Shaping a next generation network

Factors to consider when evaluating a long-term fiber lease.

The E-rate modernization enacted with the FCC’s Report and Order FCC 14-189 in December 2014 relaxed rules on funding limits for non-recurring charges that schools and libraries incur when building Wide Area Networks (WANs). Previously, E-rate funding for these expenses was limited to $500K, anything above that amount had to be financed over the life of the contract with a minimum period of 36 months. With this change, the limit on non-recurring charges was removed and the rules were revised to allow full reimbursement of the applicant portion of the non-recurring charges, either upfront or over a maximum period of four years. This change, along with the inclusion of Dark Fiber as a fully eligible WAN alternative, provides schools and libraries with new options for planning future networking needs.
This whitepaper will review changes in the networking environment affecting schools and libraries and will highlight considerations for choosing between a Private Lit Fiber Provider and a more traditional Service Provider. It will look at the costs and challenges involved with both alternatives, as well as provide important questions to ask when evaluating your options. Finally, it will examine considerations associated with emerging technologies and how those may play into decisions relating to long term agreements.

Rising Demands
Reliable, affordable and advanced networking is essential to every educational institution. Demand for communication services that support WANs, Wi-Fi and high-bandwidth educational applications continues to rise as curriculum and instruction increasingly shifts to technology-rich environments.

The sheer volume of videos uploaded and watched on YouTube helps to demonstrate how significant an impact video traffic is having on networks today. As of September 2016, over 300 hours of video are being uploaded to YouTube every minute and almost 5 billion videos are being downloaded every day.²

As part of the E-rate Modernization Order, the FCC noted the broadband targets established by the State Education Technology Directors Association (SETDA) for schools to provide internal WAN connections from the district to each school and between schools of at least 10 Gigabits per second per 1,000 students/staff and an external internet connection of at least 1G per second, again per 1,000 students/staff, by the 2017-2018 school year.³

As a result, it’s no surprise that broadband and network capacity are now the top priorities for school IT administrators.⁴
Rapid Innovation
For many years, the technology behind school WANs has remained relatively unchanged. Ethernet networks have long been the backbone connecting classrooms and administrative offices. In recent years, innovation has spurred changes in school networks, bringing higher speeds and advanced capabilities. The pace of networking innovation is certain to increase, resembling other fast moving technology shifts over the last decade, like the progression from desktop computers to laptops and tablets, to the proliferation of smartphones, and now on to the virtualization and mobilization of almost everything. It’s mind boggling to try and envision what advances the next ten years will bring.

As technology life cycles seemingly grow shorter by the day, there will be even more pressure to recoup costs and realize a return on investment, particularly for agreements that reach far into the future. How long will you be willing to commit to a particular technology without sacrificing the flexibility to embrace innovation? Similarly, how will transitioning network functions and activities to the cloud affect your WAN bandwidth needs, as well as those to your external internet connection? Let’s also not forget about the rapidly expanding speeds in the wireless world. With gigabit throughput on the horizon, we may see a day when last mile fiber can be augmented by wireless. This rapid pace of innovation is something to consider strongly when making a decision, particularly a long term decision, around a network technology.

Overall, IP traffic will grow at a compound annual growth rate (CAGR) of 22 percent from 2015 to 2020. Monthly IP traffic will reach 25 GB per capita by 2020, up from 10 GB per capita in 2015.\(^5\)
Emergence of Private Lit Fiber

With the shift in E-rate funding related to upfront expenses, providers of Private Lit Fiber have taken an increased interest in working with K-12 schools. Private Lit Fiber providers offer point-to-point connections with dedicated fiber that does not route through a shared network infrastructure. They typically lay new fiber from end to end to build a school district network, in a process that can take an extended period of time. This implementation usually involves a significant upfront cost and a requirement for a long term lease (typically 10 to 20 years). From the provider’s view, the ability to bill these large installation costs upfront now offers a much quicker and more favorable Return on Investment (ROI) for building out this type of network.

Private Lit Fiber providers have approached the K-12 education market promoting significant cost savings, greater reliability and enhanced simplicity. These are pretty compelling assertions that merit a closer look.

When looking at costs, a couple of topics are important to consider when comparing Private Lit Fiber and Service Provider alternatives. First, with typical Private Lit Fiber providers, networks are designed so that the customer receives separate point-to-point handoffs at their datacenter. The customer is responsible for aggregating these handoffs via costly router interface cards. A less expensive alternative may be available through a Service Provider that offers circuit aggregation. In this instance, lower speed port connections are aggregated into a channelized higher speed port connection, eliminating the need for these extra interface cards.

Another cost consideration relates to paying one-time and nonrecurring fees upfront vs over the life of the contract, looking at the net present value impact of each scenario and determining which approach best aligns with your budget. Paying these fees upfront can help to minimize your monthly recurring charges whereas amortizing the charges over the life of the contract may provide more financial flexibility for other pressing capital expenditures.

Next, let’s evaluate the claims of improved reliability. Private Lit Fiber providers may promote greater network reliability, claiming fewer points of failure as their point-to-point services do not route through a shared network infrastructure. If there is a failure though, such as from a fiber cut or weather event, because of the point-to-point design of their network, they may not have network redundancy in place and may be more prone to extended service interruptions. A state university system experienced this first hand when a contractor cut an internet fiber cable and crippled campus communications, leaving some buildings without internet access for three days. It’s important to understand the resources, financial and human, that your network provider has available to address natural or manmade disasters and to think through the impact to learning that would occur if your network goes down.

