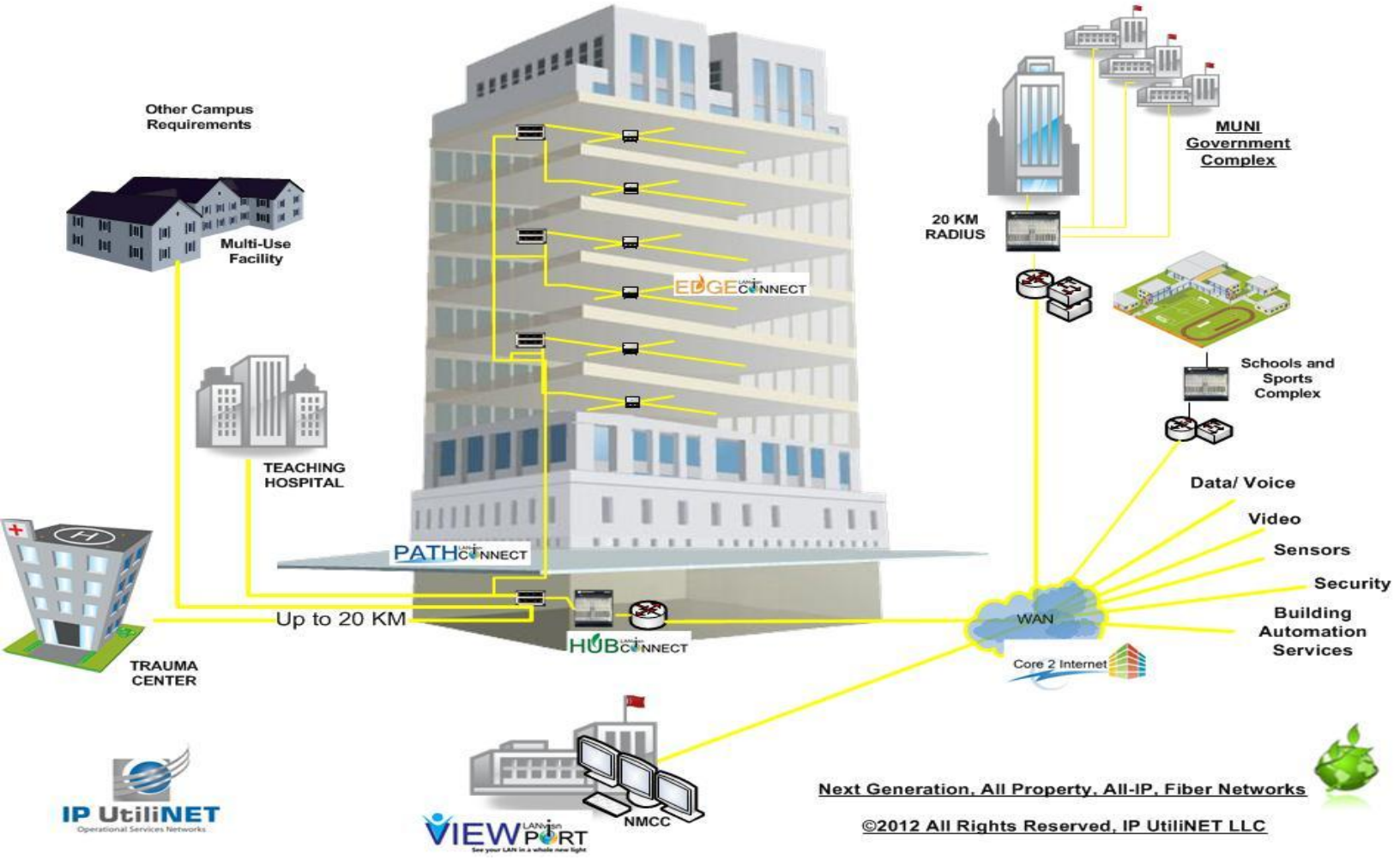
GPON Truths

“GPON vs. Gigabit Ethernet in Campus Networking”

Rebuttal to the Cisco touted Lippis Consulting Industry Paper entitled “GPON vs Gigabit Ethernet in Campus Networking” by David Quinn, Managing Director, IP UtiliNET, a GA based firm specializing in next generation all fiber multiservice GPON networking

The Game Has Changed – Get the FACTS



Reader ROI – Learn about:

A. **Discover the Facts regarding GPON vs the misinformation**
B. **How many misleading half-truths can one paper include?**
C. **Your current network vendors are in denial**
D. **Three S’s - Simple, Smart, Sustainable – from any viewpoint**

Lippis "GPON vs Gigabit Ethernet" White Paper Rebuttal

Source of Graphic: Politifact.com

Context

Next-Generation
Cost Reduced
Multiservice
Network Solutions
for
Today and
Tomorrow's
All Property
Communication
Needs
OR
Switched networks
that evolve beyond
edge routing to
distributed
data centers in all
Telco Closets

What are we as a technology industry purportedly filled with trusted advisors when a recognized expert, and a stable long-term brand publish and promote information that is so filled with inaccuracies and "pants-on-fire" distortions that it is at once laughable, embarrassing, and sad?

