Connectivity Off Campus…What Can Be Done?

Technology and education changed for everyone in March 2020. Technology departments nationwide changed seemingly overnight from standard operations and planning for the upcoming school year to dealing with an emergency that very few districts were remotely prepared to handle. Technology departments were inundated with requests for immediate solutions to keep students and staff connected while off campus.

This paper is written to help understand what the options available in the immediate future, near future and distant future. The future of education has changed, possibly forever. Federal and State guidelines for social distancing will have a long-lasting impact on how education, at all levels, will move forward. The adage to plan for the worst and hope for the best rings true, even now. Planning to be able to provide connectivity to students away from campus must be a main topic of conversation, even with the hope that students will be able to return to campus.

When attempting to bridge the connectivity gap, Infinity recommends the following options for planning the future of distance learning.

Immediate Future (1-3 months)

School Districts and Libraries cannot wait for a July, August or September delivery date for cellular hot spots from phone carriers, there is an immediate need for a solution. Some of entities who have already received cellular hot spots are dealing with connectivity issues due to lack of coverage by the carrier. What are entities that do not have any hot spots supposed to do? There is an enormous need for connectivity now, not two months from now.

It is our recommendation that entities that did not, or were not able to, purchase hot spots, provide connectivity through other means. Below are some options to consider:

1. If you have cellular hot spot devices, but not enough to provide one to each student in need, you can place a cellular hot spot device that you already own into a school bus, or district vehicle, put the connectivity log in information on the windows of the vehicle, and drive to neighborhoods most effected. Allowing students to connect to the device and download their classwork to be completed, offline.
2. Relocate existing wireless access points to the outermost regions of the campus. This could be exterior walls of classrooms, administration offices, portable classrooms etc. It is possible to extend wireless access points to parking lots or utilize exterior access points in areas where students may have access. This could be accomplished by extending data cables and using midspan PoE injectors where required.

Near Future (3-9 months)

Districts should be looking to a more permanent solution in the months to come. For the purposes of this paper, we are going to focus on the two most prominent options, Wide Area Wireless LAN and Private LTE networks. In evaluating each option for cost, neither option is what would be considered, inexpensive or feasible. However, teaching each student

remotely while staff is unable to physically be together, was also once considered not feasible, and look where are today.

1. Wide Area Wireless LAN

   A Wide Area Wireless LAN is like a hub and spoke designed fiber network. The key difference being that the fiber is replaced with a Wi-Fi signal that acts as the carrier between nodes in the system. Each spoke node connects wirelessly to the hub, as well each spoke node is a collector for the individual user nodes in a geographical area. In this topology, the hub would be the center originating point, such as the District Office, Library or other Main Distribution Frame (MDF), and each spoke node would be the Intermediate Distribution Frame (IDF). The user endpoint is relative to the data outlet in a traditional wired network.

   In a Wide Area Wireless LAN, the end goal of the project is to provide the most coverage to largest geographical area. This requires a copious amount of upfront planning to complete correctly. The spoke node locations play a critical role in the success of the solution. These locations act as the main transportation system between the user and the network. Having these locations in the correct geographical space provides the greatest ability to provide coverage to the largest area.

   How do users get coverage when they are away from the spoke node? In a Wide Area Wireless LAN, users are connected through a network of exterior wireless access points. Depending on the area where coverage is needed, there are different options available. Residential for example can allow for a very dense population to receive coverage with only a few user nodes required. When spaced proportionally in a residential area, user nodes can be placed on homes and provide connectivity to the surrounding homes, thus limiting the number of devices that may need to be installed in one geographical area.

   In more densely populated areas such as apartment buildings, condominiums and high-density residential buildings, user nodes can be placed more frequently to provide greater access with less bandwidth consumption. In non-residential, high population areas, the same can be completed with increased number of devices. In order to have a successful high-density solution, the user nodes will require additional programming to prevent overlapping signals from each device.

