires recognizing that connecting schools and libraries is not a one-time activity. Networks require continuous support to keep them running efficiently. In addition, connectivity is an evolving technology. Providing only one-time support for schools' and libraries' technology infrastructure needs essentially builds an educational bridge to nowhere, wasting funds that could be spent more effectively on the ongoing costs of real and future networks for a connected learning environment.

#### **Support Cohesive, Cost-Effective Networks**

As the information in this paper demonstrates, today's connected learning environment depends on delivering multimedia information to classrooms, students, and faculty, and doing so across a range of devices to different buildings and student homes. These capabilities require school districts and individual schools to provide a high-bandwidth, high-performance network at all times. This also requires comprehensive, business-grade broadband and network solutions to enable these capabilities.

In short, today's connected learning environment cannot be provisioned with an Internet connection and simple inside wiring alone. Schools need sufficiently robust broadband connectivity in and out of the school and sufficient broadband connectivity **within** the school. But a modern network must also include network management and maintenance, safety and security solutions, access- and distribution-layer infrastructure, wireless availability and access points, video endpoints, local caching, cloud services, and mobile access solutions for students and faculty working on educational projects outside of the school.

The E-Rate Program, therefore, should support business-grade, service-oriented networks for schools and libraries that operate as a whole to provide these services. The program also should support network architectures that ensure adequate capacity and scalability for the useful life of the network, ensuring long-term efficiency and cost-effectiveness.

#### **Eliminate the Prioritization of Services over Networks**

In order to promote the efficient use of E-Rate support, the FCC should eliminate the current rule that creates an artificial funding priority for telecommunications or Internet access services over the networks used to provide those services (the priority 1/priority 2 distinction). Cisco has seen firsthand how the current rule leads educators to structure their funding requests (and ultimately, their purchasing decisions) in inefficient ways in order to increase their likelihood of being funded. In practice, this means that schools over-order voice and broadband access services, and neglect the internal networks that are used to distribute those services among schools within a district and among classrooms within a school. In Cisco's experience, this is a significant factor contributing to most schools' complaints that they lack adequate broadband capacity. In many cases, it is not that they cannot obtain or afford adequate bandwidth into and out of the school or district; rather, it is that they cannot afford adequate bandwidth within the schools themselves. Or, even if they can afford to install adequate connectivity within the school, they cannot afford to maintain it.

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Allowing schools and libraries to order the mix of technology that will meet their curriculum needs is essential to ensuring that educators are able to deliver a connected learning environment to students in classrooms and other teaching locations in schools. This will also promote more efficient ordering and use of technology, as schools can order efficient mixes of technology without fear that doing so will reduce their chances of being funded. The FCC should not artificially dictate investment and network management decisions by limiting support to a subset of eligible network components. Schools and libraries need the long-term flexibility and control to design the most efficient networks to serve their students.

#### **Simplify Participation in the Program**

Cisco's work with the educational community has revealed that many schools and libraries are daunted by the administrative application process to obtain E-Rate funding. Schools that take the time to parse the complex rules - or those that can afford to hire E-Rate consultants to do so - fare better than schools that do not, irrespective of their relative need for support. This can lead to undesirable outcomes in the allocation of support among schools. The complexity of the rules also results in costs for all participants in the process, and these resources are effectively "dead weight loss" that could be better spent on services.

The E-Rate Program would be both fairer and more efficient if the administrative process were simpler. The FCC should carefully consider ways to streamline the application process. It should study educational entities' regular processes for procuring goods and services, and align the E-Rate process as closely as possible with standard educational procurement processes. The FCC should also look at ways for districts and consortia to apply in a more effective way.

#### **Set Goals That Address Present and Future Bandwidth Needs**

Today's schools will require connections of at least one Gigabit per second. As technology advances and schools use applications such as high-definition video more intensively, schools will need to grow their capacity over time. The E-Rate Program should set bold goals for current and future connectivity to ensure that schools can meet future demands for internet access. Students and teachers are able to download most files, conduct Internet research, engage in collaborative group projects, and handle most classroom tasks. The density of devices and users per square foot in schools today is among the highest found in any work environment. Neither hotels and enterprise business environments nor restaurants and hospitals see this level of demand on their networks. Given this density, a major focus of the E-Rate Program should be to increase the actual bandwidth that students and teachers experience.