The "Facts" as presented in the Lippis White Paper are not based on technical reality. Mr. Lippis is reportedly "working with clients to design their public and private" clouds yet misses the point of GPON as a Point to Multi-Point Aggregation core that is designed from inception for Cloud or Data Center technologies. Cisco is a legacy brand and for some a "trusted advisor". Cisco sales representatives are using the Lippis paper to defend against GPON as disruptive technology and in turn creating a distorted circus mirror view of the two technologies.

The truth is that there are two options and two realities in the maturing world of network technology. One, a designed for data network in which current distribution switches and edge routing systems are periodically "upgraded" along with power hungry air conditioning which leads to a future path of expensive *distributed* and *virtualized* data center technology in each of your IDFs. The other, a designed for multiservice network in which a point to multi-point aggregation core offers centralized and secure transport for personal, private, and public clouds without all of the expensive distribution power consumption and risk. Both of these architectures are important and both have relevant benefits to provide. The Lippis paper ignores that a new and important technology is emerging and prefers to mask the potential benefits via fictional accounting and a lack of technical competency. Understanding the technologies and how they apply to your campus network will lead to a decision point that can have a dramatic impact on competitiveness and operational costs. You do not want to be left behind as your competition moves forward with cost reductions that your legacy network just cannot provide. This rebuttal provides a point by point perspective from an experienced GPON practitioner. David Quinn provides an insider's view of the GPON evolution as a former Motorola employee and as an expert in the first phases of shop floor to top floor network evolution. The first phase was based on DECnet, GIGAswitch, THICKnet and THINnet and other technologies that predate Cisco, 3-Com, Cabletron, and other brands that evolved as distributed computing and switched networking became the norm.

Background – Abstract Rebuttal Points

The Passive Optical Network standard has been led by the International Telecom Union (ITU) in support of broadband optical networking. Carriers have adopted various types of PON technology for the ability to scale and add competitive services without requiring fork lift upgrades.

Wikipedia has a good definition of PON technology: "A PON takes advantage of wavelength division multiplexing (WDM), using one wavelength for downstream traffic and another for upstream traffic on a single Non-zero dispersion-shifted fiber (ITU-T G.652). BPON, EPON, GEPON, and GPON have the same basic wavelength plan and use the 1,490 nanometer (nm) wavelength for downstream traffic and 1310 nm wavelength for upstream traffic. 1550 nm is reserved for optional overlay services, typically RF (analog) video". PONs use Single Mode Fiber and do not consume power between the central chassis and the media converter which can be up to 20KM or 12.4 miles from the distribution chassis.

Telecommunication companies such as Verizon (FIOS) have been implementing Fiber to the Home (FTTH) technology since the early 2000s. Verizon is far from alone in the use of xPON technology. According to Broadband Communities magazine (www.bbcmag.com) Summer 2012 edition there are "more than 800 companies" currently providing Fiber to the Home service just in the US. The same article opens with "FTTH has become the leading technology for next-generation communications networks worldwide. On *every* continent, telecom providers are building fiber optic networks to **replace legacy copper networks**". Today, FTTH accounts for some 80 million connected households with a bit more than 10% (8.5 Million) US based. China is leading the implementations with a stated objective of 100 Million households connected by 2015.

"**FTTH is the ONLY Unlimited Broadband Technology**" – …"…in fact, one bundle of fiber cable not much thicker than a pencil can carry all of the world's current communication technology" so why would anyone consider investing another penny in copper cabling? (The quote is also from www.bbcmag.com)

In the abstract Mr. Lippis fails to assert that the evolution of fiber technology – specifically PON – has been occurring for a number of years now and based on several factors has eclipsed and/or replaced copper technologies completely. GPON is the evolution of PON based technology and is now dominant in FTTH installs. The actual leader in GPON based technologies globally is China based Huawei. In the US, the market deployment leader is Verizon who has utilized products from Motorola, Tellabs, and others. **It was 2006 when Motorola and Verizon began to migrate the product lines to LAN ready.**

GPON Argument – Point and Counterpoint - FACT

Half-Truth #1: *"Vivek Kundra championed Green IT"* while partially correct, the actual fact is based on the Energy Policy Act of 2005 which was executed by the Bush Administration. Vivek Chundra simply drove that Act forward as President Obama took office. Motorola began the migration process very early in 2006.

FACT: July 2005: The Bush Administration signs the Energy Policy Act of 2005 into law, creating the 1703 loan guarantee program.

