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PRIVATE NETWORKS FOR EDUCATION – COST-EFFECTIVE, LONG-TERM SOLUTION TO BRIDGE THE DIGITAL DIVIDE

How small cells, FWA CPEs, mobile hotspots, and connected laptops come together to bring connectivity to students in need

Sponsered By

Qualcomm

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Executive Summary

In today's hyper-connected world, online learning is an integral part of the curriculum, whether augmenting in-person classes or fully remote education. However, the *Digital Divide* experienced by some students is a significant hurdle in getting a well-rounded, holistic education. The COVID-19 pandemic and subsequent hybrid learning environments illuminated connectivity's vital role in education. According to a 2021 report from Boston Consulting Group, 12 million K-12 students in the United States had no internet connectivity at home. Financial relief made available through government grants coupled with technological advancements, like 5G, are helping society to overcome this challenge.

Students lacking connectivity don't typically have access to cable, DSL, or Fiber. While utilizing public cellular networks can often be a quick fix, Private Networks are proving to be a cost-effective, long-term solution. Technological advances in cellular networks and the recent strong traction of Fixed Wireless Access (FWA) are enabling schools to build and operate their own Private Networks in a simple and rapid fashion. These networks provide expansive coverage to many homes of students within school districts. Further, in-home Wi-Fi connectivity via mobile hotspots (aka Mi-Fi) and FWA terminals allows students to connect their laptops, Chromebooks, tablets, and other devices to continue learning and complete coursework from home.

In economically challenged areas where public cellular carriers may not have adequate coverage, School Private Networks are proving to be a potent option. Kajeet, a leader in education technology, has successfully deployed such networks in more than 40 US school districts and has shown that their Total Cost of Ownership (TCO) can be up to seven times lower than other options like utilizing data plans offered by public mobile service providers. These networks are built using small cells deployed on top of school buildings to provide coverage to the communities around schools where most students live. This way, students benefit from excellent connectivity at school and home.

The high-capacity connectivity provided by School Private Networks not only addresses students' needs but can also help solve the connectivity challenges of the larger society, especially in weaker economic locales. For example, the whole household can use the students' home internet connection to access financial, health, and other online services. The local, state, and Federal governments can assist school districts financially to ease the burden.

School Private Networks today primarily utilize 4G for wide area coverage and Wi-Fi 5/6 for in-home connectivity. 5G and Wi-Fi 7 with gigabit speeds, lower latency, and high capacity can continue this complementary role and further improve performance and reliability while enabling advanced education tools. These technologies also enable emerging applications, such as eXtended Reality (XR), that have proven highly effective in education. Essentially, 5G and Wi-Fi 7 are even more powerful and futureproof technologies for Private Networks.

In summary, School Private Networks powered by small cells and various devices come together to create a cost-effective, holistic, long-term option for closing the Digital Divide in education while enabling services to support society at large.

Digital Divide severely affects school children

In 2021, there were an estimated 13,800 public school districts in the United States, educating about 50 million students. According to a recent report, more than one-third of those districts had schools in communities classified as extremely poor. Typically, students from economically disadvantaged communities have lower levels of achievement than their peers. This gap has not narrowed in the past 50 years. It may even widen when learning is online or hybrid and requires advanced technologies.

The vulnerability of underprivileged school districts and students became more apparent during the COVID-19 pandemic when schooling moved online. Suddenly, millions of students without access to a computer or home internet connection saw their education come to a screeching halt.

In 2020, according to the US Census Bureau, among children ages 3-18, 17% lived in households without a laptop or desktop computer, and at least 11 million students didn't have a computer for online learning. Similarly, according to the National Center for Education Statistics (NCES), 14% of children ages 3-18 didn't have internet access at home, and more than 9 million schoolchildren faced difficulty completing assignments online.

As shown in Fig. 1, access to computers and the internet is a more significant challenge for economically challenged students and those from Native American, Black, and other disadvantaged communities. School Private Networks could be an excellent solution for these students, as we explain in future chapters.

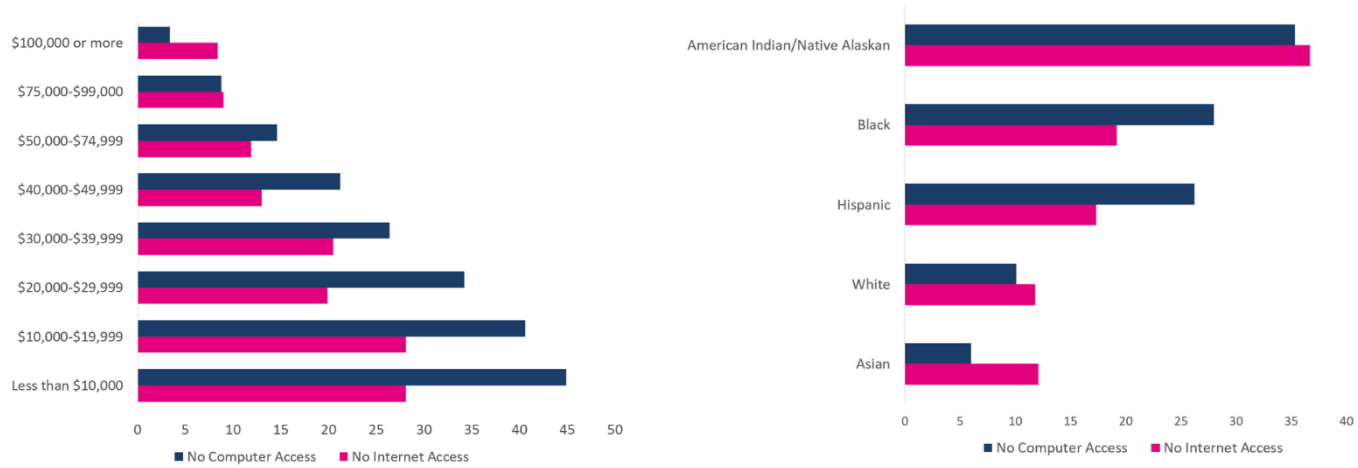

Fig. 1 – Student computer and Internet access based on income and ethnicity, Source: www.usafacts.org