The Internet is on the cusp of amazing things, many of which we cannot predict today. Just five years ago, tablets weren't used widely and Wi-Fi was available only sporadically. What will technology be like five years from now? In 10 years? In 15 years? It's hard to predict, but we will surely want our schools to be able to take advantage of the enormous possibilities, particularly around access to information, as well as communication with peers, leaders, and subject matter experts outside of the classroom. The possibilities are endless. Additionally, we will want our students to develop technology interests and skills so that they will consider studying and participating in STEM fields after they graduate.

But the ability to do many of these things is dependent on the decisions made now to put adequate infrastructure in place - infrastructure which can be scaled and increased in the future.

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Therefore, Cisco recommends that by 2014, all schools in America have Internet access of 1 Gbps per 2,000 students (or 0.5 Mbps per student) and by 2018 increase that number four-fold, to 4 Gbps per 2,000 students (or 2 Mbps per student). In addition, Cisco recommends that in geographies in which last-mile fiber infrastructure is already built, schools should double the goals to 2 Gbps per 2,000 students in 2014 and 8 Gbps per 2,000 students by 2018.

Each school is different, and speeds are only one measure of how robust a network is. So, district administrators should also consider how much connectivity is reaching students and teachers in the classroom so that students and teachers can conduct typical network activities with minimal disruptions or lag times. For internal district and school networks Cisco recommends bandwidth at five times the Internet access speeds. This translates into 5 Gbps per 2,000 students in 2014 and 20 Gbps per 2,000 students by 2018. In geographies where last-mile fiber infrastructure is already built, the goals should be doubled (10 Gbps per 2,000 students in 2014 and 40 Gbps per 2,000 students by 2018).

In doing so, we will put the infrastructure in place to provide our children with the education they need to be able to compete, not just with the kids down the road, but also students around the world.

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## Part 6: Cisco's Commitment to Education

Cisco has a unique [commitment to education](#) and has been a leader in developing creative and effective public-private partnerships. Our founders were members of Stanford University's IT staff, and the first to provide computers with the ability to speak to one another. Cisco was founded in order to enable communication. In 1984, founders Len Bosack and Sandy Lerner were experimenting at Stanford University to connect detached networks in two separate buildings on campus. After running network cables between the two buildings, and connecting them with bridges and then routers, the two realized that to make the disparate networks talk to each other and share information, a technology was needed that could handle the different local area protocols. So Bosack and Lerner invented the multi-protocol router, which they launched in 1986.

We care deeply about students and educators. Cisco has made, and continues to make, major investments of time and resources to improve education, not only in the U.S. but globally. Not only have these investments improved education and helped to develop lifelong learners, but they have provided us with valuable insights into how to integrate technology with sound curriculum and pedagogy.

[Cisco launched the 21<sup>st</sup> Century Schools Initiative \(21S\)](#) in September 2005 to support post-hurricane rebuilding efforts in the U.S. Gulf Coast while creating a sustainable, scalable, and replicable model for education reform. 21S was supported by a multimillion dollar investment in technology, training programs, and Cisco Leadership Fellows' expertise.

The aim of 21S was to transform education systems to meet the needs of 21<sup>st</sup> century learners, educators, and organizations by promoting leadership development, building capacity for collaboration, and using technology as an accelerant of change. The emphasis is on scalability, replication, and sustainability. The results are clear. Participating schools realized better test scores compared to previous years, and student performance on state tests improved in most districts.

The [Cisco Networking Academy](#) represents our largest philanthropic investment, and every year, this program teaches hundreds of thousands of students worldwide the skills needed to build, design, and maintain networks - improving their career prospects while filling the global demand for networking professionals. With 10,000 academies in 165 countries, Cisco Networking Academy helps individuals prepare for industry-recognized certifications and entry-level information and communication technology (ICT) careers in virtually every type of industry. Students develop foundational skills in ICT while acquiring vital 21<sup>st</sup>-century career skills in problem solving, collaboration, and critical thinking.

