

The background of the top half of the page is a vibrant teal color. Overlaid on this is a dark teal silhouette of the map of Puerto Rico, including its smaller islands. The map is centered horizontally. Surrounding the map are several large, dark teal geometric shapes, including triangles and polygons, which create a layered, abstract effect. The text 'SECTION V' is printed in white, uppercase letters across the center of the map silhouette.

# SECTION V

BUILDING GIGABIT CAPACITY  
TO PUERTO RICO'S SCHOOLS



The 2012 Puerto Rico Broadband Strategic Plan set the ambitious broadband connectivity goal of 100 Mbps across the Puerto Rico K-12 education system by 2015. The Plan also called for always-on online access to all students, both in and out of the classroom; ongoing development of a robust online curricula; and reform of teacher professional development plans to fully leverage online technology resources that help students achieve stronger academic outcomes.<sup>61</sup> These goals and recommendations put forth by the 2012 Broadband Strategic Plan remain keenly relevant today.

Information technology has and continues to fundamentally transform education. For multiple decades, IT solutions have been an instrumental part of the K-12 experience at school libraries, school technology labs and — for some lucky students - in the classroom. Yet, it is only recently that we began approaching a tipping point that could transform the basic paradigm of education.<sup>62</sup>

Lower-cost tablets, sufficient broadband bandwidth, online content development, and innovative pedagogical models are generating a new vision for the K-12 education experience. In this vision, Internet-ready devices (e.g., tablets and/or computers) are available to each student both in and out of the classroom at a 1:1 ratio to enable a 24/7 personalized learning experience. This model has the potential to facilitate individualized learning plans, real-time assessments, and immediate feedback on a student's academic progress. Responding to this technology challenge, in 2013 the White House launched its ConnectED initiative and the FCC embarked on reforming E-rate, the largest federal program supporting education technology.

This segment evaluates the current state of broadband and technology across Puerto Rico's K-12 system and the remaining challenges to meet the goals of the ConnectED initiative and the vision of the FCC. It then evaluates plans from the Puerto Rico Department of Education to expand Information technology throughout education, and compares those plans with similar strategies from other jurisdictions. Finally, we offer recommendations aimed at helping this important investment in education technology succeed.



## The White House ConnectED Initiative

On June 6, 2013, President Obama announced his program to connect all U.S. schools to the digital age. ConnectED is a transformative education initiative with the goal of connecting 99 percent of America's students to next generation broadband at speeds of at least 100 Mbps, but with a target of 1 Gbps within five years. In order to create a "robust ecosystem for digital learning" and ensure equity for rural students, ConnectED will also invest in professional development opportunities for teachers and build on private-sector innovation to help bring twenty-first century educational resources to millions of K-12 students throughout the country.<sup>101</sup>

Private companies have pledged in-kind contributions equivalent to over a billion dollars in investment to support ConnectED's goals. Corporate partners of this initiative include:

- Apple is donating \$100 million in iPads, MacBooks, and other products, as well as content and professional development tools to enrich the learning experience in disadvantaged schools throughout the country.
- Microsoft will provide all U.S. public schools with significant discounts on its Windows operating system, which will decrease the price of associated Windows-based devices.
- O'Reilly Media is partnering with Safari Books Online to make more than \$100 million in educational content and tools available at no cost to every school in the U.S.
- AT&T and Sprint are each pledging approximately \$100 million in free mobile Internet connectivity for middle school students' educational devices.
- Verizon has announced up to \$100 million in monetary and in-kind support, including training for teachers on how to best leverage online content to educate the next generations, among others.

The President has also called upon the Federal Communications Commission to fundamentally reform the Schools and Libraries Universal Service Fund program, E-rate. The first phase of this reform was approved by the FCC in July 2014 and injects an additional \$1 billion per year over the next five years to support Wi-Fi connectivity across schools and libraries. This wireless capacity within the school and library premises is essential to support 1:1 devices for each student and education models that expand the possibilities for personalized education. The first phase of the E-rate reform will impact school and library budgets as early as 2015. Further information regarding this reform and implications for Puerto Rico are considered below.



## PUERTO RICO DEPARTMENT OF EDUCATION TECHNOLOGY STRATEGY

The Department of Education of the Commonwealth of Puerto Rico (PRDE) recently released a revised five-year Technology Plan that drastically expands the reach and use of technology across the Island's K-12 system. According to the plan, at present "[v]ery often, only the teacher uses technology, such as a smart board; students do not have regular access to technology for learning. Where student technology access is available, it is often in a traditional "computer lab" setting rather than integrated into the everyday classroom curriculum."<sup>63</sup>

Led by the Department's Chief Information Officer, the plan envisions an ambitious 5-year technology rollout to address the gaps across Puerto Rico public schools and "significantly improve educational outcomes."<sup>64</sup> The PRDE Technology Plan also addresses various reforms necessary to ensure that the new technology achieves its intended goals including curriculum integration, professional development, monitoring and evaluation of results, community and parental involvement, and infrastructure upgrades.