Education is becoming a hybrid between in-person and online learning

While most schools have returned to in-person, the benefits of online instruction, such as the flexibility to learn at your own pace, are not lost on either students or educators. The resilience of teaching and learning outside the confines of the classroom has fueled continued interest in hybrid education, combining traditional in-person instruction with online learning. For example, recent data

from a sample of 10 states (Arkansas, Florida, Iowa, Massachusetts, Michigan, Minnesota, North Carolina, Oregon, Wisconsin, and Wyoming) revealed that enrollment in remote schools rose on average to 170% of pre-pandemic levels in 2020-21, due to the need for students to stay home. It further increased to 176% in 2021-22 even as in-person schools reopened and mask mandates fell.

The online option allows students to continue learning when they return home from school. They can review their coursework for clarity and deeper understanding at their own pace. In scenarios where students and teachers are on a shared online learning platform, they can communicate in real-time for quick resolution of questions and collaborate on group tasks and projects just as they would in person.

Advanced tools like Augmented/Virtual/Mixed/eXtended Reality (AR/VR/MR/XR) further enrich the learning experience for students. There is significant research to illustrate that students have much higher information retention when receiving instruction through such interactive visual tools. These tools require high-capacity, low-latency connectivity, which 5G can provide. These may prove even more helpful in economically challenged areas where there is a shortage of good teachers. Some technologies are not yet cost-effective enough to be provided widely in schools. However, the cost curves are falling rapidly. There are also opportunities for private companies and businesses to offer such technologies to students as part of their community outreach.

Funding to improve student connectivity

In response to the remote learning challenges posed by COVID-19, Federal and state governments responded rapidly with various measures to address the situation, including allocating substantial funding and programs to improve connectivity infrastructure. The CARES Act enacted in response to COVID-19 distributed $30.75 billion to the US Department of Education to support technological capacity and access – including hardware and software, connectivity, and instructional expertise – to support remote learning. The E-Rate Program, governed by the FCC, provided discounts to assist most schools and libraries in the US to obtain affordable telecommunications equipment and internet access. E-Rate includes support in the form of discounts for telecommunications products and services – schools receive discounts of 20%-90% compared to regular fees, depending on the poverty level and the urban/rural status of the population the school serves.

State governments created programs to support remote learning as well. For example, The California Department of Education (CDE) works with multiple entities and non-profit organizations to get broadband connectivity to California schools. Similarly, the California K-12 High-Speed Network (K12HSN) provides high-speed Internet access to California schools, and the Corporation for Education Network Initiatives in California (CENIC) provides high-speed Internet access to California County Offices of Education, districts, and schools.

There are many other ongoing Federal and state programs. Suffice it to say that several funding sources are available for schools to improve their institution's and students' connectivity.

School Private Networks offer a cost-effective, long-term solution

Providing sufficient funding is just the beginning of addressing the Digital Divide facing students. Equally important is ensuring funds are utilized most efficiently to provide practical, long-term, and substantial remedies to the challenge. The quickest solution during COVID-19 was to use the funds to purchase discounted mobile broadband subscription plans and devices from public cellular providers. This provided immediate relief to many students and alleviated the issue.

This remains the go-to solution for many schools. However, there are some inherent and unavoidable shortcomings. First, many economically challenged regions may not have adequate coverage from public operators. As mentioned earlier, such locales may not have robust fixed connectivity or coverage from public mobile networks.

Similarly, discounted data subscriptions can serve as a simple and quick fix, but they do not address the root cause or provide a long-term sustainable solution. For example, some funding for discounted data subscriptions and devices provided during Covid-19 is expiring soon. If funding is reduced or stopped, it is nearly impossible to maintain services and programs for students who need them most. Additionally, there are often limits on how much data can be used on these plans, and their rates might change without notice, making it hard to make long-term budget forecasts.

A more sustainable, long-term solution is to utilize the funds to deploy a Private Network. Private Networks can utilize existing school district buildings, power supply, and, in many cases, fiber connectivity to provide cellular coverage around the school where students live. Since these networks have a very long life, they provide long-term predictability and service assurance.

School Private Networks are not just a theoretical idea. Kajeet, a leading educational technology and service provider, has successfully deployed networks in over 40 school districts spanning 10 states, proving that this model works.

How to build School Private Networks

For many people who only know about public cellular networks, deploying and managing private cellular networks might seem like a massive and costly undertaking, requiring lots of technical expertise. However, the continuous evolution in small cell technology, such as self-optimizing and managing features, simplified interoperability between multiple vendors, optimized size, power, cost, scalability, etc., have made their deployment "plug-and-play" and very efficient. Core Networks have also been miniaturized and simplified, further streamlining the deployment of Private Networks.