Finally, Cisco reaches scale by investing in [education innovators](#). We work with students, educators, nonprofits, and education system leaders in developed and developing countries, providing volunteer expertise, cash, and technology grants. For example, we collaborate with and support nonprofit partners such as Teach for America, Teachers Without Borders, City Year, Blue Ribbon Schools of Excellence, and Citizen Schools. We also make strategic investments in organizations committed to using technology to transform education. Examples include the National Center for Learning Disabilities, MIND Research Institute, and the New York Hall of Science.

Many of our partnerships, including those with Citizens Schools and MIND Research Institute, have a very specific focus on STEM - organizations that help to equip students with the skills they need to be successful in these areas. Cisco supports a broad range of employee volunteer activities in many educational non-profit organizations. This volunteer work is not only good for the organizations and the communities they serve, but it also helps our employees understand the importance of supporting our education system.

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## Conclusion

We have a historic opportunity to use the massive acceleration of technology currently taking place to inherently change teaching and learning. In a recent statement on the White House ConnectED announcement, Cisco's Chairman and CEO, John Chambers said,

President Obama's announcement is a major step toward bringing our nation's classrooms into the 21<sup>st</sup> century. A modernized E-Rate Program will lay the groundwork for connected classrooms across the country, where students have digital textbooks and access to libraries of information at their fingertips. This will help our children and grandchildren prepare for an 'Internet of Everything' future where technology is integrated into all aspects of work and life.

Under the leadership and vision of Mooresville Graded School District superintendent Dr. Mark Edwards, the Mooresville Middle School where the President made his announcement is a model for how technology can transform a classroom. We at Cisco stand ready to work with the Obama Administration and the FCC to replicate this model around the country.

## Endnotes

1. CDE, Tech Market Briefing, 2013
2. Statement of James G. Coulter, Co-founder, TPG Capital at Senate Commerce Committee E-Rate 2.0 Hearing, July 17, 2013
3. White House ConnectedED Fact Sheet
4. "Revolutionizing Education Through Technology: The Project RED Roadmap for Transformation." (2010)
5. "Revolutionizing Education Through Technology: The Project RED Roadmap for Transformation." (2010)
6. Silicon Valley Historic Association: <http://www.siliconvalleyhistorical.org/#/cisco-systems/c1vg0>

## For More Information

To learn more about E-Rate and Cisco solutions for schools and communities go to [http://www.cisco.com/web/strategy/education/us\\_education/e-rate.html](http://www.cisco.com/web/strategy/education/us_education/e-rate.html).



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RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARK PRYOR TO  
JAMES G. COULTER

*Question 1.* Considering your work on the LEAD Commission and your background with Dartmouth and Stanford, are there lessons that our K12 schools can learn from colleges and universities to leverage their funds to increase connectivity? Similarly, once connected, how can K12 schools ensure their dollars are being spent effectively to connect the individual students to the Internet and digital learning tools?

*Question 1a.* I come from a rural state where our more rural and lower income schools have struggled to keep up technologically. In your research for the LEAD Commission, did you get a sense of the relative benefits that rural students receive as digital learning tools are brought into the classroom? How could E-Rate be improved to further reflect your findings with the Commission?

Answer. There are a number of lessons that can be learned from colleges and universities that have effectively leveraged funds, through collaborative efforts such as buying through research and education networks, with both regional providers and national providers, such as Internet2. These efforts have resulted in colleges being able to provide significantly more bandwidth at lower costs than can generally be found in the commercial marketplace.

Rural areas have a tremendous amount to gain if our country implements a program to bring improved bandwidth to all our country's schools. Rural areas also have a lot to lose if we fail to do so.

In February 2013, the Pew Internet & American Life Project, which explored middle and high school teacher usage of technology at home and in the classroom, found that the lowest income students were faced with the most challenges when trying to bring digital learning resources tools to the classroom.<sup>1</sup> There is demonstrated demand for the implementation of technology in U.S. classrooms; however, the current rate of adoption is unacceptably slow and uneven. Digital learning must be a national priority to ensure that every child, regardless of socio-economic status, has access to the same high-quality, 21st century resources. Without equitable technology implementation in the classroom we risk further exacerbating the digital divide. This is particularly relevant for rural communities as they generally are behind urban communities in terms of the bandwidth available in their communities.