### SCHOOL BROADBAND INFRASTRUCTURE UPGRADES

The PRDE's Technology Plan lays out an ambitious broadband infrastructure upgrade across all schools that will — in most cases — necessitate gigabit fiber connectivity to schools and back-offices in the system. "According to the PRDE Technology Plan, there is a broad consensus that Internet bandwidth is woefully inadequate, not only in the schools, but also in the regional offices, district offices, and even, to a lesser extent, at the department headquarters."<sup>65</sup> To address these deficiencies, key technology rollout goals include:

- Broadband access capacity to the school premise — Increasing from current levels to 10 Mbps per 1,000 students in 2015 and progressively up to 100 Mbps per 1,000 students by 2019.
- Robust wireless access capacity (Wi-Fi) within the school premise — Wi-Fi support to 25% of all classrooms by 2016 and 100% by 2019.
- 1:1 teacher and student educational devices
  - Starting in 2014, plans include pilot projects in which students can bring their own devices (BYOD) to the classroom.
  - By 2015 teachers will have a modern laptop or tablet at a 2:1 ratio (devices to teachers) and students will have use of a wireless device at a 5:1 (devices to students) ratio.
  - By 2016, all teachers will have a laptop.
  - By 2019, all teachers and each student will have access to their own device.



This technology rollout plan is highly ambitious and, if successful, will fundamentally transform Puerto Rico's education system and its technology capacity.

## Top Five Largest School Districts in the United States Based on Pre-K to 12th Public School Enrollment

The Puerto Rico Department of Education is the third largest school district in the United States by public school enrollment in grades Pre-Kindergarten to 12th. One of the most glaring challenges with the Island's school population is that the vast majority of students are eligible for the free/reduced lunch program indicating that households are in a strained economic situation.

The Island also experiences the lowest high school completion rates compared to the other large school districts in the United States. Geographically speaking, the Puerto Rico Department of Education encompasses more square miles than the New York, Los Angeles, Chicago, and Dade County (Miami) school districts combined. Further, the rural population is the highest among all other districts included in the table below.

Rank	School District	Grades Pre-K to 12 Public School Enrollment <sup>102</sup>	Percentage of Students Eligible for Free/Reduced Lunch <sup>103</sup>	Pupil to Teacher Ratio	High School Graduation Rate <sup>104</sup>	Land Area of School District Per Square Mile <sup>105</sup>	Percentage of Population Living in Rural Areas <sup>106</sup>
1	New York City Department of Education	990,145	72.0%	15.9	61.3%	303.4	0.0%
2	Los Angeles Unified School District	659,639	61.7%	22.9	67.9%	640.9	0.1%
3	Puerto Rico Department of Education	437,744	95.1%	13.3	60.2%	3,423.7	6.2%
4	Chicago Public School District	403,004	86.3%	18.3	65.4%	227.1	0.0%
5	Dade County Public School District	350,239	71.9%	16.6	77.2%	1,893.3	0.4%
	United States Totals	48,212,483	45.1%	15.9	79.0%	3,532,292.4	19.3%



The table below provides statistics of broadband connections contracted across approximately 1,380 public schools in Puerto Rico's K-12 system in school years 2013-2014 and 2014-2015. The 2012 Broadband Strategic Plan reported that no school at that time had a broadband connection greater than 1.5 Mbps.<sup>66</sup> Median school broadband capacity in 2013-2014 was 3 Mbps. In line with the 2014-2019 PRDE Technology Plan, school connectivity in the current school year of 2014-2015 is expected to grow significantly.

The minimum planned broadband capacity per school for 2014-2015 is 5 Mbps, with a maximum planned connectivity of 150 Mbps. The median planned school connectivity across Department of Education school regions is 30 Mbps, with the exception of the Bayamón Region which will have median school capacity of 50 Mbps across all schools in the region.

This increased capacity translates into a drastic increase in bandwidth per student planned for the current school year. In 2013-2014, the average number of students per Mbps of capacity ranged from 92 to 112. Plans for 2014-2015 would result on average 6 to 10 students per Mbps of capacity. Once this level of connectivity to the school premises is achieved, plans for expanding wireless signals — or Wi-Fi service within the school premises - to enable 1:1 device educational models would become viable.

Puerto Rico Public School Bandwidth 2013-2014 School Year		
Connected Bandwidth	Number of Schools	% of Schools or Classrooms
T1 (1.55 Mbps)	137	9
DSL (2 Mbps)	275	19
3 Mbps	853	58
5 Mbps	113	8
10 Mbps	90	6

Source: PRDE request for E-rate funding to USAC, Funding Year 2013.



