Moving Beyond Bandwidth *Lessons Learned from Fiber Deployment*

By: Prayson Pate

Consumers want faster internet, and that means fiber to the home. Service providers are answering this demand with gigabit passive optical network (GPON) technologies. GPON is fast and inexpensive. But internet access is about more than speed. It's about the entire user experience. Here's my personal fiber broadband journey, along with some lessons for service providers.

Lesson 1: You Never Get a Second Chance to Make a First Impression

I was all ready to move away from cable broadband to fiber. Luckily one of the national fiber providers came through the neighborhood with signup specials. There was no cost for installation, so I decided to give it a try.

The initial installation and turnup went great for me, but not so well for some of my neighbors. They went from a working service to no internet. Maybe it was a configuration error on the part of the operator, and maybe it was due to end-user error. At any rate, some of them switched back to cable, and the fiber provider was out the cost of the installation and service calls. Plus, the provider had burned a bridge with those potential customers.

Lesson to learn: Ensuring a smooth start to a service is the first step to winning a customer. And that means a full-featured management system and automated procedures to prevent misconfiguration and missing steps during installation and turnup.

Lesson 2: Change Wi-Fi from a Problem to an Asset

My new service was blazing fast, and everything was great - for a while. Then I started to get periodic outages for no apparent reason. I was working from home at the time, and these outages would interrupt voice and video calls.
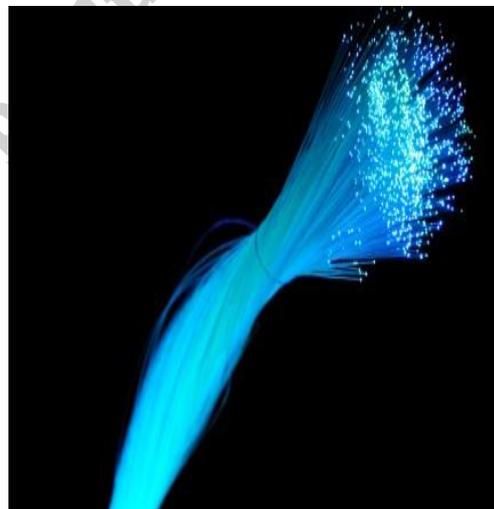
Poor Wi-Fi is often the cause of issues like these. I had installed my own Wi-Fi and was able to verify that it was not the problem by bypassing the Wi-Fi with a cable. Most people don't have the time or ability to do that type of troubleshooting themselves.

Lesson to learn: Offering managed Wi-Fi at an attractive price is a good way to drive more revenue and prevent service calls. In this case, the operator would know that the issue was not the Wi-Fi.

Lesson 3: It's Better to Tell the Customer There is a Problem than Vice Versa

The operator installed an optical network terminal (ONT) in my home to terminate the GPON access. An ONT is also known as an optical network unit (ONU).

I eliminated Wi-Fi as the problem as described above, and I verified there was not a larger service outage. I then had to repower the ONT to restore service. That's a very poor user experience.

During one of the outages I used the ONT login to look at its status. I could access the fiber interface and see that the optical power looked good, but that the optical line was showing errors. When I reported this to the service provider, the support person said that she could also see both the errors and outages. I was quite taken aback at this news. My service provider had the means to see the errors and had failed to report them to me or take any action.

Lesson to learn: Sophisticated equipment monitoring and reporting systems are wasted if you don't leverage them by taking proactive action on network issues. Find and fix the problem before the customer sees it.

Lesson 4: Correlate those Errors

During my first service call the technician came out and replaced the ONT. That was a logical response to the fact that there were errors on the line when the power was good. What was not logical was what happened when the errors and outages continued. The second technician came out and changed the ONT again, because that was the standard procedure. In this case, however, the problem was elsewhere.

Lesson to learn: The device reporting the errors is often not the culprit. Correlation of errors across the network can help identify the root cause and prevent chasing red herrings.