Building a Private Network can be divided into four main parts: 1) Deciding or acquiring spectrum; 2) Developing a solid network design; 3) Buying and deploying the equipment; 4) Managing subscriptions and ongoing maintenance. Let's look at each of them more closely.

Spectrum – Spectrum used to be the most challenging aspect of cellular networks, but no more. The availability of CBRS spectrum has made it a default option for Private Networks in the USA. CBRS is a shared spectrum band typically available for free in most parts of the country. Many school

districts could also be eligible for special spectrum allocations from the FCC for educational purposes. Outside the USA, countries like Germany have allocated dedicated spectrum for Private Networks. There is also a global push for more shared and unlicensed spectrum.

Network Design - Solid, well-thought-out network design is essential for a good deployment. The design should consider and address the needs of students, especially coverage and capacity requirements. It should also have provision for future growth to support new technologies like AR/VR/MR/XR when they become available. Any school district usually consists of many elementary schools, a few middle schools, and a couple of high schools. Typically, students live around these schools. In such a case, rooftops of these school buildings become natural sites for small cell deployment, with readily available fiber for backhaul, power, and other utilities. Most importantly, this type of small cell deployment doesn't require additional zoning, building permits, etc.

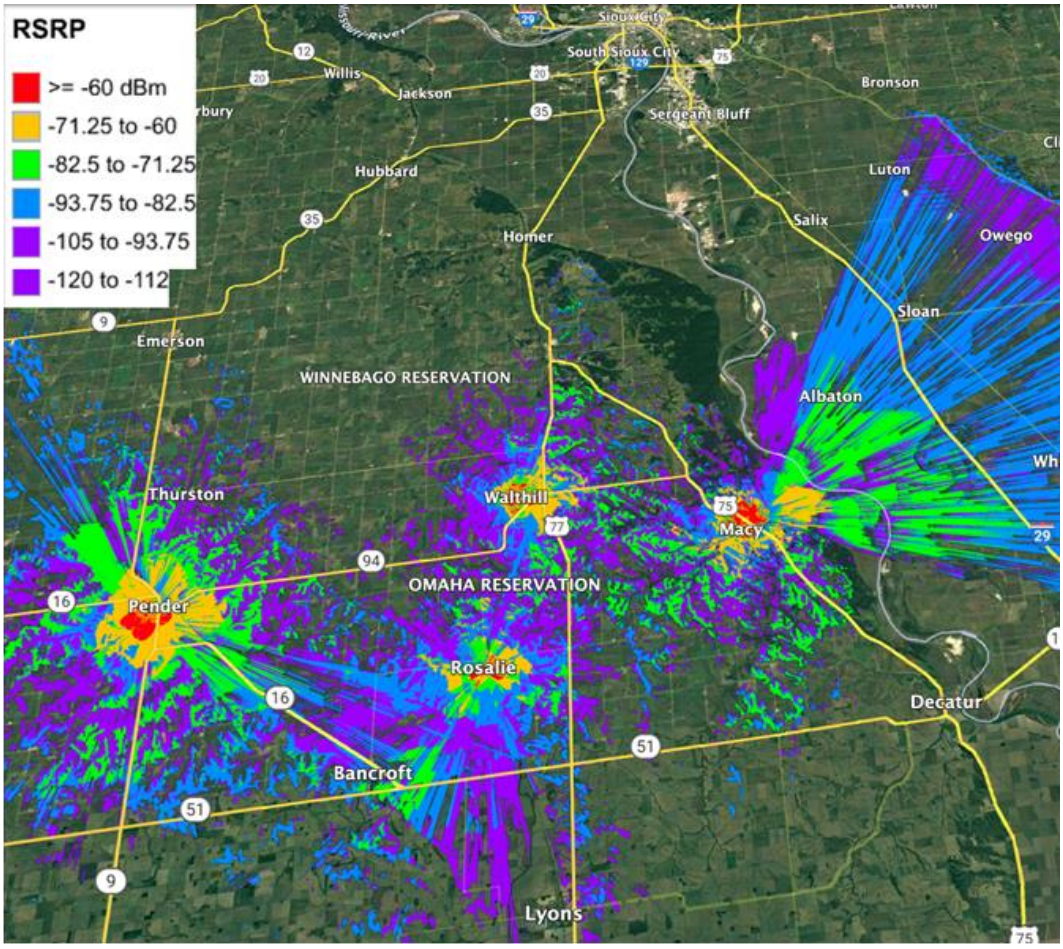

Fig. 2 – Coverage of a typical School Private Network

Network Equipment and Deployment - The Private Network equipment mainly consists of small cells, antennas, Core Network software and hardware, cabling, etc. The most crucial part of equipment selection is choosing suitable equipment to meet the coverage, capacity, and performance needs. With this in mind, Kajeet has sourced small cells from multiple vendors. It has used its own custom-built Core Network software in its deployments.

Fig. 3 – Small Cell deployments on rooftops of school district buildings

Management System - The subscriber provisioning and ongoing management system is one of the key parts of the Private Network, as it is the interface between the staff and the network. It is used to configure, activate/deactivate subscriptions, set policies for using the network, allow or block content, troubleshoot, etc. The chosen system should be easy and user-friendly so that routine tasks can be performed by school IT staff or others who may not have deep knowledge about cellular systems.