Puerto Rico Public School Bandwidth - 2014-2015 School Year		
Connected Bandwidth	Number of Schools	% of Schools or Classrooms
5 Mbps	4	
10 Mbps	53	4
20 Mbps	605	41
50 Mbps	357	24
100 Mbps	165	11
150 Mbps	1	
Classrooms with Wired Drops		22
Classrooms with Access to Wi-Fi Signal		16

Source: PRDE request for E-rate funding to USAC, Funding Year 2014.

The following table presents data of school broadband connectivity by each of seven education regions used by PRDE for planning purposes. Data for school year 2013-2014 is historical; data for school year 2014-2015 reflects planned connectivity. The table includes summary data of school connectivity for each of these school years and includes the median speed connectivity and average number of students per Mbps contracted in each region.

Puerto Rico Public School Bandwidth by Education Region 2013-2014 and 2014-2015 School Years							
		2013-2014 School Year			2014-2015 School Year		
Education Region	Number of Schools	Number of Students	Median Speed (Mbps)	Average Number of Students per Mbps	Number of Students	Median Speed (Mbps)	Average Number of Students per Mbps
Arecibo	179	58,755	3	109.41	56,965	30	10.61
Bayamón	171	57,945	3	112.95	56,153	50	6.57
Caguas	196	58,904	3	100.18	57,245	30	9.74
Humacao	184	59,363	3	107.54	56,888	30	10.31
Mayaguez	223	61,631	3	92.12	59,754	30	8.93
Ponce	221	65,479	3	98.76	63,102	30	9.52
San Juan	205	61,857	3	100.58	60,843	30	9.89

Source: PRDE.

# BUILDING GIGABIT CAPACITY TO PUERTO RICO'S SCHOOLS



The following table presents data of school broadband connectivity by municipality. Data for school year 2013-2014 is historical; data for school year 2014-2015 is planned connectivity. For each of these school years, the table includes minimum, maximum, average, and median bandwidth across all public schools in each municipality.

Puerto Rico Public School Bandwidth by Municipality 2013-2014 and 2014-2015 School Years										
			2013-2014 School Year Download Speeds (Mbps)				2014-2015 School Year Download Speeds (Mbps)			
Municipality	School Region	Number of Schools	Min	Max	Mean	Median	Min	Max	Mean	Median
Adjuntas	Ponce	10	1.5	10	2.95	2.25	30	100	46.00	30
Aguada	Mayaguez	20	1.5	10	3.53	3	30	100	48.00	30
Aguadilla	Mayaguez	22	3	10	3.41	3	30	100	41.82	30
Aguas Buenas	Caguas	12	1.5	10	3.71	3	30	100	45.00	30
Aibonito	Caguas	13	3	10	4.62	3	5	100	48.08	50
Anasco	Mayaguez	12	1.5	10	3.96	3	30	100	44.17	40
Arecibo	Arecibo	36	1.5	10	3.40	3	5	150	46.43	40
Arroyo	Caguas	10	3	10	3.70	3	30	100	43.00	30
Barceloneta	Arecibo	9	1.5	10	3.67	3	30	100	55.56	30
Barranquitas	Caguas	16	1.5	5	3.28	3	30	100	48.13	30
Bayamon	Bayamon	61	1.5	10	3.26	3	10	100	44.92	50
Cabo Rojo	Mayaguez	16	1.5	10	3.91	3	10	100	49.38	50
Caguas	Caguas	49	1.5	10	3.27	3	10	100	43.13	30
Camuy	Arecibo	13	1.5	10	3.96	3	30	100	52.31	50
Canovanas	Humacao	15	1.5	5	3.30	3	30	100	41.33	30
Carolina	San Juan	42	1.5	10	3.18	3	30	100	52.86	50
Catano	Bayamon	11	1.5	10	3.68	3	30	100	45.45	50
Cayey	Caguas	22	3	5	3.18	3	10	100	47.27	30
Ceiba	Humacao	5	1.5	10	4.10	3	30	100	48.00	30
Ciales	Arecibo	11	1.5	10	3.59	3	10	100	44.55	30
Cidra	Caguas	13	1.5	10	3.58	3	30	100	64.62	50
Coamo	Ponce	18	1.5	10	3.86	3	10	100	44.44	40
Comerio	Caguas	13	3	10	4.00	3	10	50	33.08	30
Corozal	Bayamon	14	3	5	3.14	3	10	100	50.71	50
Culebra	Humacao	1	10	10	10.00	10	10	10	10.00	10
Dorado	Arecibo	12	3	10	4.33	3	30	100	44.17	40
Fajardo	Humacao	11	3	10	4.27	3	30	100	61.82	30
Florida	Arecibo	5	3	10	4.40	3	30	100	56.00	50
Guanica	Ponce	10	1.5	5	2.90	3	30	100	39.00	30
Guayama	Caguas	19	1.5	10	3.24	3	30	100	53.68	50
Guayanilla	Ponce	9	1.5	10	3.61	3	10	100	51.11	30