Technology has the ability to be an incredible equalizer for traditionally underserved communities. Unfortunately, uneven technology adoption in our Nation's schools risks exacerbating existing socio-economic inequality. Today, effective use of technology has the unique ability to reverse this trend by improving learning and equipping students with 21st century skills needed to be competitive in today's global economy. For rural students it can mean access to the all kinds of advanced or specialized courses that without such technology, students in rural areas would not have access to. It can mean the same kind of personalized feedback and curriculum that today, only wealthier students in urban areas have access to. For all students, digital technology can be a tide that lifts all boats, but given the data and relative position of rural communities, rural communities have the most to gain by moving educational opportunities to the digital platform and widely distributing the bandwidth necessary to take advantage of those opportunities.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. AMY KLOBUCHAR TO  
JAMES G. COULTER

*Question.* STEM—Schools. I am a strong supporter of increasing technology in the classroom. If we want our students to go on to be the next scientists, engineers, and innovators of tomorrow, they need early exposure to advanced technology in the classroom today. Mr. Coulter—What type of impact does access to hands on interactive learning through connected devices have on student interest in STEM subjects?

Answer. There is certainly anecdotal evidence that digital learning is particularly useful for STEM subject matters as it allows students to move at their own pace, enabling more naturally gifted students to move faster than traditional classrooms would allow, and providing the kind of feedback that allows other students to master the fundamentals before moving on to more advanced materials. It also allows students from across the country, including rural areas, to have access to the best

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<sup>1</sup>National Writing Project, Pew Research Center, The College Board, *How Teachers Are Using Technology at Home and in Their Classrooms*, February 28, 2013 <http://www.pewinternet.org/Reports/2013/Teachers-and-technology.aspx>

instructional materials in advanced and specialized courses that are often not otherwise available in many schools around the country.

This is, as the question implies, an important issue of international competitiveness. As the LEAD Commission Report noted, many other countries are advancing digital learning in schools through collective national efforts to clear the pathway for scalability. For example, South Korea has 100 percent of schools connected to the Internet, 100 percent of teachers trained in digital learning and 70 percent of curriculum involving e-learning as a result of four national “master plans” for digital learning. South Korea is also moving toward all digital textbooks by 2015.<sup>2</sup> In Thailand, about 850,000 tablets have already been distributed throughout urban and rural classrooms and, by the end of 2014, the government plans to distribute handheld computers to 13 million school children at a cost of about \$100 each—a total of \$1.3 billion—and then replace them every two years.<sup>3</sup>

Earlier this year, Turkey’s Prime Minister toured the U.S. to identify a technology provider that will supply 11 million tablets to Turkish students by 2015.<sup>4</sup> These countries and others believe the earlier they put technology in the hands of students and make it an active part of their education the better prepared those students will be to participate in an increasingly tech savvy workforce.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARK WARNER TO  
JAMES G. COULTER

*Question 1.* Mr. Coulter’s testimony notes that “five years ago, the national implementation of educational technology in a large-scale fashion would have been prohibitively expensive with \$1,000 work-stations, shrink-wrapped sub-par software and torn up walls to wire school buildings. Today, thanks to the plummeting costs of tablet computers, innovative cloud-based software and enterprise Wi-Fi technology, implementation is affordable and achievable.” He also acknowledged that “E-Rate currently supports operating expenditures but does not incentivize long-term investment in fiber.” What do you recommend we do to better focus E-Rate on long-term investments?

Answer. In 1996, Congress, on a bipartisan basis, instructed the FCC to assure that the tools of modern communications were brought to every classroom in the country. Since 1996, changes in communications technology have caused nearly every enterprise to change how it obtains and uses communications technology. It is appropriate, therefore, that the FCC take a hard look at how the E-Rate program distributes funds to assure that the money is spent to maximize its long-term impact, and this is one of the most important questions involved with the current FCC proceeding.

We believe that proceeding will demonstrate a consensus that the current system does not do a good job providing schools an incentive to invest efficiently in what are long-term assets. The LEAD Commission looks forward to evaluating various proposals designed to do so. For example, there are likely to be proposals that improve transparency, so as to create a more efficient market for long-term investments. Others, we believe, will advocate for benchmarks or targets to realign incentives for long-term investments. Another proposal worthy of consideration is the creation of a capital investment fund to reflect, as most enterprises do, the difference between using funds for capital expenses and operating expenses. At this time, the LEAD Commission is not firmly wedded to any particular tactic for focusing funding on long-term investments but looks forward to evaluating all the proposals before the FCC. We are confident the process will reveal a number of good ideas for improving how funds are used.

