Build or buy?

Factors to consider when comparing Dark Fiber and managed service provider networks

The E-rate modernization enacted with the FCC’s Second Report and Order FCC 14-189 in December 2014 provided similar treatment for schools and libraries seeking support for Dark Fiber with those seeking support for lit fiber. Dark Fiber leases and customer owned Dark Fiber networks allow the purchase of capacity without the service of transmitting data—lighting the fiber.

This white paper will explore considerations for schools when choosing between a Dark Fiber and lit fiber solution. It will look at the costs and challenges involved with these approaches, as well as important questions to ask when evaluating your options. Finally, it will examine considerations to help K-12 leaders develop plans to upgrade their networks and prepare for future network needs.
First Things First: Making the Networking Decision

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 continue to rise as curriculum and instruction increasingly shifts to technology-rich environments.

As a result, K-12 school districts are faced with an ongoing challenge to ensure their network infrastructure will adequately serve their constituents’ needs, now and into the future.

With E-rate modernization, institutions are now looking more closely at the economics of whether to build and maintain their own networks using Dark Fiber, or to trust the job to a communications service provider.

Making this decision has significant and long term implications. IT directors must analyze a number of factors to determine the most effective approach for their districts. Considerations will include looking at the Total Cost of Ownership (TCO), evaluating the opportunities to embrace innovation in the face of rapid technology change, identifying network control and security impacts, and determining the availability of in-house resources and expertise to manage “Day Two” issues, just to name a few.
Does it Make More Sense to Build or Buy?
As district leaders consider options for improving WAN/MAN connectivity, one of the first critical decisions that they will face is whether to lease Dark Fiber with an indefeasible right to use (IRU), to build their own network or to procure the services they need from a service provider.

On one hand, owning or leasing a Dark Fiber network can be a carefully thought-out part of a telecommunications strategy that includes delivering additional capacity as bandwidth needs and student population grow. For districts that have the budget for buying and repeatedly refreshing networking equipment, and the personnel to maintain and manage their own network, a Dark Fiber optic network can deliver high levels of network performance and internal control of network traffic and district data.

Building a network is a real possibility for school districts now because of changes to the E-rate program that have opened up funding for Dark Fiber networks. On the surface, it may appear that this is a more cost-effective solution for districts, particularly for smaller, rural districts not currently serviced by broadband facilities.

Potential Downsides to Building
There are potential downsides, however, to building and managing a Dark Fiber enabled network. For starters, it may require an upfront capital expense instead of an ongoing operational cost. If your district routinely makes capital outlays for computing devices or other equipment, you are tying up funds in your network that could potentially be used elsewhere—such as a 1:1 initiative. If upfront capital investment is limited, paying a consistent monthly recurring fee for the life of the contract to a service provider may be easier to budget and will help to limit the possibility of unexpected costs down the road.

A district would also have to factor in the employee expenses for ongoing management of the infrastructure—a difficult task when so many districts are already strapped for resources. Entrusting network design and management to a proven provider can help an organization avoid costly mistakes, improve efficiencies and ensure operational continuity.

District IT resources would also have to take responsibility for managing network performance levels, rather than negotiating service-level agreements (SLAs) with a service provider. This may mean taking your focus from supporting mission-critical functions such as enterprise systems and applications, network security, digital learning tools, new technology solutions, and, most importantly, from day-to-day support for students and teachers. Service providers install software updates and handle other routine maintenance as part of a networking contract. School districts that operate Dark Fiber networks are often limited when it comes to testing and installing updates—a new software release, for example, may well have compatibility issues or other unintended consequences causing problems across your network. An established service provider has network engineers on staff who are able to test new software in a fully equipped lab environment before deploying it in the network. This provides a margin of safety that is critical to maintaining near-seamless operations.
Furthermore, building a network locks you into owning, operating and managing that network and its specific technologies for the long term (typically 10 to 20 years), making it difficult for you (or your successors) to change course in the future. Technology life cycles are getting shorter by the day, creating challenges because there is not as much time to recoup costs and realize a return on investments. Even if a high-level analysis suggests that initially buying new Customer Premises Equipment and installing or augmenting existing infrastructure is more cost effective than outsourcing to a service provider, it’s important to factor in on-going upgrades (routers, switches and other networking gear), new software releases and other change management necessary to keep a network in optimal working condition. No less important, are the implications of making large, long-term capital investments in buildings whose useful life may be limited due to age or changes in student demographics.

Finally, although building a Dark Fiber network provides dedicated, high volume bandwidth, for many districts that could easily be overkill. District leaders will need to evaluate whether it makes more economic sense to pay for needed bandwidth now, while ensuring that you’ve chosen a solution that can be easily upgraded when required.

### Shedding Some Additional Light on Dark Fiber

It’s important when evaluating Dark Fiber to factor in costs that not only come with the upfront implementation, but also with ongoing management burdens and expense.

