Fiber Optic Cabling and Passive Optical LAN for Education (K-12) Market

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Introduction

Fiber to the Premises (FTTP) and Optical Local Area Network (OLAN) can help K-12 school districts cut information and communications technology (ICT) costs while improving school and student ICT services.

The current K-12 service delivery model multiplies ICT cost across the total number of schools served (Figure 1). That is, each school requires separate services (e.g. voice, internet, wireless, other services), WAN/LAN equipment, power, space and support (e.g. equipment maintenance agreements, local IT support).

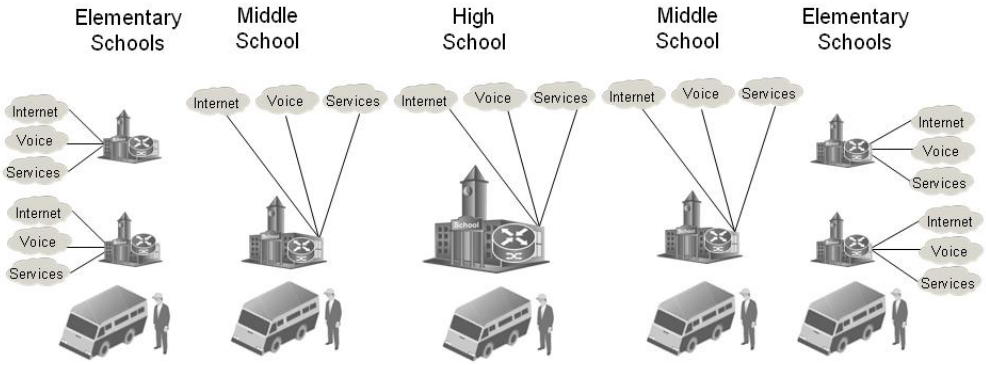

Figure 1: Every school replicates service connectivity, network equipment, power, space and support

FTTP and Optical LAN provide the ability to consolidate both WAN and LAN network equipment into one converged passive optical network. This architecture enables school districts to deploy an "open network" where single service contracts can be competitively bid annually for the delivery of voice, internet, wireless and all other services across a single PON infrastructure (Figure 2). This is possible because of the natural hierarchy that is present between elementary schools, middle schools and high schools that more than likely are all within 20 to 30 kilometer proximity (Figure 2). Net result – instead of multiplying the school ICT cost by number of total schools, the school district can reduce ICT cost by a factor equal to the total number of schools served.

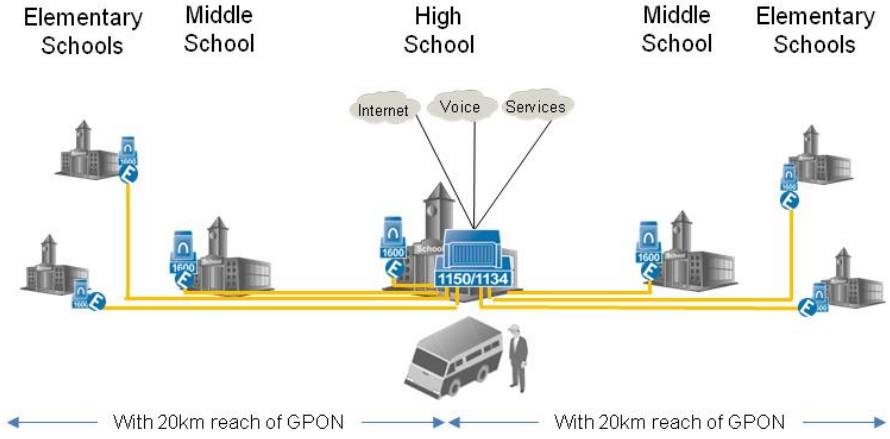

Figure 2: Converge all service delivery across passive optical network (PON) to all schools

FTTP and Optical LAN provide high speed broadband fiber connections directly to the local area network end users. It is the next generation enterprise technology that replaces legacy copper based LAN equipment, and associated copper-based CATx wiring, with passive GPON equipment, near future-proof single mode fiber, additional security, and faster speeds. Customer generated business cases have exposed significant CapEx savings and year over year OpEx savings associated with less equipment to purchase up-front, install, power, cool, provision and maintain over time. Tellabs Optical LAN uses 50-70% less capital, 80% less power and 90% less space in comparison with legacy copper based LAN (http://www.tellabs.com/solutions/opticallan/).