Puerto Rico Public School Bandwidth by Municipality 2013-2014 and 2014-2015 School Years										
			2013-2014 School Year Download Speeds (Mbps)				2014-2015 School Year Download Speeds (Mbps)			
Municipality	School Region	Number of Schools	Min	Max	Mean	Median	Min	Max	Mean	Median
Guaynabo	San Juan	20	3	10	3.75	3	30	100	44.00	30
Gurabo	Caguas	10	1.5	3	2.85	3	30	100	54.00	50
Hatillo	Arecibo	14	1.5	10	3.39	3	30	100	43.57	40
Hormigueros	Mayaguez	6	3	10	4.17	3	30	100	60.00	50
Humacao	Humacao	26	1.5	10	3.10	3	10	100	44.23	30
Isabela	Mayaguez	19	1.5	10	3.21	3	10	100	46.32	30
Jayuya	Ponce	11	3	10	3.64	3	30	100	41.82	30
Juana Diaz	Ponce	20	1.5	10	3.38	3	10	100	50.00	50
Juncos	Humacao	13	3	10	3.54	3	30	100	56.92	50
Lajas	Mayaguez	11	3	10	5.18	5	10	100	46.36	30
Lares	Arecibo	15	1.5	10	3.53	3	30	100	43.33	30
Las Marias	Mayaguez	7	3	10	4.00	3	30	50	32.86	30
Las Piedras	Humacao	11	3	10	4.45	3	30	100	60.91	50
Loiza	Humacao	11	1.5	10	4.50	3	30	100	43.64	30
Luquillo	Humacao	8	1.5	10	3.50	3	30	100	52.50	40
Manati	Arecibo	20	1.5	10	3.13	3	30	100	48.00	30
Maricao	Mayaguez	6	3	10	4.17	3	10	30	26.67	30
Maunabo	Humacao	6	3	10	5.17	5	30	50	36.67	30
Mayaguez	Mayaguez	33	1.5	10	3.23	3	10	100	36.97	30
Moca	Mayaguez	17	1.5	10	3.29	3	10	100	40.59	30
Morovis	Bayamon	15	1.5	10	3.30	3	30	100	52.00	50
Naguabo	Humacao	11	1.5	10	3.36	3	30	50	39.09	30
Naranjito	Bayamon	15	3	10	4.07	3	30	100	47.33	50
Orocovis	Bayamon	16	1.5	10	3.41	3	10	100	35.63	30
Patillas	Humacao	10	1.5	10	3.40	3	10	100	41.00	30
Penuelas	Ponce	13	1.5	10	3.42	3	30	100	43.08	30
Ponce	Ponce	67	1.5	10	3.10	3	10	100	50.00	50
Quebradillas	Arecibo	10	1.5	10	3.60	3	30	100	62.00	50
Rincon	Mayaguez	7	3	10	4.00	3	30	50	38.57	30
Rio Grande	Humacao	15	3	10	3.60	3	10	100	50.67	50
Sabana Grande	Mayaguez	10	1.5	10	3.75	3	30	100	53.00	30
Salinas	Caguas	19	1.5	10	3.39	3	10	100	36.84	30
San German	Mayaguez	15	1.5	10	3.37	3	10	100	37.33	30
San Juan	San Juan	126	1.5	10	3.31	3	5	100	40.32	30
San Lorenzo	Humacao	14	1.5	10	3.82	3	30	100	54.29	40
San Sebastian	Mayaguez	22	1.5	10	3.07	3	10	100	47.27	30