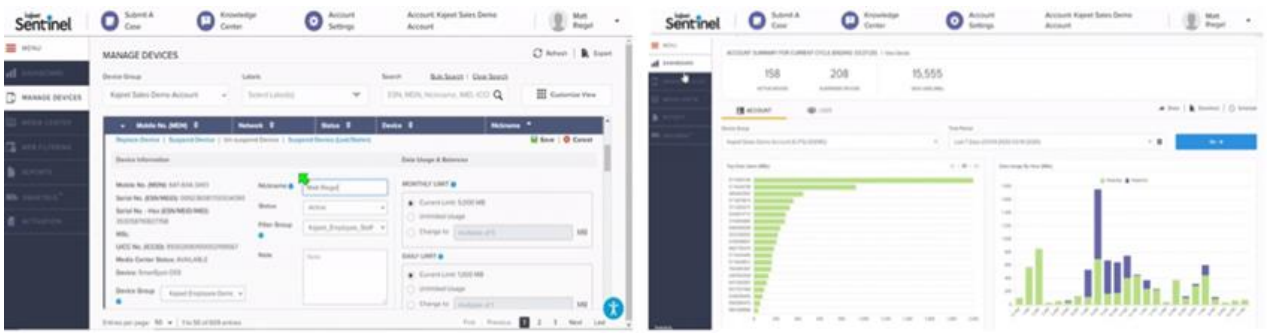

Fig. 4 – Sentinel - Kajeet's subscriber management system

Devices that all make it possible.

It's not just the Network; various end-point devices also play a crucial role in closing the Digital Divide for students. Devices with cellular connectivity, such as smartphones and connected laptops, could connect directly to the cellular network. All other devices connect through in-home Wi-Fi. This could be through mobile hotspots or FWA CPEs (Consumer Premise Equipment). Both connect to the cellular network on one side and user devices using Wi-Fi on the other. Hence, the Wi-Fi performance of these devices is extremely crucial. So that there is good Wi-Fi coverage in homes, many user devices can simultaneously connect to the network without degrading performance, etc. This allows other people in the student's home, such as siblings and adults, to utilize student connectivity for other school-permitted uses.

Using mobile hotspots or FWA CPEs largely depends on the use case. Mobile hotspots are a great option as an efficient and easily scalable approach for providing in-home Wi-Fi connectivity. On the other hand, FWA CPEs are excellent in extending the range of the cellular Private Network, as they can be mounted outdoors or connected to outdoor antennas. They ensure more homes, including the ones further away from the school buildings or in hard-to-reach areas, get adequate coverage. Many existing School Private Networks typically support 4G but are quickly upgrading to 5G. Most

new networks will support 5G. Similarly, most devices support Wi-Fi 5/6/e and will soon support Wi-Fi 7.

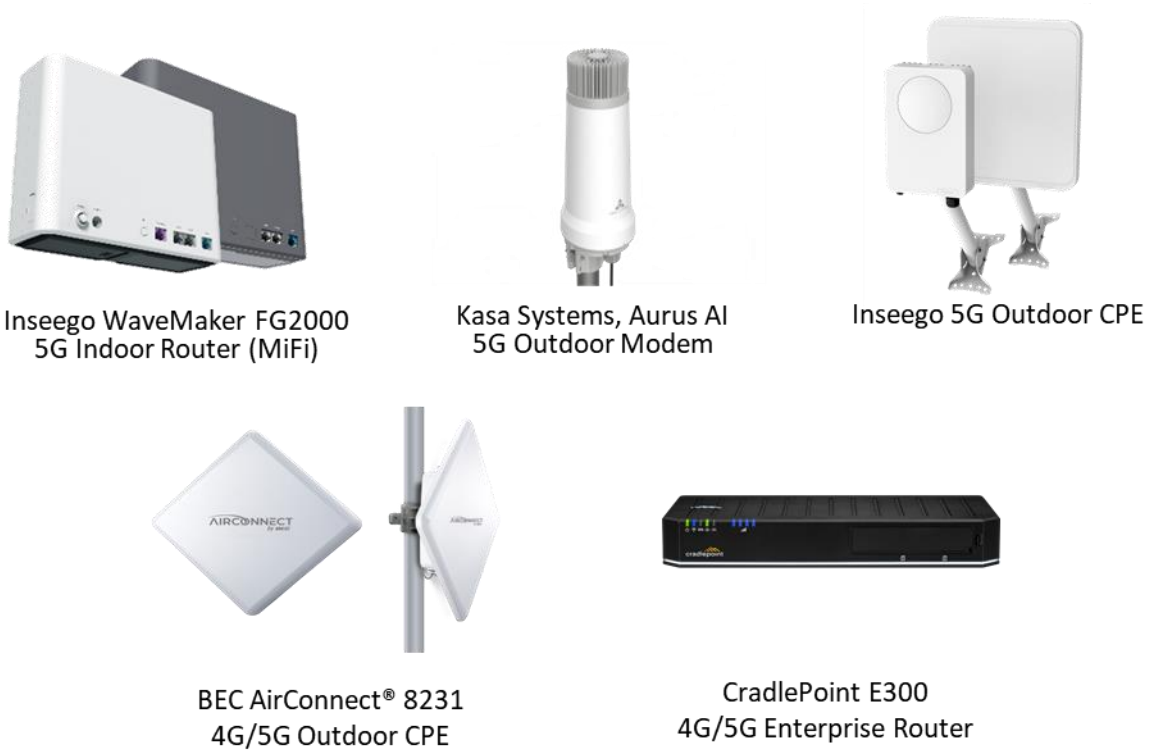

Fig. 5 – FWA CPEs for Private Network deployments in school districts

On the devices side, Chromebooks are the most popular computing devices in the education segment, mainly because of cost efficiency. Microsoft Windows laptops are also becoming popular as education tools evolve and need higher processing power. Both of these offer excellent connected experiences and ease of manageability. Other devices like tablets and smartphones are also used by students in classrooms and homes. All of them use the Cloud for classroom collaboration and storage. Hence, making cellular and Wi-Fi connectivity robust and reliable is mission-critical.