This migration from FTTP to Optical LAN can be accomplished with flexibility and with three distinct architectures:

- Phase I – Converge Internet service across all schools over PON network
- Phase II – Converge all services across all schools over PON and leverage CATx infrastructure at schools
- Phase III – Converge all services across all schools over PON and with fiber infrastructure at schools

Phase I – Converge Internet service across all schools over PON network

FTTP architecture (i.e. no bridged LAN peer-to-peer functions) can provide internet connectivity to all schools over PON with each school receiving one fiber and one 4-port (10/100/1000 Mbps) Tellabs 1600-709GP ONT (Figure 3). Optical Distribution Network (ODN) splitters can be co-located at main IT building data center, or centrally located high school, with one fiber dedicated to each school. At a maximum, all ONT ports will have that ability to provide one Gigabit Ethernet service delivery through industry accepted traffic management and quality of service provisioning. At a minimum, 1:32 provides at least 35 Mbps symmetrical non-blocking internet or 1:16 would provide 75 Mbps non-blocking to each school. This will benefit the school district since this eliminates need for ISP service at every school served. Thus, the school district will only contract one ISP connectivity located and managed from main IT building data center or centrally located high school.

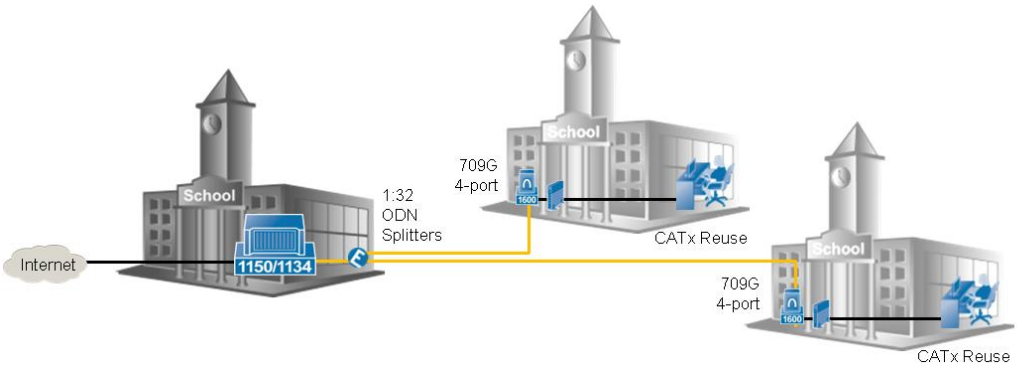

Figure 3: Converge Internet service across all schools over PON network

Phase II – Converge all services at all schools over PON and leverage CATx cabling at schools

OLAN architecture with bridged LAN peer-to-peer functions can provide voice, internet, wireless and all other services connectivity to all schools over PON. In this configuration each school receiving one multiple fibers that are paired with equal number of ODN splitters located at individual school communication closet and co-located with 24-port (10/100/1000 Mbps) Tellabs 1600-728GP ONTs (Figure 4).

Each ONT728GP can deliver Ethernet services (e.g. internet, wireless access, IP camera surveillance) re-use existing CATx cabling within each school. With ONT728GP located in communications closet matching existing legacy copper based LAN footprint, there will be no cable infrastructure impact at the individual schools. At a maximum, all ONT ports will have that ability to provide one Gigabit Ethernet service delivery through industry accepted traffic management and quality of service provisioning. At a minimum, each ONT728GP 10/100/1000 Mbps port will be able to deliver at least 12 Mbps symmetrical non-blocking service. The school district will benefit by eliminating legacy copper based LAN equipment at every school served and subsequently eliminate power, thermals, space, support and annual maintenance contract expenses.

Additionally, actual traffic levels hitting the ISP/WAN is reduced since intra-school traffic is switched at the centrally located data center. This allows a district to pay less for a single ISP uplink interface, as opposed to the current model of paying for multiple ISP interfaces per school. Finally, intra-school traffic congestion is significantly reduced based on the large amount of bandwidth the OLAN provides coupled with bridged LAN peer-to-peer function.

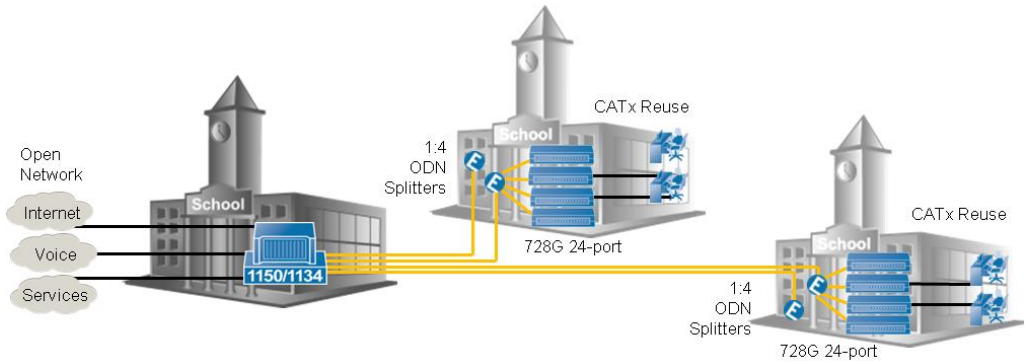

Figure 4: Converge all services at all schools over PON and leverage CATx cabling at schools