<table>
<thead>
<tr>
<th>TCO Category</th>
<th>Points to Consider</th>
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<tbody>
<tr>
<td>Dark Fiber IRU</td>
<td>• Dark Fiber is typically priced on a per foot or per mile basis. Longer fiber runs will result in a higher cost.</td>
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<td></td>
<td>• Terrain or urban versus rural settings may also impact the price per mile or foot.</td>
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<td>Equipment To Light Fiber</td>
<td>• What is the useful life of the equipment (how often do you have to refresh)?</td>
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<td>• Will emerging technologies (e.g., software defined networks and network function virtualization) render today’s equipment obsolete?</td>
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<td>Hub CPE to Aggregate Dark Fiber Handoffs from Remotes</td>
<td>• What additional CPE costs will you incur to bring all Dark Fiber circuits into your district datacenter?</td>
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<tr>
<td></td>
<td>• What additional equipment refresh charges will you incur?</td>
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<tr>
<td>Labor Cost To Manage Network</td>
<td>• Do you have highly experienced network engineers on staff?</td>
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<td></td>
<td>• If not, do you have budget to support additional headcount and personnel expenses?</td>
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<td></td>
<td>• What impacts will staff turnover have on your TCO (as well as your ability to keep the network running)?</td>
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<tr>
<td>Network Management Platform</td>
<td>• What systems will you use to ensure network uptime or to make changes in near real time?</td>
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<td></td>
<td>• Who will manage compliance with internal metrics or requirements?</td>
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<tr>
<td>E-rate Funding</td>
<td>• Will E-rate always fund Dark Fiber?</td>
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<td></td>
<td>• Can you show that Dark Fiber is more cost effective than Ethernet from a service provider?</td>
</tr>
<tr>
<td>Other Costs</td>
<td>• How will you pay for or manage fiber cuts or relocations?</td>
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Planning Ahead for “Day Two”
“Day Two” begins once the fiber has been lit and management of the network is controlled by the school district IT organization. The following are some additional questions to consider when leasing a Dark Fiber network or construction of your own network.

- How quickly can you adjust bandwidth to address unexpected changes in student population, increased technology use (shift to 1:1), etc.?
- If you upgrade bandwidth, what affect does that have on other networking elements—such as content filters, firewalls, intrusion detection, traffic shapers? Will higher speeds (100G) require more expensive carrier class content filters?
- Are you staffed to support 24/7 monitoring and management? Does your team have dedicated engineers to keep networks performing at a high level rather than being involved in the day-to-day operations?
- If fiber needs to be moved, what impact will that have on your network availability? Will any Dark Fiber capital outlays be recouped if the building is closed or the facility 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? Does your fiber agreement come with maintenance?
- Do you have plans/budget to address redundancy, since it is not funded through E-rate?

Simplifying with a Service Provider
Service providers offer more than just fiber—they provide a team of experts that will design and configure an organization’s network and manage it over the long haul.

When evaluating a service provider, you can choose from either dedicated or switched networking options to support your district’s needs.
A dedicated Ethernet solution from a service provider allows you to take advantage of speeds similar to Dark Fiber without the concern for managing the day-to-day operations.

This architecture—when backed by Service Level Agreements (SLAs) and proactive 24/7 monitoring—helps to ensure Internet connectivity and near-seamless access to applications. Dedicated Ethernet can support a wide range of speeds, similar to Dark Fiber, offering flexibility that is critical to educational institutions.

Service providers also offer switched Ethernet connectivity over a Multi-Protocol Labeling Service (MPLS) backbone. MPLS provides an inherently highly secure environment, eases the deployment of emerging applications, supports bandwidth growth at specific sites and delivers great performance for real-time services. MPLS also offers an efficient, scalable way to integrate legacy and leading-edge applications by providing the connectivity and flexibility to support voice, video and data applications on a single network.

Software-Defined Networks (SDNs), utilizing MPLS architecture, are the latest innovation from the data networking industry, providing schools with the ability to go in to configure and manage virtually every aspect of their network on their own. With SDNs, districts don’t have to sign up for a specific speed right up front, allowing them to dial up or dial down their broadband speeds depending on their needs. Ordering is evolving to become much more of a customer controlled process, with customers having the ability to easily add or change services.

This new, dramatically improved customer experience will not only simplify IT and network operations for district leaders, but will also allow them to focus on their core mission of education.

Final Thoughts
In summary, here are some of the key benefits associated with leasing an activated, lit fiber network from a service provider:

- The service provider assumes all the cost (and risk) of refreshing networking technology
- The service provider installs, manages and maintains the network
- Capital funds are freed up for other expenses or equipment
- You have more flexibility to make moves and changes, avoiding stranded facility cost if a location is closed or moved
- Service-level agreements can be negotiated to support agreed performance levels
- You can take advantage of emerging technologies sooner

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