School Private Network deployment – A case study

The best way to understand the concept, benefits, and process of deploying School Private Networks is to examine an actual deployment. Here is a case study of one of Kajeet's deployments for the Nebraska Indian Community College (NICC). This deployment also was selected as one of the finalists for the Small Cells Forum award in the "Social Impact" category.

The Challenge

Nebraska Indian Community College provides a culturally infused learning environment dedicated to bringing state-of-the-art facilities to students. Established in 1973, NICC was created to offer post-secondary education to residents on the Omaha, Santee Sioux, and Winnebago reservations. The institution is located in Northeast Nebraska and is authorized to provide accreditation up to an associate degree. The college continues to serve and create life-changing opportunities for students by providing various cultural, educational, and social resources to Nebraska's isolated and economically underdeveloped areas.

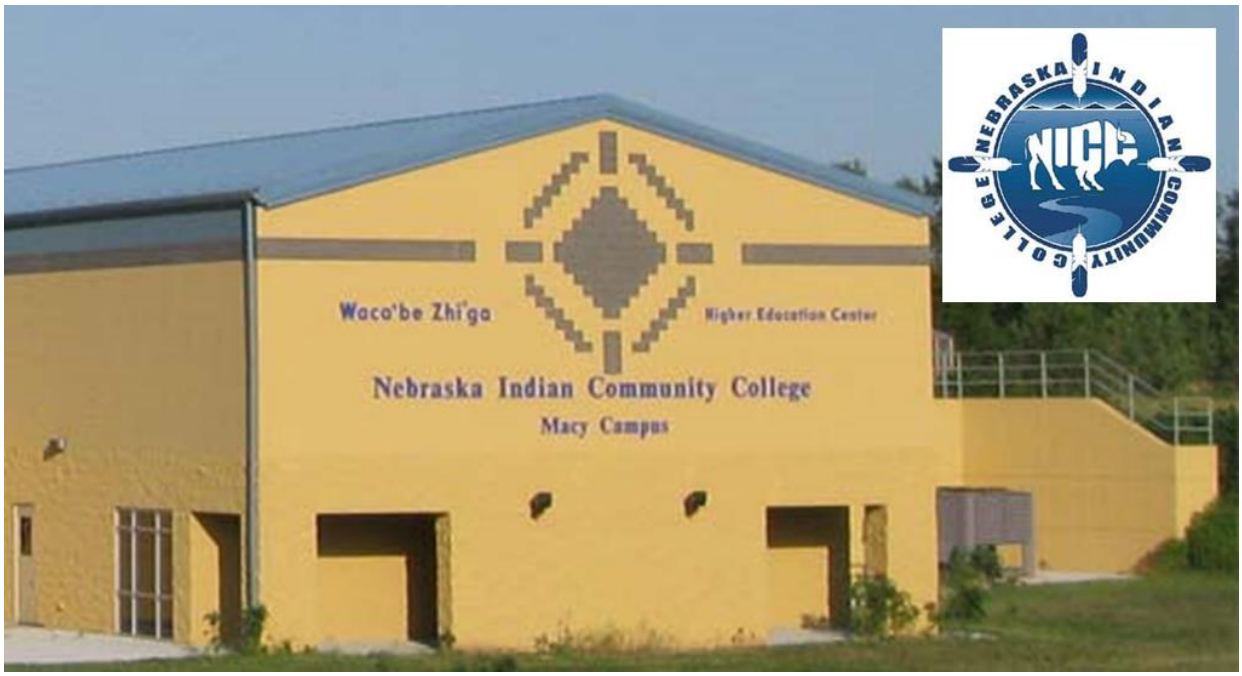

Fig.6 – Nebraska Indian Community College (NICC)

Like many economically challenged regions, cellular coverage in the NICC campus locales is sparse. Internet penetration is also very low because of unaffordable prices. The plans, offered primarily by local Wireless Internet Service Providers (WISPs), can be as high as $130/month for a mere 10 Mbps/1 Mbps speed. This became a huge bottleneck and threatened to stop the education of NICC students when the COVID-19 pandemic hit, which forced all the schooling to be online.

Federal and local governments rushed assistance to schools, including NICC, to provide adequate student connectivity. However, that didn't help most NICC students, as there were no easy or quick means to provide connectivity. Due to the lack of coverage, the USB Dongles, Mi-Fi devices, and smartphones, used elsewhere for such connectivity were of little help to NICC students.

The Solution

That's when Kajeet devised an innovative idea of rapidly deploying a Private Network to address this challenge. This solution is also cost-effective and long-term, enabling NICC to control its destiny.