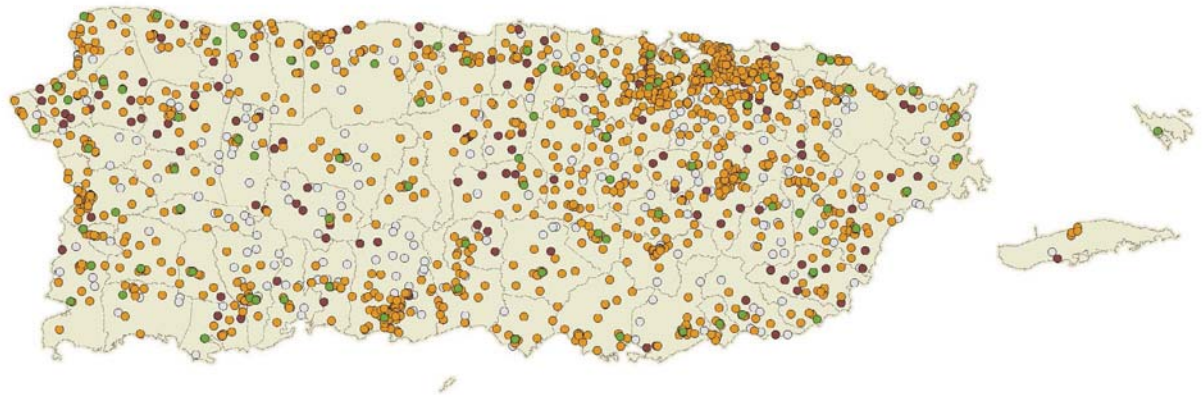
Puerto Rico Public School Bandwidth by Municipality 2013-2014 and 2014-2015 School Years										
			2013-2014 School Year Download Speeds (Mbps)				2014-2015 School Year Download Speeds (Mbps)			
Municipality	School Region	Number of Schools	Min	Max	Mean	Median	Min	Max	Mean	Median
Santa Isabel	Ponce	10	3	10	3.90	3	10	100	44.00	30
Toa Alta	Bayamon	16	1.5	10	3.47	3	30	100	53.75	50
Toa Baja	Bayamon	23	3	10	3.65	3	30	100	51.30	50
Trujillo Alto	San Juan	17	1.5	10	3.44	3	30	100	40.00	30
Utuado	Ponce	16	1.5	10	3.25	3	10	100	48.75	30
Vega Alta	Arecibo	12	3	10	4.33	3	30	100	61.67	50
Vega Baja	Arecibo	22	1.5	10	3.61	3	10	100	51.82	30
Vieques	Humacao	7	1.5	10	3.79	3	10	50	27.14	30
Villalba	Ponce	15	1.5	10	3.43	3	10	100	49.33	50
Yabucoa	Humacao	20	1.5	10	2.90	3	10	100	39.00	30
<i>Yauco</i>	<i>Ponce</i>	<i>22</i>	<i>3</i>	<i>10</i>	<i>4.27</i>	<i>3</i>	<i>10</i>	<i>100</i>	<i>38.18</i>	<i>30</i>

Source: PRDE.

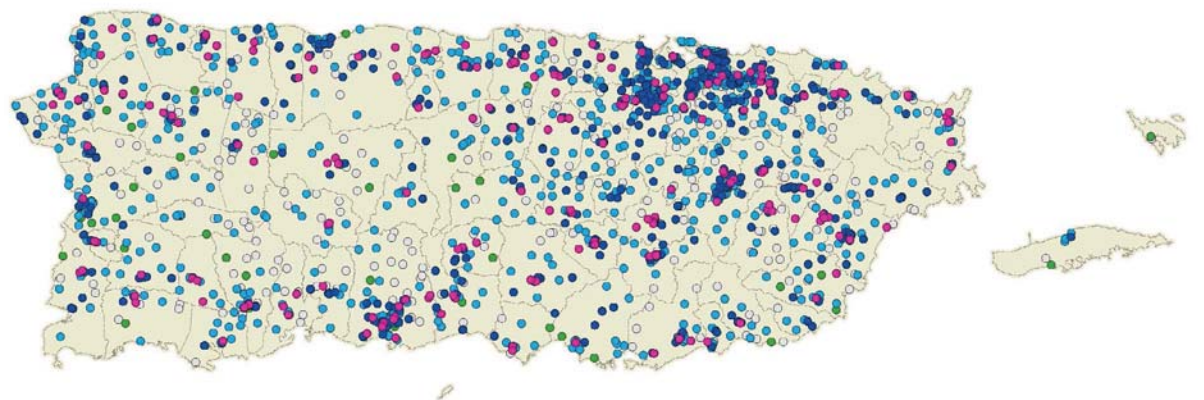


The following maps depict all public schools in Puerto Rico classified by contracted or planned broadband connectivity for each school. In line with the above data, the two maps show a marked increase in planned school connectivity in school year 2014-2015 relative to the connectivity available in year 2013-2014.

## Puerto Rico Public Schools - Contracted Bandwidth, 2013-2014 School Year



## Puerto Rico Public Schools - Contracted Bandwidth, 2014-2015 School Year



### Symbology

- Download speed of at least 100 Mbps
- Download speed of at least 50 Mbps
- Download speed of at least 30 Mbps
- Download speed of at least 10 Mbps
- Download speed of at least 3 Mbps
- Download speed of at least 768 Kbps
- Unknown download speed
- Municipality Boundary



Meeting the K-12 system's connectivity demands will require additional broadband capacity build-out. The investment and timeframe to accomplish this will be significant and require collaboration between multiple parties.