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Finally, from a simplicity standpoint, the point-to-point design of a private network is indeed fairly easy to design and manage. Potential problems could emerge though should a need arise to move fiber due to a local government mandate such as a public transportation project. Since the fiber is laid specific to the network design, if a move is needed, it’s important to understand who will be responsible for the cost and how much network downtime will be required to facilitate the fiber relocation. If the school is on the hook for the cost, then this could create a budget challenge down the road. Another scenario that requires upfront consideration has to do with building closures or moves. Will you be able to recoup any private fiber capital outlays if a building is closed or a facility moved to a new location? On a related issue, be sure you understand the costs and timelines applicable to adding new sites to a private fiber network.

Reliability and Innovation
AT&T offers a host of network options to support the needs of schools and libraries and is investing in innovation to bring even more efficiency and flexibility into network management. These network options include dedicated Ethernet, private, point-to-point transport similar to Private Lit Fiber providers, and switched Ethernet, using a variety of connection options via software configuration to enable the aggregation of multiple remote connections to a single high speed connection. You can choose the network option that best fits your district’s needs and, as appropriate, add capacity to meet the State Educational Technology Directors Association (SETDA) recommendations for broadband.

Both dedicated and switched Ethernet provide highly reliable connections with Service Level Agreements (SLAs) and redundancy to help ensure your network is highly available. If you are the curious type, you might wonder what “highly available” equates to? For AT&T Dedicated Ethernet, with the Port Protection Plus option, this means a 999999% Network Availability SLA. Diversity features can also further minimize single points of failure.
The AT&T network is built on redundant and reliable transport paths over extensive and diverse fiber routes. In the U.S, the AT&T network fiber facilities include more than 103,000 route miles of intercity fiber optic cable and over 460,000 route miles of metro and local facilities in its 21-state footprint. AT&T has also invested heavily in building a Network Disaster Recovery team to help recover communications as quickly as possible in the event of a manmade or natural disaster. AT&T was the first company nationwide to receive the United States Department of Homeland Security’s Private Sector Preparedness certification.

AT&T also has invested heavily in network innovation and now offers emerging services that include Software-Defined Networking (SDN) and Network Functions Virtualization (NFV). SDN provides IT leaders with the ability to configure and manage virtually every aspect of their network on their own. With SDNs, districts don’t have to choose a specific speed up front, allowing them to dial up or dial down their broadband speeds depending on their needs. NFV enables organizations to virtualize premises equipment and functions, such as routing, firewalls and WAN acceleration, into a cloud environment, helping to simplify management and reduce expenses. The SETDA Broadband Imperative II report suggests considering the impact of SDN and NFV when evaluating future bandwidth needs.7

Private Lit Fiber providers may not have the resources to invest in upgrading their networks to support these new technologies. Be sure to factor in innovation before committing to a long term lease using a specific technology. It’s important to consider the pace of network innovation and not make it difficult for you (or your successors) to change course in the future and reap the benefits of network evolution.

<table>
<thead>
<tr>
<th>Netting It Out</th>
<th>AT&amp;T Dedicated Ethernet</th>
<th>Private Lit Fiber</th>
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<tbody>
<tr>
<td><strong>Speeds Supported</strong></td>
<td>1G, 10G, 40G, 100G</td>
<td>1G, 10G, 40G, 100G</td>
</tr>
<tr>
<td><strong>Network Management</strong></td>
<td>24x7 monitoring and management to AT&amp;T demarc</td>
<td>24x7 monitoring and management to Private Lit Fiber provider demarc</td>
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<tr>
<td><strong>Aggregation Capability</strong></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Diversity and Protection</strong></td>
<td>Standard Option</td>
<td>Custom Design</td>
</tr>
<tr>
<td><strong>Network Architecture</strong></td>
<td>Service delivered through hardened Central Offices with fiber route diversity</td>
<td>Point to point connections with no built-in diversity</td>
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Planning Ahead
The following are questions to consider when considering a long term lease on a Private Lit Fiber network.

• How quickly will you be able to add new locations to support new schools?
• If fiber needs to be moved, what impact will that have on your network availability? Will any fiber capital outlays be recouped if a building is closed or moved to a new location?
• What type of network redundancy do you have if the fiber coming to the school datacenter is cut? How will you reroute traffic in the case of failure? How significant would the impact to learning be if your network was down for an extended time?
• Does your fiber agreement come with maintenance?
• Who will bear the risk and costs of required network relocations and of disaster recovery?
• Do you have plans/budget to address redundancy, since it is not funded through E-rate?
• How long will you be willing to commit to a particular technology without sacrificing the flexibility to embrace innovation?
• Based on the rapidly changing computing/education environment, how significant is your risk in making a 10-20 year commitment to connect all sites to your datacenter when more and more network activity is being moved to the cloud?
• How might wireless play into your future networking needs?
Final Thoughts
K-12 administrators have an increasingly complex path to follow when making network decisions in a rapidly evolving technology environment. Decisions must be made on how best to build out networks to support current needs, while also keeping close tabs on future innovation to determine when the time is right to move forward. These are not decisions to be made lightly as the impact may last many years into the future.

AT&T is committed to offering high bandwidth, reliable and cost effective Ethernet solutions for schools and libraries, expertly designed and managed to meet your needs; with an unparalleled focus on innovation to help make your network more efficient than ever.

About Philanthropy & Social Innovation at AT&T
AT&T is committed to advancing education, strengthening communities and improving lives. Through our community initiatives, we have a long history of investing in projects that create learning opportunities; promote academic and economic achievement; or address community needs. AT&T Aspire is our signature philanthropic initiative that drives innovation in education by bringing diverse resources to bear on the issue including funding, technology, employee volunteerism, and mentoring. Through Aspire, we’ve passed the $250 million mark on our plan to invest $350 million in education from 2008-2017.

Learn more about how AT&T can help meet your schools’ network needs.

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