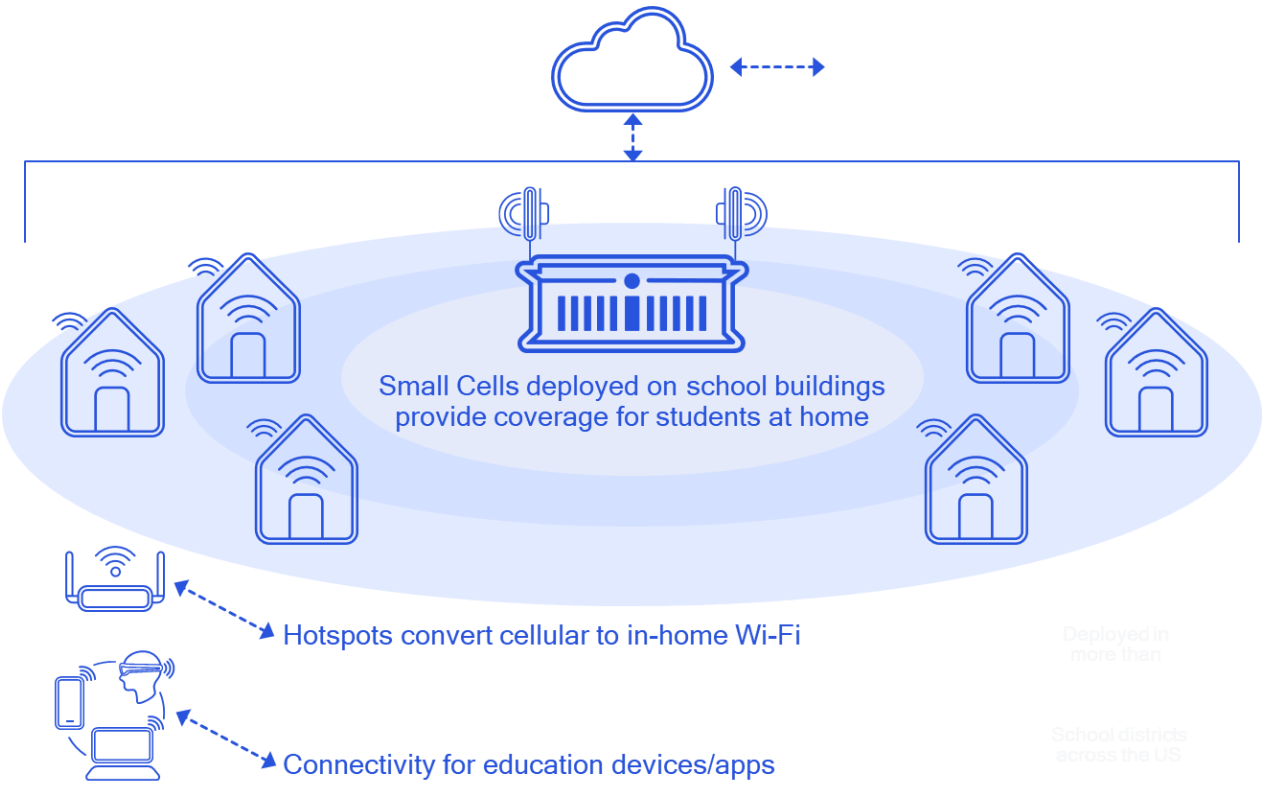

Fig. 7 – NICC Private Network topology

Kajeet used small cells based on the Qualcomm FSM RAN Platform to deploy an LTE Private Network in and around the NICC campus. The Network consisted of five outdoor small cells, all installed on rooftops of school buildings. As is typically the case, all the NICC buildings were connected using fiber. This came in handy in providing backhaul to the small cells. NICC (working with Kajeet) applied for and got the license to the 2.5GHz broadband spectrum (188 MHz bandwidth) under the FCC's Educational Broadband Spectrum (EBS) program.

Each student's home was equipped with a mobile hotspot or FWA CPE connecting to the LTE network and offering Wi-Fi coverage inside homes. Since most NICC students live around the campus, the network provided good LTE coverage to all their houses. Since students already had Chromebooks and other computing devices offered through other programs, they could take them home, connect to the mobile hotspots or FWA CPEs, and continue their learning without any hindrance.

Thanks to the easy deployment of small cells and Kajeet's compact Core Network, the network was deployed much more quickly than would otherwise be possible. It only took a couple of months from contract finalization and spectrum granting to deploy and activate the Network. It was deployed in the summer of 2020 and was ready to use when students started their school year in the fall.

Features such as self-optimizing and managing features, combined with Kajeet's easy-to-use Network and device management suite, made deploying and managing NICC's LTE network a breeze. Currently, NICC's IT staff fully manages the network without requiring new headcount or resources.

The whole project was funded through various Federal, state, and local government relief programs offered in response to the COVID-19 pandemic.

The Impact

Although the impact of allowing thousands of students to continue their education, even during the world's worst-hit pandemic, is immeasurable, there were tangible benefits and clear RoI for this project.

The network currently covers an estimated 1500 students of NICC. The users get speeds of up to 10 Mbps in the downlink and 3 Mbps in the uplink. These are set to increase with the upcoming network upgrade. Most served students are economically challenged, and the whole area is recognized as financially underdeveloped. NICC's Private Network stands as a beacon of innovative ideas that help close the Digital Divide and is an excellent example of how technology can solve society's challenges.