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Half-Truth #2: *"GPON bandwidth advantages have been eliminated as Ethernet Switching has progressed"*

FACT: As with any technology, the standards evolve. Single mode bend-insensitive fiber has twice the tensile strength as CAT-6 (49 ft lbs. vs. 28) and has a 20 KM distance limitation (ITU-T G.984) unlike copper at 300 feet and multimode fiber at 1200 feet.

Today, GPON is ITU-T G.984 based and offers 2.4Gb down, 1.2Gb up. Each PON can incorporate from 1:1 up to 1:64 splits and is dependent upon the committed and peak information rates. The next generation XG-PON or ITU-T987 is based on 10Gbps and offers 10GbE bi-directional, and up to 1:64 splits – no need to upgrade or replace the chassis; The generation to follow is NG-PON2 also known as Sardana offering 320Gbps, 100km reach, and ring reliability.

Fiber vs Copper; "Single mode fiber supports over 69 Tbps of throughput, making it a 'future proof' transport medium" – a single strand of *single mode fiber half the size of a human hair* carries as much data as a copper wire that is 4 inches thick.

………..

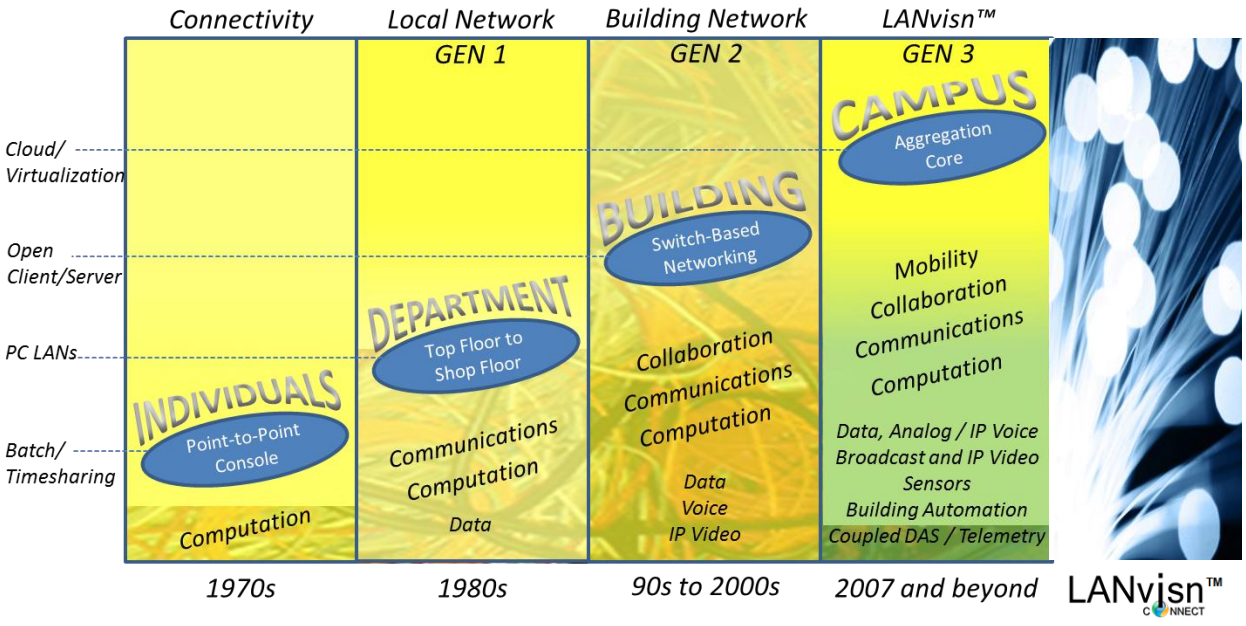
Half-Truth #3: "Fiber Optic Cable physical security is no more secure than copper"

FACT: Fiber Optic Cable has no Crosstalk, is not affected by EMI or EMP, and is non-conductive. The coverage area for a Passive Optical LAN is 483 square miles. This coverage and architecture difference limit the number of external connections – especially MetroE and other public internet connections when working to interconnect buildings horizontally. Installations that comply with Hardened Carrier PDS per NSTISSI 7003 and SIPRNet/Classified LAN Protection methods are available. Additional NSA approved Encryption devices are available along with monitoring software. This far exceeds copper solutions. Additionally, Secure PON – Alarmed PDS with Thin Client & Cross Domain classifications can exist in the same physical plant. Armored Fiber provides further protection.