   A Wide Area Wireless LAN is a scalable solution that provides a great deal of growth for small and large communities. There is an initial investment requirement for the spoke nodes and hub location, however the cost is a scalable based on the number of user nodes. The end goal may be to provide 100% coverage for a geographical area; however, the initial cost may be too high for a full build out in one construction phase. Therefore, a viable option may be to complete the spoke node installation, and phase in the user coverage, beginning with the most needed areas first, and phasing in complete coverage for the area over time.

2. Private LTE

   A Private LTE network is a cellular network that is owned and operated by a private/public (non-commercial) entity. The system bandwidth is separate from any cellular carrier and limits its connectivity to those devices that are programmed to operate on its network. Recently the FCC held an auction for the 5Ghz broadband spectrum, in which the major cellular carriers purchased all available licenses, making it difficult for anyone looking to operate a private LTE network. However, in a very friendly move to private LTE networks, the FCC released a very large unused spectrum of military bandwidth in the 3.5-3.7Ghz range. Additionally, they created the CBRS, or Citizens Broadband Radio Service, which upon creation limits the users that can utilize this spectrum to private/public companies/individuals. To use this service, there is a membership due, but what it solidifies is that your radio spectrum, is yours, and that a LTE carrier is not allowed to use your space for the customers cellular or data bandwidth traffic.

   Like a Wide Area Wireless LAN, a private LTE network can provide coverage to a large area. The system requires headend servers and equipment as well as spoke nodes, the difference comes in the user nodes. Switching from a Wi-Fi signal to a LTE signal migrates connectivity from connecting to a wireless access point to connecting to any LTE enabled device. Entities who own their own LTE hot spot devices, that are not under service contracts, can exchange carrier SIM cards to private SIM cards that are provisioned for their private networks. This allows districts to provide hot spots on an as needed basis to students, rather than install equipment in a residential area.

   A private LTE network works just like a carrier network, where antennas, towers, microcells, and other devices are used to provide coverage in areas where existing coverage is limited. In the case of school districts, one feasible solution is to use each campus as a spoke node, to provide a large umbrella coverage for the surrounding areas. While this is a good start, it may not work in all scenarios, and additional design considerations should be taken into account for additional locations.

   Much like in areas where high density residential populations are located and non-residential entities may need to be considered for coverage, microcell technology is available, when large towers are not feasible for construction. These allow for high capacity coverage when space is at a premium.

Near-Distant Future (9-18 months)

It is extremely difficult to estimate where society will be in a years' time. Will students be back in the classroom? Will everyone be back to work, and the economy running as before? Only time will tell, but how do you plan for what comes next? It is our recommendation that districts need to plan to be able to provide students connectivity, where the student is, not where the school is. The adage to 'prepare for the worst and hope for the best', stands true. If preparations are made for a continued 'off campus' learning environment, and it is warranted, then the prepared district will not be forced to make speedy and costly purchase decisions. If the preparation is not warranted, students and teachers will be able to continue

learning away from campus, regardless of the in ability for connectivity, further closing the digital divide.

Funding – Who's Paying for This and How?

Inevitably the question always arises of, 'how much is this going to cost?' It is the proverbial 600-pound gorilla in the room. Everyone wants to provide connectivity to their students; however, the reality is that these solutions are not cheap, inexpensive or quick. Rather they can be quite costly and time consuming. Costs for each system vary greatly depending on the size of the deployment and required coverage area. Additionally, there are the costs that are associated with projects that require expediency. Tight timelines lead to increases in overall cost.

Cities, Counties, School Districts and Libraries looking to move forward with planning the systems described above should understand that a budget of $20,000.00-$30,000.00 will not complete either of these solutions. Districts need to take a realistic long-term approach to these solutions and understand that these solutions will require a hefty upfront investment.

Infinity has worked with entities to complete these solutions and would honor the opportunity to support you in your effort to complete your solution. Infinity is also watching and working closely with federal programs and grants that can assist with the procurement of these solutions. If you are interested in project pricing please reach out to Infinity through your Business Development Manager or through our website, contact form.