COVID-19 has forever changed education. Even as regular on-campus classes have resumed, much learning, interaction, and schoolwork continue to occur online. Recognizing this, NICC plans to continue to utilize its Private Network and expand it by adding four more sites.

In the words of NICC's President Michael Oltrogge, *"…We continue to choose Kajeet Private Network for their cost effectiveness, easy and rapid deployment capability to ensure our students have the most robust internet connection with an economical communications solution. Through the partnership of Kajeet Private Network, NICC has truly been able to "connect the unconnected" with an economical and reliable communications solution.*"

Proven track record of School Private Networks

NICC is just one example. Kajeet has deployed Private Networks for over 40 school districts across 10 states. The typical network size ranges from a few sites/small cells to a dozen. Kajeet's financial modeling has shown that building a School Private Network TCO is almost seven times lower than utilizing broadband plans offered by public cellular operators. The model is for about 20,000 students and evaluates capex and opex for five years. It compares the unlimited 50 GB plan offered by major cellular carriers against school districts acquiring equipment, using the CBRS spectrum, and hiring a third party to design, deploy, and support ongoing maintenance. The numbers may differ depending on the timelines, operator coverage, geography, number of students, population density, coverage requirements, etc. But, in most cases, a School Private Network would be more economical.

Like NICC, many school districts have realized the value of Private Networks. In many cases, they may even need higher capacity, even better performance, support for new applications and services, etc. And that's where 5G and even Wi-Fi 7 can play a crucial role.

5G and Wi-Fi 7 to further supercharge School Private Networks

Like Private Networks in Enterprise and other segments, the School Private Networks started off with 4G LTE and had an upgrade path to 5G. Now that 5G has become mainstream with a vast ecosystem and its infrastructure prices falling rapidly, it is a safe bet that new School Private

Networks will start with 5G. Moreover, 5G is even more suitable for private networks for various reasons.

In existing School Private Networks, the in-home connectivity typically supports Wi-Fi 5 and, in some cases, Wi-Fi 6/6e. Wi-Fi 6e devices are readily available; Wi-Fi 7 devices are expected soon. Wi-Fi 6e brings up to 1200 MHz of spectrum, and Wi-Fi 7 has many advanced features, which will provide even more robust performance.

5G and W-Fi 7 provide gigabit speeds, huge capacity, and extremely low latency. Higher rates enable HD-quality video calls for online classes, distant learning, or collaboration. Higher capacity supports many students engaging in these activities simultaneously, for example, in the evening when all students are home checking out their study videos, uploading their work, etc.

Along with speeds and capacity, 5G and Wi-Fi 7's lower latency enables new applications such as AR/VR/MR/XR, which have proven highly effective according to the latest education research. These could be even more impactful in economically challenged areas, as getting enough good teachers there may be difficult. Some of these technologies are still expensive, but the pace of development is making them more affordable and available at scale.

It is apparent that any school district looking to deploy Private Networks should consider 5G and have provision to upgrade to Wi-Fi 7 easily. This will ensure networks are futureproofed and can support new high-performance applications and services when they become available.

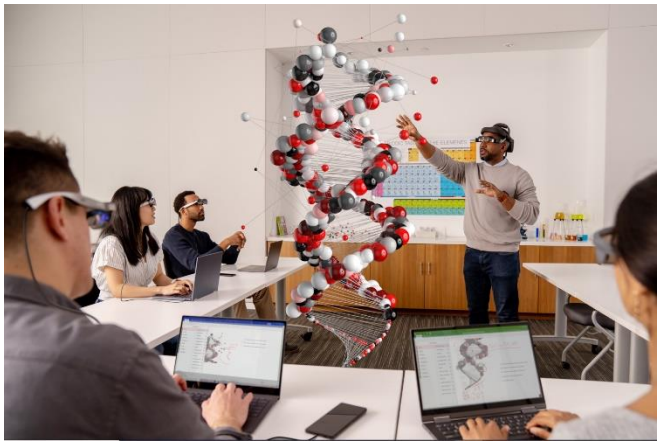

Fig.8 – New applications such as AR/VR/MR/XR are highly effective learning tools

Opportunity to use School Private Networks to close the societal Digital Divide

The primary objective of the School Private Network is to connect students and enrich their learning. However, it can potentially connect everybody in these economically challenged areas, not just students, and serve as a tool to help address the much broader societal Digital Divide.

There is a strong and proven positive correlation between access to the internet and economic development. The connectivity provided by the School Private Network could be potentially used by all the members of the household, dramatically increasing internet penetration in underprivileged communities. This could help household members access various online services, including health and financial services. For the other household members, this would also reduce the hardship of going to libraries or other places to access the internet. This network could become a channel for local governments to offer their social, health, and other civil services to those in need. It could be the ultimate municipal network that many cities worldwide have been aspiring to build for many years.

Fig.9 – School Private Network can become the family broadband connection

Of course, that requires many more sites/small cells, much higher capacity, better access management, etc., so that students' learning experience is not compromised. To facilitate that, local, state, and Federal governments could provide subsidies, financing, and other financial support to make it economically viable for all involved. There are already excellent management tools available to manage access and prevent abuse. In fact, Kajeet's management system already provides some of this functionality in their existing School Private Networks.