Lesson 5: Know Before You Go

The second technician also checked the optical levels and verified that they were within acceptable ranges. Even so, he respliced the optical cable both inside the house and at the curb. I asked him why he was doing that and he told me that sometimes the ONTs report errors even when the optical levels are good. I suppose that's possible, but I was skeptical. Of course, the errors and outages continued. Lesson to learn: Low-cost in-service optical time-domain reflectometry (OTDR) monitoring systems are now available. Using such a system would have shown that the optical levels and splices were good and hadn't changed since installation. That would have saved the time and cost of resplicing the fiber, and been another clue to look elsewhere.

Lesson 6: AI Can Help

The third technician finally solved the problem. Like the others, he came to the house and checked the ONT and the light levels. He did replace the ONT (again) as this seems to be part of the operator's

standard procedure. But he also applied some logic: If it's not the ONT and it's not the fiber, what else could be the problem? The obvious answer is the port at the head end device, or optical line terminal (OLT). He switched the OLT port and the service has been perfect ever since. Note: it's possible that I may have suggested this to the other technicians.

Lesson to learn: Troubleshooting an issue like this is difficult, and experience helps prevent mistakes. Sadly, mistakes are the usual path to experience. But it doesn't have to be that way. A management system with end-to-end visibility and artificial intelligence (AI) can guide the troubleshooting process, minimizing or eliminating service calls to the home. In my case, there was never a need to visit my house.

Lesson 7: A Good Problem to Have

Assuming that other residents in an area start to adopt fiber services, the next problem is backhaul from the OLT to the network. All those end users streaming videos and having video calls means potential congestion on the uplink from the OLT. This means you must add capacity. How do you provide more bandwidth without pulling more fibers - and incurring more cost?

Lesson to learn: Dense wave-division multiplexing (DWDM) is a well-known way to put multiple services across the same fiber. But DWDM has historically been too expensive for many access applications like GPON backhaul. That has now changed, and cost-effective coherent DWDM pluggables are available. They can be retrofitted into an OLT to provide the ability for multiple OLT uplinks and even multiple OLTs to share a single existing fiber. And they work with passive optical multiplexers, so no active equipment is needed.

Lesson 8: GPON is for Business Too

Assuming that we learn all the lessons above, GPON can provide a fast and reliable service with quick service turnup, proactive monitoring, and quick repair times. We can also address growth in bandwidth in an efficient and economical manner. That means GPON is suitable for many business services. But you must provide a business-level service-level agreement (SLA) to win and keep those business customers.

Lesson to learn: Be sure you select GPON systems that can support business-level SLAs. Then you can get the most of your GPON investment by offering lucrative and sticky business services.

Lesson 9: What About Wireless Services?

We hear a lot about 5G and its higher speeds. Those higher speeds come with the need for lots of small cells - and that's an opportunity for fiber-based operators. They can leverage their GPON fiber plant to provide wholesale backhaul services. But there's a catch. Small cells require synchronization, and that's not part of most GPON systems.

Lesson to learn: There are packet-based synchronization systems that can be added to existing GPON networks. Adding them where needed can open new opportunities for providing backhaul services for 5G networks.

Closing Lesson: GPON is a Start, but not the End

Leveraging GPON deployments is a great way to enable gigabit residential and business services. But we can see from the lessons above that GPON alone is not enough. You must support cost-effective bandwidth with sophisticated management and monitoring systems to ensure a smooth service

turnup and quick resolution of any problems. Adding managed Wi-Fi and synchronization capabilities enables additional services. And don't forget that all that user data has to go somewhere, so efficient backhaul is a must.

Learn from the missteps of others and avoid the pitfalls of the "school of hard knocks." Adopt a holistic approach to your GPON networks and services. Then you can be well-positioned to drive increased revenue by winning and retaining customers with enhanced user experience, reduced downtime, and continued service improvement.