In order for the technology to fully impact student academic achievement and empower teachers, multiple transformative processes will need to occur simultaneously. Online content will need to be developed, teachers will need training, parents and communities will have to ensure off-campus access, and best practices must be developed to safeguard the security and privacy of every student. Bottom line, while robust broadband pipes serving Puerto Rico schools and wireless connectivity within those schools are necessary conditions for the success of this Plan, they alone are insufficient.

As the Department of Education has rightfully recognized, all of the components addressed in the PRDE Technology Plan are essential to better prepare Puerto Rico public school students to compete in the twenty-first century. For this reason, it is imperative that each of these aspects are re-assessed and revised on an ongoing basis. Likewise, a key recommendation from the 2012 Puerto Rico Broadband Strategic Plan is now even more important than before — it is imperative to promote collaboration across private and public stakeholders, both local and Island-wide.<sup>67</sup> Publicly elected officials and the Department of Education will need to lead and collaborate with private and public broadband stakeholders, including the Telecommunications Regulatory Board, Puerto Rico Office of the CIO, and Puerto Rico Broadband Taskforce for successful implementation of these plans. These stakeholders should collaborate with the PRDE's Evaluation Committee in its annual assessment of the Technology Plan's goals and progress. Support could include:

- Conducting an independent annual inventory of fiber optic availability to public and private schools across Puerto Rico. Such inventory should be reflected in publicly available, easy-to-use maps.
- Conducting an independent annual inventory of the broadband capacity contracted across Puerto Rico schools, including capacity to the premise and wireless capacity per student and staff at each institution.



### THE COST OF REVAMPING TECHNOLOGY ACROSS THE K-12 PRDE SYSTEM

Budget estimates for the PRDE technology rollout through 2019 build upon past PRDE data and assume the continuation of historical E-rate rules. The recent FCC reform of the E-rate program, described further in the following section, directly impacts these estimates, and they will need to be revised. Notwithstanding these adjustments, the PRDE budget estimates provide a benchmark for understanding the cost of these plans.

The PRDE Technology Plan estimates the total technology-related expenses over the 5-year rollout period to be \$236.5 million or just over \$573 per student user in the system.<sup>68</sup> The PRDE Technology Plan estimates E-rate contribution to this 5-year budget to be \$125,259,749, which is projected to be complemented with \$111,294,094 in funding provided from other sources. The majority of this match, over \$97 million, of the non-E-rate supported budget would fund the purchase of teacher and student devices.<sup>69</sup>

On a per student basis, these PRDE estimates are consistent with cost estimates of a robust 1:1 educational program in other jurisdictions. For example, the FCC estimates \$150 per student over a 5-year period to support robust Wi-Fi connectivity within the school premise,<sup>70</sup> coming in lower, but not too far off the PRDE 5-year estimate costs for Wi-Fi connectivity of \$179 per student.

Similarly, recent estimates from the Nevada Department of Education and the Nevada Commission on Educational Technology assume a cost of \$610 “per seat” to cover the costs of internal infrastructure (Wi-Fi), devices, classroom management software, professional development, and state leadership necessary to coordinate these efforts.<sup>71</sup> This estimate excludes the cost of providing broadband access and telecommunications service to the school premise. By contrast, the PRDE estimates a 5-year cost of \$428 per student for devices and internal connections — an estimate that does not consider the cost of professional development.

However, these estimates may be conservative when factoring in the unique complexities facing the PRDE relative to other school districts in the U.S. As noted in this chapter, the geographic scope and topography of the schools managed by the PRDE implies more complex network rollout plans than those needed for other school districts in large metropolitan areas. Further, because current broadband access across PRDE schools is lagging behind many comparable systems, the PRDE’s gigabit gap is significantly greater and closing it will require more financial resources.

PRDE estimates a technology rollout budget of \$236.5 million over five years. The E-rate contribution to this 5-year budget is estimated at \$125 million to be complemented with \$111 million in funding to be provided by other sources.

The aggressive PRDE technology rollout will be expensive and need support from both federal and local funding sources. It is imperative that Puerto Rico’s publicly elected officials acknowledge the need for financial investment and work with the Department of Education to ensure adequate funding is available to support this critical technology investment.



## RE-EVALUATE PRDE'S IP STRUCTURE IN ORDER TO ENCOURAGE MORE COMPETITION IN BROADBAND PROCUREMENT

PRDE currently operates an integrated WAN solution that links each school to both the Internet and each other through a hub and spoke approach that utilizes one centralized network – the PRDE Data Center.<sup>72</sup> This IP structure choice has historically led to PRDE partnering with just one broadband provider who offers broadband service to the Department throughout the entire Island. Consistently, the winner of this all or nothing PRDE broadband procurement process has been the telecommunications incumbent carrier Puerto Rico Telephone Company, or Claro.