GPON vs. Traditional Ethernet Network Differences:

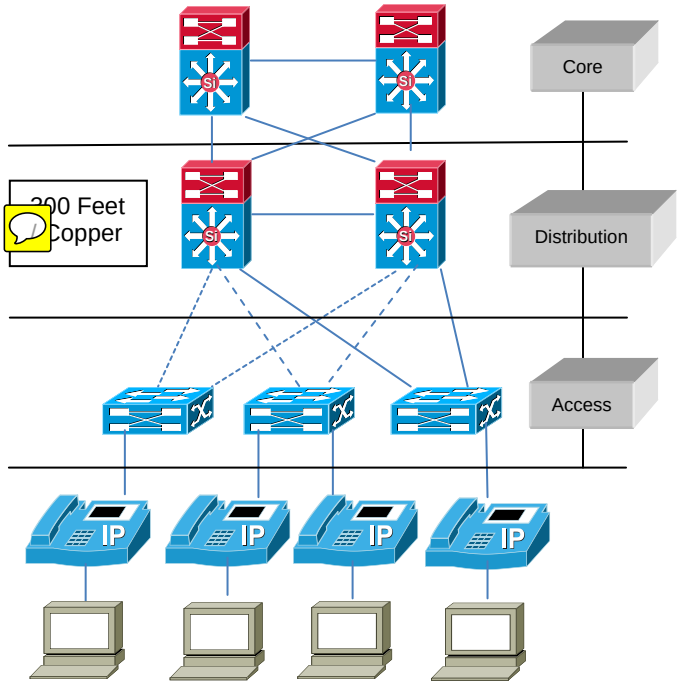
There are a number of solution providers in the xPON space today and more emerging as the customer base continues to evolve. Names such as Alcatel-Lucent, Calix, Ericsson, Hitachi, Huawei, Motorola Mobility (now Google), Tellabs, Zhone, and ZTE and a number of analyst firms such as Current Analysis; http://www.currentanalysis.com/teb/products/831-GPON.asp?gclid=CL35kKHrm7ECFQmd7Qod-lXSzw provide realistic information on the PON products and marketplace as it evolves.

As Mr. Lippis states, the "current" best practice for *switched* network design is based on a "three-tier network architecture of access, distribution, and core. What Mr. Lippis ignores is that switched networks were designed for data and evolved with the expansion of fixed compute technology (the personal computer) to the office and the shop floor. Switched networks solve the problem of *connectivity* and evolved symmetric capabilities to reduce copper cable plant congestion leaving us with costly and fragmented "islands of connectivity". Switched networks solved the problem of connectivity from data centers to devices but relegated other content services such as cable television, Audio/ Visual, Analog telephone, and distributed antenna systems to parallel cable plants. Today, xPON based networks are entering a phase of maturation that we call LANvisn™ Generation 3. Gen 3 is G-PON based and uses single mode fiber to provide multi-service transport of Ethernet or IP packets in buildings and across campus environments. G-PON networks are Gigabit Access networks that expand capability for Ethernet packets using current best practices and evolve the network architecture model to edge, distribution, and core. An G-PON based access network provides content services via Ethernet to fixed, mobile, portable, and vehicular devices consistently and securely at lower cost without fragmentation.

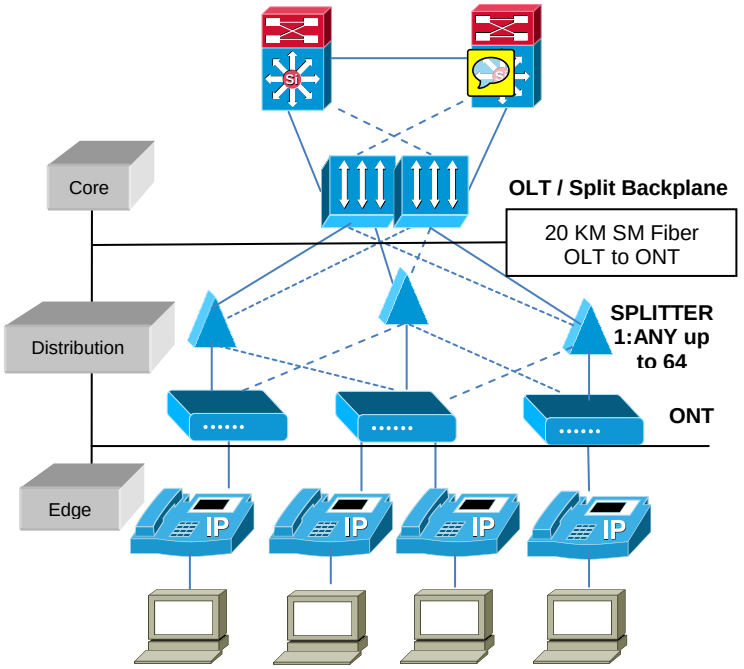


Ethernet vs. GPON Architecture Comparison

Switched Ethernet Design



GPON Ethernet Design - Redundant



Mr. Lippis correctly states that GPON in the campus eliminates the need for active access and distribution switches with passive optical devices and this is about all that is properly explained.

ONT or Optical Network Termination: are fiber to copper media converters that offer RJ11, RJ45, and F-Series connectors to any device. These devices are available in many configurations and port densities up to 24 ports. ONTs are available for outdoor and indoor use, provide POE or no POE, 10/100/1000, AES encryption, and can include batteries for survivability in the event of a power outage. Ports on the ONTs are manageable at the bit, port capacity, and power level.

