Middle Mile:

Scaling Backhaul for Rural Internet Connectivity

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A National Priority

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A National Priority

High-speed broadband has recently become a policy priority in the U.S. As a result, enormous funding opportunities have been made available to large and small service providers in an effort to cover some of the costs of deploying service in unserved and underserved markets.

Building a Strong Backbone

As service providers pursue rural buildouts, they need to determine which network architecture best meets their goals as well as the best approach to building it. And as they make those decisions, they must consider not only the speed and quality of the connectivity to end-user locations, but also the capacity and scalability of the backhaul connectivity to the internet itself.

Without this important piece, even the best access network is going to deliver poor service—hampered by a less-than-optimal middle mile backhaul network that bottlenecks your broadband success.

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Feeling the Demand

Bandwidth demand, which has been climbing steadily for years, has only been exacerbated by the COVID-19 pandemic, and rural markets will bear the brunt of it.

There are a multitude of reasons for this increase, including:

Increased Streaming

Data revealed by Charter Communications in 2021 suggests that peak aggregate internet traffic on their backhaul network could reach anywhere from 154 Gbps to 220 Gbps.

Online Conferencing

Among employed adults who work from home, 81% say they use video calling or online conferencing some of the time; 59% say they use such services often.

Remote Employment

According to Pew Research, COVID forced over 70% of Americans to adopt a work-from-home model. Though some have returned to the office, this arrangement appears to be a new normal, rather than a temporary trend.

Migration from Urban to Rural

Studies show that between 14-23 million Americans intend to relocate due to the telework option. In most cases, this migration will flow from high cost urban areas to lower cost rural communities.

The Need for Speed

Considering these drivers of bandwidth demand, service providers are growing increasingly interested in deploying XGS-PON broadband networks that can support speeds up to 10 Gbps per customer symmetrically. Future operators are expected to deploy even higher-capacity PONs, designed to support speeds up to 50 Gbps, and even 80 Gbps.

This is important because it has been clearly shown in the last several years that when given higher speed connections, customers will inevitably use them. In all cases, backhaul infrastructure will need to be designed to keep pace with increasing bandwidth and speed demands.

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Understanding Your Backhaul Options

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The Lay of the Land

According to a recent NTCA member survey, rural communities are often located a considerable distance from internet points of presence (POP). In fact, the average distance between rural broadband provider members of NTCA—The Rural Broadband Association—and an internet POP is roughly 93 miles.

Greenfield Builds

Service providers have several different backhaul options to support fiber network deployments and upgrades. Providers moving into new areas may need to essentially start from scratch—an option known as a greenfield build. A greenfield build also may be appropriate for a provider that relies on a leased service to provide backhaul connectivity, as the company may be able to save money by building its own backhaul network.

Upgrading Existing Backhaul Networks

Broadband providers that already have their own backhaul infrastructure will likely need to upgrade that infrastructure as they upgrade or expand their access networks. As they upgrade the backhaul network, they may want to consider alien wavelengths and reclaiming capacity on existing spans.

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Alien Wavelengths

Alien wavelengths are typically deployed in point-to-point configurations to increase capacity on a specific span. They're deployed using a WDM terminal at either end of the link and run over the existing line system.

The line output of the new transponder card (one at each end) is added to an empty port on the optical mux (i.e., the filter) and the laser is tuned to the channel corresponding to that port. At that point, the alien wavelength is aggregated with the existing channels and sent out over the fiber link to the far end node, where it is demuxed and directed to the far end line card.

Importantly, the new WDM terminals do not have to be from the same vendor that manufactured the system onto which the alien wavelength is being added. It is also possible for one service provider to use the alien wavelength approach on a WDM system operated by another service provider.

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Reclaiming Capacity on Existing Spans

Alien wavelengths also have the benefit of reclaiming capacity on existing spans for providers that have congested backhaul networks or that are already operating at full capacity. It's a means of extending the life of a legacy system and a more economical alternative to leasing fiber.

If you consider a fully filled 40-channel system with wavelengths operating at 10 Gbps, adding a single 200G alien wavelength can free up 19 ports on the optical mux that can then be used for new traffic. This can be done by simply rolling up to 20 existing 10G channels over as clients to a 200G muxponder line card and connecting that output to one of the freed ports on the mux.

Doing it a second time replaces all the capacity on the line and frees 38 ports for additional traffic.

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Selecting the Right Optical Transport Solution

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Selecting the Right Optical Transport Solution

For a green field installation, service providers will likely need a wide range of WDM equipment and will want to make sure that the manufacturer chosen has a full line of equipment that supports specialty capabilities such as the extended reach and bi-directional communications over a single strand of fiber.

Reclaiming Capacity on Existing Spans

Working with the right vendor is key. Here are five considerations that should be top of mind when making your choice:

Control of product development

Equipment providers that develop their own components are generally preferable to suppliers that rely on third-party vendors for turn-key solutions. This allows for better product differentiation and limits potential supply chain issues.

Hidden costs

When making your choice, be aware that some manufacturers demand license fees to upgrade systems to higher speeds, and some use keyed optics designed to prevent service providers from using optics from other suppliers.

Product training and support

Does the manufacturer you're considering offer classroom options to technicians with limited WDM experience? Do they outsource technical support and logistics depots? Some do—and it pays to be aware of that from the start.

Lead times

Ask manufacturers about delivery lead times, as lead times of twelve months and more are becoming more common among DWDM manufacturers.

Vendor Commitment

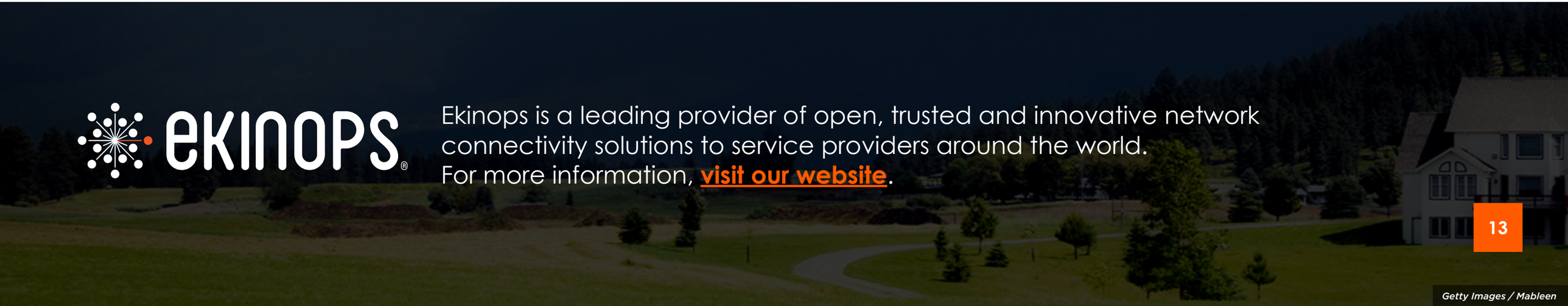
Make sure the vendors you work with are properly scaled to help a business of your size. Larger vendors are often focused on their largest customers—which may leave rural providers getting less attention than they need.

Conclusion

As the U.S. pursues the goal of universal broadband, rising subscriber usage levels and changing population demographics have the potential to stress existing rural broadband systems. For service providers planning rural deployments, it's critical to proactively anticipate current and future backhaul capacity to meet these increased requirements.

Today, more than ever, the opportunity exists for building and improving rural broadband networks in a way that is both meaningful and profitable. Selecting the right backhaul solution and the right vendor can help ensure that a service provider's rural deployment is accomplished on time and within budget.

The decisions you make today will shape the success of your broadband network tomorrow.



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