*Question 1a.* It seems to me that some of the E-Rate eligible services, such as paging, are outdated. Should the list of eligible services be revisited? If so, are there any services that you believe should be removed? Are there any that you believe are missing from the list?

Answer. I agree that some services are outdated and the list of eligible services should be revisited. As a preliminary matter, the FCC should consider whether all currently eligible services that are not part of the broadband infrastructure should at a minimum be de-prioritized and possibly removed from the eligible services list; priority one could include both services and equipment related to broadband, such

<sup>2</sup>Digital Trends, *South Korean school textbooks will be all digital by 2015*, July 5, 2011.

<sup>3</sup>Tablets Thrust Thai Classrooms into Digital Era, <http://www.foxnews.com/world/2013/06/18/tablets-thrust-thai-classrooms-into-digital-era/#ixzz2WnNdU2b3>

<sup>4</sup>See Countdown begins for Turkey’s high-tech Fatih Project (May 20, 2013), <http://www.invest.gov.tr/en-US/infocenter/news/Pages/200513-turkey-fatih-project-tender-processstart.aspx>

as Internet access, WAN Connectivity, LAN equipment, Wi-Fi equipment, and potentially firewalls and content filters. It may also prove important to include those costs, which, as noted above, enable long-term investments so as to lower the ultimate cost.

*Question 1b.* Is it possible to incentivize long-term investments without increasing the overall cost of the E-Rate program?

Answer. When evaluating costs, it is always important to remember the cost is both a function of amount and time. That is, one can spend less in a given year but if one spends that amount over more years, the overall cost of the program could be greater than it should be. So here, the focus should be how do we provide the necessary bandwidth upgrade to the greatest number of students in the shortest amount of time at the lowest cost, rather than an artificial, and misleading focus on a single short-term metric.

Further, there are ways to incent long-term investments that do not lead to increasing the overall cost, and in the long run, reduce costs. As noted above, one proposal worth considering is to carve out a portion of the program funds for a capital investment fund. This could be done with some of the unused rollover funds and could be supplemented with the funds saved by eliminating certain currently eligible services, also as noted above.

*Question 1c.* How could E-rate be modified to enable the deployment of enterprise Wi-Fi? Might this help to lower overall costs or to provide services that currently fall beyond the funding cap?

Answer. Enterprise Wi-Fi is already an eligible service. The problem is that under the current system, it is a Priority 2 service and therefore, few schools receive funding for it. This problem could be solved either by making it a Priority 1 service or by making it part of an E-Rate capital investment program. Either would both improve the quality of the service and the efficiency of the investment.

*Question 2.* There is very little data available on the capacity and speed of current school networks. Would it be beneficial to require schools who apply for E-rate funding to provide data on the speed and capacity of their networks? If not, why not?

Answer. Yes. It should be done through passive monitoring, in a way similar to the FCC's Measuring Broadband America program. This will improve the FCC's ability to manage the program and focus funds on the schools that most need the upgrades.

*Question 2a.* Should a minimum bandwidth or speed level be implemented? If so, what should this level be based on (*i.e.*, number of users/school, demand for bandwidth)?

Answer. We believe that the FCC should establish a minimum bandwidth level that reflects both the current need for the greater bandwidth to deliver today's digital materials as well as building capacity for future needs. We look forward to reviewing the comments in the FCC proceeding to evaluate the dimensions of those minimums. Based on the extensive research by the LEAD Commission, which is consistent with a number of other studies conducted by other groups, we believe the initial target for a Wide Area Network connection should be 1 gigabit and that every school with more than 100 students should have a fiber connection capable of providing that capacity.

*Question 3.* How can this data be plugged into the National Broadband Map?

Answer. It is very easy to plug the information into the Map. The FCC can have its mapping team write an application programming interface (API) that would allow the National Broadband Map to pull the data.