Splitters: Optical Splitters use the principle of Brewsters Angle to split the light received from a single PON port into multiple usable wavelengths of light. Splitters are an architect's choice and can be installed anywhere in the configurable mid-span. The architect has 20KM of distance from the OLT to the ONT and 29.5 db of loss to plan for. A splitter can range from any single fiber cable input to up to 64 outputs. As a rule of thumb, a 1:32 splitter typically supports up to 128 RJ45 ethernet ports via a 1:4 ONT; 32X4=128.

OLT or Optical Line Terminal: The OLT is the heart of the aggregation core network and can offer a split backplane as in the drawing above. OLTs will typically operate using redundant DC power (-48VDC) and have at least 1 Line card for incoming internet, 1 System Card for on-board configuration, and 1 to many GPON cards. Each GPON card consists of 4 GPON ports. A GPON port that uses a downstream 1:32 splitter can support 32 – 4 port ONT's or up to 128 RJ45 based Ethernet ports.

Mr. Lippis states that “some OLT vendors are starting to offer VLAN-aware products”. This is patently incorrect. OLTs support multiple VLANs – in the case of Motorola up to 4000 VLANS per OLT. The choice of native VLANs or VLAN tagging is part of the system configuration and operating process. Additionally, the statement regarding 200 Gbps of switching capacity is incorrect. The dual switch cards in the chassis support up to 6 1Gb connections each or 2 10GB connections. Each card has a built in 200Gb/s switch that is complemented by a non-blocking backplane. All internal interconnects on the backplane are 10Gb/s Full Duplex providing throughput capabilities of 25 Tbps. The Motorola AXS1800 offers capacity for 14 GPON cards each having 4 GPON ports or 56 on-board GPON ports. Using the math from the prior section and the 1:32 splits rule of thumb, the AXS1800 has the capability to support up to 7,168 Ethernet Ports.

The drawing on the proceeding page offers more complexity than is necessary as all parts of the PON solutions are designed for carrier dependability and long term use. It is typical to see Mean Time between Failures (MTBF) data of 120 or more years, no failures for Splitters as they are entirely passive, and 20 or more MTBF years for the ONTs.

Attributes as reported by Lippis	**Corrections per this rebuttal**
“The physical GPON network is a hub and spoke architecture that multiplexes upstream and broadcast downstream traffic flows”	GPON networks are point to multi-point aggregation core network architectures that offer port and bit segmentation for guaranteed Quality of Service (QOS)
“The logical GPON network is a single layer 2 broadcast domain as layer 3 services are provided in the core Ethernet swtich”	GPON networks are Layer 2 non-fragmented multiservice network architectures that complement the Layer 3 services offered by a core switch through native or tagged VLANS, native SIP support and bit, port, and segment visibility, control and management. **GPON does not broadcast**.
“Traffic is restricted to flow from desktop to core Ethernet switch and back. Therefore, mesh flows are not supported”	Traffic flows in symmetric fashion within assigned segments and VLANS. ONTs configured for one VLAN can not be swapped for another VLAN or segment at any time. This improves security, manageability and network performance.
“All traffic flows to the core Ethernet switch creating the potential for a choke-point or bottleneck”	Any network of any type will have this potential. When the network is properly designed for Peak and Committed Information Rate (PIR/CIR),segmented by VLAN and service for QOS,and established according to the input capacity to include the core switch, performance will be exceptional largely from the elimination of switch fragmentation.
“All network intelligence and network services are placed in the core Ethernet switch”	Nothing could be further from the truth. The GPON chassis is accompanied by a management workstation that presents a GUI and CLI for configuration purposes. The ability to manage bit, port, and power levels across the system, in

	VLANs and groups, and down to individual ports provides performance assurance that is just not available in legacy switched network configurations.
“Transmit and receive bandwith rates are different…” and “Traffic is broadcast in downstream from OLT – ONT direction thanks to splitters”	This is correct but does not observe that GPON networks also support the 1550 wavelength. This wavelength is used when QAM video is injected for F-Series delivery via the distribution network. **GPON does not broadcast.** GPON distributes all downlink traffic through secure, virtual point-to-point connections. These point-to-point connections utilize AES-128 encryption between the OLT and ONT.
“As most IP phones are equipped with a four port ethernet switch, these switches are left as unconnected islands”	A GPON ethernet port that connects to a VOIP phone operates in the same fashion as a traditional switched network. If the ONT is configured in support of QOS for the VOIP connection, it will support that bit rate. If additional port capacity is needed is is a simple matter of configuring the port capacity for the required services. The architect will want to consider the impact of additional ports to the QOS across the segment.
“Each endpoint or desktop requires an ONT”	ONT location is optional and based on design preferences. If the location in question prefers high density 10/100/1000 ONT’s mounted on shelves in IDFs, in-ceiling enclosures, in or on-wall enclosures, or on the desks or some other mix, it is purely up to the systems architect.
“Bandwidth is shared per splitter”	GPON bit rates are configured according to QOS requirements for given services. A fully integrated GPON network actually reduces the number of disjointed network management systems and bandwidth requirements within a data center or wiring closet. GPON provides convergence of voice, data, IP and RF Video, POTS, security, surveillance, VTC, alarms, environmental systems and access control systems over a single network utilizing the advanced security features of QoS, class of service and VLAN mechanisms.
“Power over Ethernet is not supported resulting in IP phones and WLAN access points needing 120V outlets”	Incorrect. GPON ONTs are available with PoE, both in low power IEEE 802.3af and high power IEEE 802.3at standard configurations. The GPON configuration can also provide guaranteed power management or elimination of POE. Broadcast storms from loopback cables are also eliminated via a 5ms default port shutdown and non-conductive fiber.
“Encryption is used …thanks to the broadcast nature of GPON”	**GPON does not broadcast**. AES128 is used for security purposes.