Guidelines for school districts looking to deploy Private Networks

As the case study and more than 40 school districts that have already successfully deployed Private Networks indicate, they are a potent option for connecting students. As mentioned in the previous section, deploying a private cellular network is not as complex as it may initially seem. Based on the learning, here are some of the considerations and guidelines for school administrators.

Establish the needs and challenges – First, the challenges and the extent of the needs of students have to be fully understood. School districts must ascertain whether the lack of connectivity at home is a systematic problem for a substantial portion of students or an isolated issue.

Reliable coverage from public cellular providers – If connectivity is established as the issue, then the next thing is to understand whether public operators have enough reliable coverage in the areas where the students live. If the coverage is adequate and the connectivity challenge is determined to be isolated to only a few students, then subsidized operator subscription data plans and devices might be sufficient.

Economic/TCO considerations - Private Networks could be the only option if there is no reliable coverage. Instead, if there is coverage, but connectivity is a systematic challenge affecting many students, then Private Networks should be evaluated.

The most significant evaluation criterion should be the Total Cost of Ownership (TCO). For the School Private Network, this will include equipment costs, deployment costs, ongoing maintenance costs, etc. A typical Private Network could have a life span of up to 10 years, with simple upgrades for new features and regular upkeep. For the operator data plan option, calculating TCO is pretty straightforward. It is simply monthly charges for the number of subscriptions needed. The calculation should also consider expansion plans and possible increases in data plan pricing. The device pricing will mostly be similar between the two options as the same type and number of devices will be needed.

School Districts should also consider the capex vs. opex impact. Private Networks need substantial upfront capex investment, whereas buying subscriptions is primarily opex.

Kajeet's modeling has shown that building its own School Private Network could be significantly cheaper than utilizing the public cellular network when available. However, each school district's needs, environment, and cost differ. Hence, each district has to thoroughly analyze and make the decision.

Identify the right partners – Once school districts decide to go the Private Network route, the most crucial decision is selecting the right turnkey partner to design, supply, deploy, and manage the Network. This partner should help school districts design and dimension the right-sized network, facilitate spectrum acquisition, and supply the best-performing small cells, Core Networks, antennas, management software, etc.

Deployment – Network deployment is obviously the most important step. School officials must be fully involved to ensure the correct site selection, efficient installation, and proper device selection, especially mobile hotspots and FWA CPEs.

Ongoing and life cycle management – One of the critical things a Private Network needs is proper maintenance and upkeep. This includes the right policy and access privileges for content and usage of the devices. Depending on whether the district wants to manage the Network through its IT department or hire an external agency, the partner has to train and transfer knowledge to the people who will manage the network.

Conclusion

Education institutions across the country have realized that hybrid learning is here to stay, and it is essential that all the students are equipped with the proper devices and adequate connectivity to meet their potential. While the pandemic drew attention to the persistent division between students with and without connectivity, the need for digital equity has never been greater.

Federal, state, and local governments have acknowledged the needs and are addressing the challenge by continuing to provide funds and resources to schools. However, determining the best path to utilize those funds and successfully provide students with reliable, cost-effective, and long-term connectivity is not an easy decision. From the analysis in this paper and the experience of early adopters, one of the most potent emerging solutions is School Private Networks.

Thanks to the advances in technology, availability of small cell solutions, and miniaturization of the Core Network, deployment of Private Networks is becoming more straightforward and cost-effective. While small cells provide cellular coverage, mobile hotspots and FWA CPEs provide Wi-Fi connectivity in students' homes, connecting Chromebooks, laptops, tablets, and other devices.

Kajeet, a leader in the education industry, has pioneered this model and has successfully deployed Private Networks in more than 40 school districts. Encouraged by this early success, school districts are looking to expand their networks and adopt 5G.

5G and Wi-Fi 7 can further improve the performance of School Private Networks to bring even higher speeds, capacity, as well as reliability and enable new advanced educational tools such as AR/VR/MR/XR. Initial studies have shown that these tools could significantly increase the effectiveness of education.

School Private Networks not only bridge the Digital Divide for students but also have the potential to address the larger social gaps in equitable access with the correct support from local governments.

From the Sponsor

At Qualcomm Technologies, we are reimagining education to enable a world where all learners are intelligently connected from home, the classroom, or virtually anywhere. From enabling premium connectivity on laptops and other devices optimal for student-learners, to cellular and Wi-Fi infrastructure capable of connecting the unconnected, Qualcomm Technologies portfolio is bridging the digital divide, making learning more accessible and preparing students for the future.

Compute Platforms - Educators need tools to engage, empower, give immediate personalized feedback, and deliver curriculum – from virtually anywhere. Snapdragon-powered laptops support the students with intelligent applications and productivity features built-in on a device that is security-focused, lightning-fast, Wi-Fi, and cellular-enabled so students can continue exploring and building their skill sets no matter where they are. With responsive performance and up to multi-day battery life, the Snapdragon-powered laptops enable educators to enhance class instruction and elevate student work.

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Wireless Fiber - Qualcomm® Fixed Wireless Access Platforms expand fixed wireless access reach and performance. With advanced features like extended range and Dynamic Antenna steering, these platforms can bridge the digital divide and deliver consistent high performance and service.

W-Fi Networks - Qualcomm Technologies Wi-Fi networking platforms enable diverse applications on a common architecture, from connected home mesh systems to massive capacity access points for enterprise and public venues. Our cutting-edge configurations include Wi-Fi 5, 6, 6E, and 7 for seamless coverage and optimized connectivity speeds.