This centralized IP design could imply that smaller, possibly local and regional providers offering robust and cost effective service may be effectively barred from competing for the contract because, unlike Claro, they lack the ability to make an Island-wide offer. As a result, this centralized IP topography may be hampering – instead of encouraging – competitive bids to support the Department's broadband needs. Further, such a centralized IP network injects rigidity into the technology design, which could delay and increase costs for the PRDE Technology Plan phased rollout.

The PRDE acknowledges these potential constraints and calls for an evaluation of alternate options, such as “[r]edesigning the network to include intermediate aggregation points, which in turn aggregate into the PRDE Data Center.”<sup>73</sup> This assessment of current PRDE IP topography is critical as the Department plans its ambitious technology rollout over the coming 5 years.

Public and private broadband stakeholders, including the Telecommunications Regulatory Board, Puerto Rico Office of the CIO, and Puerto Rico Broadband Taskforce, should work with the PRDE to evaluate its IP topography structure and assess whether a less centralized and more regional approach can result in more competition in broadband procurement that helps rein in the costs of meeting the new, ambitious PRDE broadband targets.

## E-RATE MODERNIZATION - IMPLICATIONS FOR PUERTO RICO

The Schools and Libraries Program, or E-rate, is one of four Universal Service Fund programs managed by the FCC and the largest educational technology program in the U.S.<sup>74</sup> E-rate aims to provide support for telecommunications and broadband service to private and public schools and libraries across the nation. Since its inception, E-rate has provided up to \$2.4 billion in annual subsidies to over 100,000 schools and over 10,000 libraries across all U.S. states and territories. A total of \$240 million E-rate subsidies were disbursed in Puerto Rico between 1998 and 2013. In 2012, over \$15 million in E-rate funds were disbursed to Puerto Rico eligible entities, and over \$23 million in 2013. In short, E-rate represents an important funding source for Puerto Rico schools and libraries.<sup>75</sup>

On July 23, 2014 and December 19, 2014, the FCC released two E-rate Modernization Orders marking the most significant reform to the E-rate program since its inception



in 1997.<sup>76,77</sup> The E-rate modernization process had commenced a year prior following President Obama's announcement of the ConnectED initiative that aims to accelerate deployment of education technology across the nation, and of which reform to the E-rate program is a key component.

The first E-rate Modernization Order is an important step in refocusing the program on broadband capacity, particularly by providing immediate, substantial support for on-campus wireless networks within schools and libraries. The Order provides for up to \$2 billion in funding over the next two years to on-campus wireless networks that will, in particular, help schools deploy 1:1 device learning models and enhance public wireless Internet access at libraries. The FCC has budgeted \$5 billion for this fund over the next five years; this effectively increases available funding under E-rate by an additional \$1 billion over the next five years. These funds will be allocated to schools and libraries based on a per-student and per-square foot formula, respectively. The goal for these funds is to bridge the "Wi-Fi gap" that, according to the FCC, is present in at least three out of five schools.

The Order also marks a key milestone in the Commission's efforts to revamp and reorient all four of its universal service subsidy programs away from legacy services and toward broadband services. In particular, the E-rate Modernization Order phases out support for legacy services such as dialtone voice service. The Order also streamlines the application process and makes better, more transparent data on the E-rate program available.

E-rate Discount Rates Applicable to PRDE					
	School Year starting in				
	2015	2016	2017	2018	2019
Telecommunications Service	70%	50%	30%	10%	0%
Broadband Access To School Premise	90%	90%	90%	90%	90%
Equipment and Maintenance of Wireless LAN Capacity	85% Capped at \$30 per student per year				
Teacher or Student Devices	0%	0%	0%	0%	0%
Fiber build-out to schools	90% 95% if the Government of Puerto Rico finances the remaining 5%				

E-rate subsidies are based on a percentage discount (or reimbursement) over retail prices paid by the school or library for telecommunications and broadband services, both broadband to the facility's premise and wireless broadband service within the premise. Schools and libraries are offered different discount rates based on income metrics of the population they serve, as well as whether the institutions are located in areas designated as rural. Due to the relatively high poverty levels across Puerto Rico, all of the schools managed by the Department of Education of Puerto Rico qualify for the highest discount rates. For 2015, these rates include a 90% discount off of retail prices





on broadband services to all schools in the system, an 85% discount for services and equipment supporting Wi-Fi connectivity within the school premise, and a 70% discount for legacy services such as traditional dial-up or mobile services. Under the FCC's Order, the PRDE discount rate for legacy services will decrease annually as reflected in the discount rate table below.