GPON Power Consumption in a 2500 node network

Lippis again misleads readers. Using the same assumptions, we assert that the proper configuration can be implemented with a single AXS 1800 and 625 ONTs versus the 2500 that were configured. Additionally, ONTs having densities as high as 24 ports can be utilized. For comparative purposes, this configuration represents a qualified comparison versus the position that Lippis took. This presents a dramatically different story as indicated below:

GPON	Equipment	QTY	WATTS
Core Switch	Cisco 7604	1	836
OLT	Motorola AXS1800	1	1,275
ONT	Motorola ONT 1120GE	625	7,969
GPON Total			**10,080**
Switched Network Solution			
Core Switch	Cisco 7604	2	1672
Distribution	Cisco 4503-E	2	1448
Access	Cisco 4510R-E	16	15571
Switched Network Total			**18,691**

Since the OLT backplane can be split and the chassis can accommodate up to 7,168 ethernet ports or 3,584 per half chassis, there are no claims regarding redundancy or configuration comparison. LAB based energy studies have shown that an Optical LAN network consumes up to 80% lower power when compared to Active Ethernet networks. In general, As the table above indicates, Active Ethernet users command 7.476 Watts per port and are within the range of 8W to 12W industry average per user port power utilization. A GPON configuration as above consumes 4.032 Watts per channel again within the industry range of 2.0 W to 5W power consumption. The data from this properly configured network is within the industry claims and defeats the Lippis assertion of “paradoxical “.

PON simplifies the network design by eliminating the Ethernet distance restrictions and equipment hierarchy that plague traditional Enterprise LANs. PON networks reduce space requirements by 90% through convergence of network service to a single smaller medium that supports higher density of users. In 2012, the cost of copper cabling is at an all-time high while fiber prices continue to decline. A major advantage that GPON has over legacy active Ethernet is the ability to easily control bandwidth for every user port. Provisioning bandwidth provides the ability to establish Service Level Agreements (SLAs) that guarantee bandwidth as required for each port and user. If desired every user can be guaranteed a minimum amount of bandwidth and bursting rates up to 1Gps.

Lippis concludes the desktop performance by stating that the "..GbE network offers higher desktop performance and lower overall network power consumption than GPON." **This claim is patently untrue.**

PoE was not included in the analysis for good reason. A GPON network supports PoE in low power IEEE 802.3af and high power IEEE 802.3at standard configurations on all ports of the ONTs and the capability to manage total power draw or on/off. Solutions for a centralized DC power system that manages the PoE power and UPS/backup power for these devices also exists. ONTs utilize power bricks to convert available AC to 12, 24 and 48 VDC, as such these devices are capable of operating in the emerging Microgrid or in-building distributed DC plants.

IP UtiliNET has previously issued a primer document entitled "LANvisn Clouds". The primer can be found at; http://www.slideshare.net/iputilinet . The following power comparison and related information is taken directly from that paper:

➔ GPON - A Technology Advance that Eliminates Significant Cost

The networking industry sells comparative data that is designed to encourage you to spend incrementally. Demand for network services is increasing exponentially which is driving increasingly shorter upgrade, replacement, and augmentation lifecycles. While this may be great for companies that are in the business of providing distribution switches, cables, cooling systems, and energy, it is highly disruptive to your budget, your staff, and it is detrimental to your profitability. In 2008, Cisco published a public information paper entitled; "Ethernet Power Study of Cisco and Competitive Products". We extracted the HP and Cisco comparative data and added a current generation column:

	Current LAN gear - SUNSETTING		LANvisn™ CONNECT
	HP ProCurve 3500yl	Cisco 3750-E	IP UtiliNET LANvisn™
Power per switch	212 W	143 W	NOT NEEDED
Power in a 3 switch rack	636 W	429 W	NOT NEEDED
Heat dissipated in BTU (1 watt = 3.41 BTU)	2168.76 BTU	1462.89 BTU	NOT NEEDED
Power consumed in cooling 1 BTU	.105 W	.105 W	NOT NEEDED
Power consumed for cooling	227.71 W	153.60 W	NOT NEEDED
Total power consumed	863.71 W	582.60 W	NOT NEEDED
Cost per Kwh	10 cents	10 cents	NOT NEEDED
Cost per day	$ 2.07	$ 1.39	NOT NEEDED
Cost per year	$ 755.98	$ 510.36	COST ELIMINATION

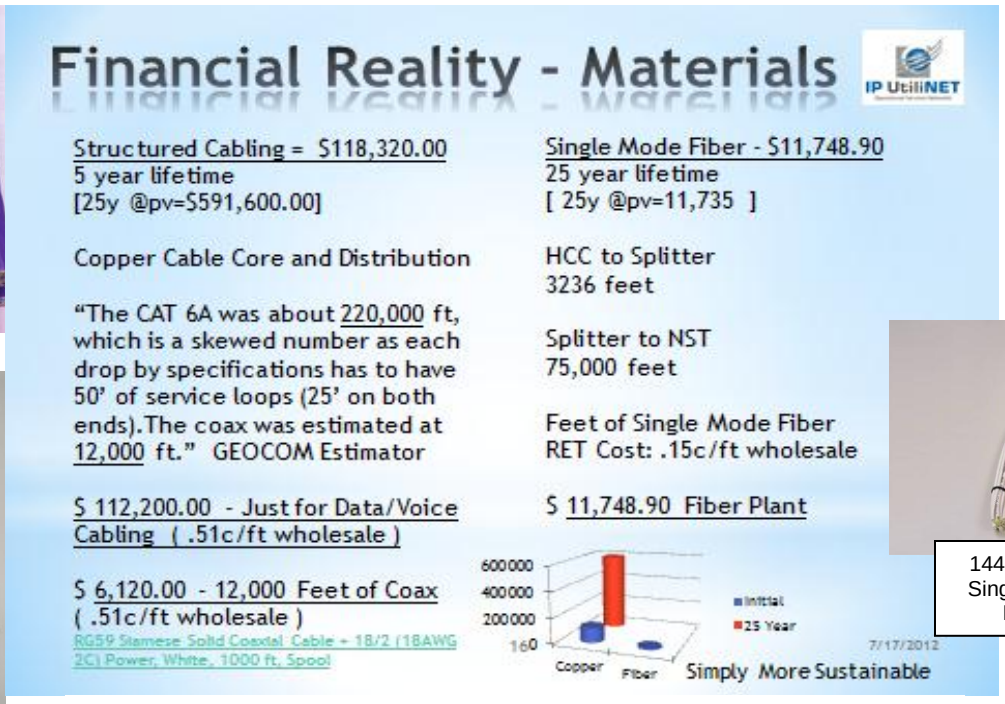
Is it better to save $245.62 incrementally (diff. in cost per year) or will your stakeholders vote to eliminate cost altogether? Is a decrease in power consumption better or is net elimination preferred? Is it better to decrease the carbon emission by close to a ton as in the example above – or is it better and more sustainable to eliminate the cooling needs completely? Current generation GPON based networks provide significant cost elimination as described herein are simply more sustainable.

Lippis also incorrectly asserts that building automation systems are “not afforded to GPON installations”. This is another misleading statement. The truth is that a GPON system is so extensive and so adaptable that any range of sensors and energy management systems can be connected and isolated at the bit and port level. In fact, unlike a switched network which wastes ports when delivering low bit rates a GPON architecture supports QOS in the K range. This means that a 10/100 24 port ONT can be managed at a port level to 2K or whatever bit rate is required by a sensor or it can be extended by DIN Rail components further eliminating long runs of two wire cabling. Additionally, due to the extensive 20KM range of GPONs, the capability to manage indoor and outdoor sensors of any type consistently throughout a campus exists. Intelligent Power management at the campus or individual property level is now a matter of defining a desired class of service.

➔ Cabling Cost

Recently, IP UtiliNET provided a competitive cabling cost for a GA based education institution. In addition to the cabling, the configuration below eliminates 7 racks of equipment from the plant.

144 Strands (ea) CAT 5



144 Strands Single Mode Fiber

Cat 6 = 39 lbs Per 1K feet

Compare to SM Fiber: 4 lbs Per 1K feet

The Lippis paper again incorrectly judges another critical factor when the claim of "The cable plant is equal, comparing CAT5 and fiber". Lippis also states that installers are more comfortable with copper just as technicians of the past were more familiar with rotary dial phones. Learning to connectorize single mode fiber can be completed in less than a day. Unlike the days of fusion splicing and brittle fiber, current bend insensitive single mode fiber is connectorized using tools such as the Corning mechanical CAM pictured on the right. The CAM is handheld and does not require a work surface.