Phase III – Converge all services at all schools over PON and with fiber cabling at schools

Once again, OLAN architecture with bridged LAN peer-to-peer functions can provide voice, internet, wireless and all other services connectivity to all schools over PON, but this time that fiber extends all the way to the end-users. That is, all schools CATx cabling infrastructure is replaced with single mode fiber (SMF). Every office and classroom is then equipped with 4-port Tellabs 1600-709GP ONT (Figure 5). At a maximum, all ONT ports will have that ability to provide one Gigabit Ethernet service delivery through industry accepted traffic management and quality of service provisioning. At a minimum, all four 10/100/1000 Mbps ports of ONT709GP can deliver at least 35 Mbps (1:32) symmetrical non-blocking internet or 1:16 would provide 75 Mbps non-blocking. Once again, the school district benefits with the elimination of legacy copper based LAN equipment at every school served and the elimination of power, space, support and annual maintenance contract expense. School district also gains the benefit of collapsing all individual school LAN infrastructure on to one school district wide LAN managed from main IT building data center, thus achieving significant operational expense savings from network management efficiencies.

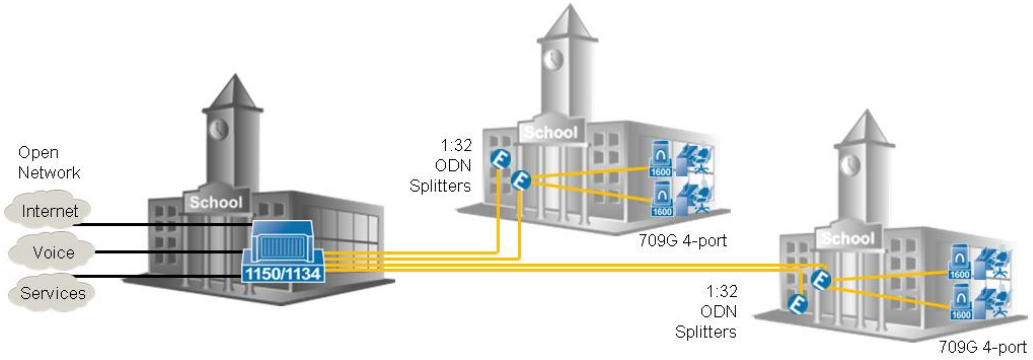

Figure 5: Converge all services at all schools over PON and with fiber cabling at schools

Benefit of Fiber versus copper cabling Infrastructure at schools

The benefit of fiber optics versus copper has long been known. Fiber optics has always had significantly better reach, capacity, EMI tolerance and fire safety when compared to copper based CATx. Over the past decade, fiber optics has benefited from, improved durability, reduced bend radius, simplified connector systems and lowered costs. During this same period copper based CATx cabling has desperately tried to keep pace with bandwidth demands. CATx has gone through a series of major re-designs from CAT3 to CAT5 to CAT5e to CAT6A to CAT6B to CAT7. The problem being that every time CATx moves to the next generation they do offer better capacity but reach has stayed constant, EMI is still poor, diameters have increased, weights are heavier, bend radius has gotten worse, connectors have become bulkier and pricing has increased. We now are well past the tipping point where SMF trumps CATx for Local Area Network (LAN) in-building structured cabling.

As stated earlier, Tellabs has seen customer generated business case studies that shows Optical LAN achieving up to 50-70% less capital, 80% less power and 90% less space in comparison with legacy copper based LAN – SMF is a compelling piece of that positive business case. Furthermore, leading industry organizations are now embracing Optical LAN and its fiber optics based in-building structured cabling. For example, Leadership in Energy & Environmental Design (LEED) developed by the U.S. Green Building Council (USGBC) positively endorses environmental building guidelines understand the benefits and design savings with fiber optics for new buildings. In addition, Association for Passive Optical LAN (APOLAN) has built an entire organization and industry partnership dedicated to the growth and education of passive Optical LAN and is focused on formulating solutions on how best to market, install, educate, and support this burgeoning field (http://www.apolanglobal.org).

Summary

Tellabs has been at the forefront of PON innovation for the past decade as the North American leader in PON ports and ONTs shipped, R&D investment has spanned five generations of PON technology. As members of standards bodies including FSAN, BICSI, TIA, ITU, APOLAN and IEEE, Tellabs strategy is to develop and implement “standards” based technology into the product portfolio. Again, FTTP and OLAN can help school districts *invert* their traditional ICT cost equation from *multiplying costs* by the total number of schools to *dividing costs* by the total number of schools. Tellabs looks forward to enabling K-12 schools to achieve their goal of lowering cost and improving ICT services to students, teachers and extended school staff.

For more information, please contact your local Tellabs sales representative, local Tellabs sales office, at the phone numbers provided below or visit www.tellabs.com.

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