*Question 4.* In the past, E-Rate funded connections have been audited to ensure that only school/library traffic was riding on the subsidized connection, which resulted in high usage during the typical school day and unused capacity during evenings, weekends, and school vacations. Should E-Rate 2.0 include provisions that could support home-based broadband connectivity for students? If not, why not?

Answer. The FCC should consider whether to make home connectivity an eligible service but at a lower priority level so that it does not interfere with ensuring that schools have the connectivity and infrastructure they need. Further, if the FCC includes home-based connectivity, it should consider a cap on the amount of the reimbursement per student.

*Question 4a.* Do you believe E-Rate funded connections could be leveraged during these "down" periods to provide for load balancing and added technology availability for the campus/community? If so, do you have any suggestions regarding how this type of function could be utilized without a large increase in costs or in concerns about the accountability of the program?

Answer. The FCC should consider allowing experimentation concerning community off-hour usage and it should also consider a broader program allowing such usage. The amount of capacity subsidized by E-Rate funds, however, should be based on the usage during the school day.

*Question 5.* On June 6, 2013, the Administration unveiled a new initiative called ConnectED, which intends to connect 99 percent of America's students to the Internet through high-speed broadband and high-speed wireless within 5 years. Do you have any recommendations for the FCC or Congress in terms of how E-Rate can be better aligned to support curriculum or technology training goals?

Answer. The curriculum and technology training goals are very important and all levels of government should coordinate as to how to best achieve them. There are a number of programs designed to address these goals. However, the E-Rate program is currently oversubscribed and is likely to remain so. We believe it should stay focused on providing the necessary foundation of infrastructure and its mandate should not be expanded to include these other goals.

As the LEAD Commission discusses in our recent Report Paving a Path Forward for Digital Learning in the United States (Sept. 2013) (submitted herewith), we believe the government should act to develop safe, effective and efficient ways for teachers, school principals, school districts and states to evaluate and purchase comprehensive, high quality digital learning products. To foster that acceleration, the LEAD Commission recommends the following:

- Evolve State and District Purchasing Cycles to the Digital Age. Currently, many states and districts live with multi-year purchasing cycles dictated by the traditional textbook "edition" model. In a world of constantly changing digital delivery, states and districts need to adopt more flexible, timely procurement processes.
- Create an Independent Certification Program. An independent, non-governmental certification program that identifies approved, high-quality curriculum and content solutions is needed in the market. It would help support a safe purchasing process and incentivize school districts to accelerate the transition to digital learning.
- Increase Innovation and Research Funds. The marketplace would benefit from the availability of capital to fuel both new innovations and research to better understand and verify the effectiveness of new advances. Capital targeting entrepreneurs, businesses and researchers would not only help bring new, more effective products to market, but also foster greater competition. We have seen variations of this model work successfully with the National Institutes of Health, InQTel and DARPA . . . why not in education?

*Question 6.* Could Elementary and Secondary Act (ESEA) Title II funds, typically allocated for teacher training, be used in a different manner to ensure teachers are trained to integrate educational technology into their instruction?

*Question 6a.* Is Title I participation the "right" basis for subsidy calculations or should it be based on technology need and the actual dollars necessary to reach a desired speed/capacity level and sustain it over time?

*Question 6b.* How do we effectively harness the opportunities enabled by technology to train or retrain individuals to enter sectors that will experience high growth?

Answer. The LEAD Commission does not have specific recommendations at this time as to the specific Federal funding allocations. On the training side, the LEAD Commission Report has demonstrated a need and suggested a framework for improvements. The LEAD Commission believes digital learning is not about "one to one" learning between a student and a device; it is about "one to one to one" learning involving a teacher, a student and a device. A common perception is that teachers are anti-technology, but LEAD's polling shows that 96 percent of teachers believe that the integration of technology in teaching and learning is important to the education of America's students. Yet only 18 percent of teachers believe they are receiving the necessary training to use technology to its fullest potential in the classroom. For technology to be properly deployed, teachers need to be empowered to embrace and use it effectively in the classroom.

The LEAD Commission strongly recommends establishing a program to empower 100 percent of teachers on use of information and communications technology over the next three years. The creation of "master teachers" to help train other teachers in best practices could be crucial to scaling this program (a practice used success-

fully in other countries). Funding for teachers' professional development would utilize portions of existing Federal dollars available for teacher training.