Subsidies for eligible telecommunications and broadband services are not capped at either the applicant level or the specific school recipient level. If funding requests by all eligible entities surpasses the E-rate annual cap, funding priority is given to those entities with the greatest need, or highest discount rates. This rule implies that PRDE and other eligible entities across Puerto Rico have historically had priority access to scarce E-rate funds.

Budgets for broadband and telecommunications service and the portion that would be financed via E-rate are projected in the PRDE Technology Plan. Funds available to support Wi-Fi connectivity are capped for each school based on the number of students enrolled. Each school's budget eligible for Wi-Fi E-rate support is capped at \$150 per student over a five-year period. For PRDE schools, 85% of this budget, or \$127.50 per student, would be funded via E-rate. Based on PRDE 2014 student enrollment numbers of approximately 412,000 students, this implies an E-rate eligible Wi-Fi budget of approximately \$62 million over five years. Of this, approximately \$52.6 million (or 85%) would be funded via E-rate. The remainder, or \$9.3 million, would need to be financed through other sources. In short, these additional funds offer a significant opportunity for PRDE. Successful application for E-rate funds will mark a critical step to help meet the very ambitious broadband goals set by PRDE in its Technology Plan. Broadband stakeholders should support PRDE as it makes plans to leverage this opportunity and ensures an efficient rollout of broadband resources to all PRDE schools throughout the ensuing five years.

The second E-rate Modernization Order establishes a permanent and significant expansion in E-rate funds. The Order raises the program's annual cap from \$2.4 billion to \$3.9 billion starting in 2015. The Order further aims to support expansion of fiber connectivity to schools and libraries where it is lacking. To do so, it streamlines the rules to request funding for one-time capital investment projects to bring fiber access to schools and libraries lacking the infrastructure. These additional resources signify an important opportunity for PRDE and other private and public eligible entities across Puerto Rico.

The second Order also incentivizes states to help finance these infrastructure projects by creating a matching mechanism that will expand the amount of E-rate subsidies to support these construction projects where states and territories are willing to inject local funds. For Puerto Rico, these new rules could imply an increase in the effective E-rate subsidy rate from 90 to 95 percent, significantly reducing PRDE's matching needs to fund fiber construction projects to unserved schools.





E-rate Modernization changes will impact E-rate funding starting in school year 2015-2016. It is unclear at this stage the full impact of the program changes on school and library available funding via E-rate and, ultimately, its impact on school and library technology choices. However, the impact of this federal funding opportunity will certainly be significant for the institutions eligible for the funding and the communities they serve. It is therefore important for public and private broadband stakeholders to monitor future E-rate developments and work with PRDE and other schools and libraries to ensure that all Puerto Rico eligible entities will be prepared to fully leverage this opportunity.



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## E-STRATEGIES TO BRING GIGABIT CAPACITY TO PUERTO RICO SCHOOLS

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### SUMMARY RECOMMENDATIONS

Advances in education technology are transforming schools across the nation and the world. To ensure that Puerto Rico students can benefit from this transformative innovation, it is imperative that schools have access to ultra-high-speed broadband, both at the school premise and wirelessly within the school. The Puerto Rico Department of Education and other stakeholders are working to meet this challenge and offer strategic recommendations to help bring Gigabit capacity to all Puerto Rico students. This chapter addresses these developments and offers strategic recommendations to help bring Gigabit capacity to all Puerto Rico students.

#### Key Recommendations:

- The Telecommunications Regulatory Board, Puerto Rico Office of the CIO, and Puerto Rico Broadband Taskforce should collaborate with Puerto Rico's Department of Education to support its annual assessment of the Technology Plan's goals and progress. Support could include:
  - Conducting an independent annual inventory of fiber optic availability to public and private schools across Puerto Rico. Such inventory should be reflected in publicly available, easy-to-use maps.
  - Conducting an independent annual inventory of the broadband capacity contracted across Puerto Rico schools, including capacity to the premise and wireless capacity per student and staff at each institution.
- Puerto Rico should support the financial needs of the Department of Education to ensure adequate funding to meet its broadband expansion plans.
- Broadband stakeholders, including the Telecommunications Board, the CIO's office and the Puerto Rico Broadband Taskforce should support the PRDE and other eligible entities to ensure they effectively leverage E-rate and other federal funding opportunities.
- Public and private broadband stakeholders, including the Telecommunications Regulatory Board, Puerto Rico Office of the CIO, and Puerto Rico Broadband Taskforce, should work with the PRDE to evaluate its IP topography structure and assess whether a less centralized and more regional approach can result in a more efficient competitive offering that helps rein in the cost of meeting the new, ambitious PRDE broadband targets.



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