Cable plants cannot scale in the same manner that fiber does. The Lippis paper asserts that "cable plant is a one-time capital cost that is recouped over time". We disagree with this assertion as cable plants and standards are constantly evolving – CAT3,5,6,7 …etc. Copper is physically limited in capacity, and getting **larger** in diameter unlike fiber which is currently limited by the lasers that are in use.

➔ GPON vs. GbE Network Design Attributes

Point 1: GPON offers a Lack of Network Design Flexibility

The physical layout of a GPON network is a point to multi-point aggregation core. The paper claims that reliability and performance difficulties have been reported by customers yet offers no specifics. There is not a way to validate these claims and no factual data to support the statement in the Lippis paper. If this is in fact the case, why would some 800 carriers now be using some form of PON technology? Carriers are known to seek the most reliable, durable, and scalable solutions in the market and do so for performance and supportability reasons. PONS are simply making their way into the campus environments almost 12 years after carriers first began to use PON technology.

Point 2: Ethernet Networking Scales

"Another misleading statement from the Lippis paper; "GPON networks do not allow for mixed speeds; every user gets the same bandwidth independent upon need."

GPON ports can be managed at the bit, port, and power level and as with any network, devices can be connected at any tier of the network fabric. GPON is especially scalable when splitters are used at the core and expansion is required at the edge. The simple act of removing the strand of fiber that goes to the floor or building and connecting that strand to a GPON port then adding a splitter to the other end allows the same cable that may have previously served a single ONT to now serve 128 or more without running additional riser or plenum cabling. The entire mid-span is infinitely configurable and when used with solutions from companies such as Sumitomo (www.futureflex.com) the scalability in vertical and horizontal implementations offers to dramatically alter future budgets. Copper based switched networks that have served data are 25 years old and heading toward their end of usable life just as bag phones, rotary dial phones, 1939 Fords, and Buggy Whips did.

Point 3: GPON Network Capacity

All networks have constraints and bottlenecks and when assumptions focus on a single product – the ONT 1120GE which is the low end of the multi-port ONT products and then shift the discussion to the upper end of the Cisco line with the Catalyst 6500-E appearing for the first time in this paper it is fairly simple to put some topspin on the discussion. Let's look at this a bit further and look at capacity for real.

Every manufacturer including Cisco makes a range of switches or ONT products that offer different capacities, thus we can rule out the first claim of ONT performance. The second claim is the optical fiber power budget**. The link loss budget is 29.5db over 20 Kilometers or 12.4 MILES**. Let's see copper cable or multimode fiber do that. The link loss budget is an architecture concern that parallels Crosstalk, Magnetic interference, and attenuation – all common factors in copper cable plants. Third is the backplane capacity of the OLT. Really? Mr. Lippis has been reading the technical documents but again proves that there is no real experience in this emerging market. From the Motorola technical spec; "*Line rate performance with 200Gbps switching fabric; 10Gbps dedicated to each switch and line card*" The 200Gbps switching capacity is based on a single line card which provides input connection from the core switch. Each line card has 6 ports and can handle up to 6 1Gb connections or 2 10Gb connections. A switch rate of 200 Gbps is more than sufficient for 6Gbs of incoming internet connectivity. The Line cards hand off to the chassis which has 10Gb interconnects. Overall, the chassis supports 25 Terabits of throughput capability and sports a completely balanced non-blocking backplane. The backplane can be split and additional chassis can be added to a campus configuration without massive add-on hardware and software costs. Where capacity, scalability, performance, or geographic challenges demand additional chassis, the Motorola Enterprise Management System (EMS) runs on a 1u Sun Sparc Server and ships with licenses for at least 5 or alternatively 50 OLT. The Tellabs EMS runs on your selection of chip and OS and ships with licenses for 10 OLTs - both providing coverage for 483 square miles. A functional characteristic of OLTs are split backplane, scalability in the same cabinet, scalability geographically, and use of the same EMS.

Point 4: GPON's Very Dumb Access Devices

ONTs are media converters that terminate the fiber in a GPON system and convert that fiber to RJ11, RJ45 (IEEE 802.3 standard), and F-Series connection types. These connections support analog phone, CATx wiring, and Cable Television or Analog cameras and other services as needed. Some ONTs to include indoor/outdoor support four wavelengths of light; 1310 nm voice/data transmit, 1490 nm voice/data receive, 1550 nm video receive and 1590 nm for video return path while still others such as the 1:1 RJ45 only. QOS is available for bit rate, port rate, and power level and can be status monitored through the addition of statistics collectors. POE is choice based and unlike POE switches in which "some" of the ports are actually usable GPON POE port configurations with quad,16, and 24 port are available today.

Point 5: Lack of Troubleshooting Tools

In 1990 one could have made the same claim for switched networks. The facts today are that GPON is a rapidly emerging technology just as switched networking was at one time. There were no tools, there was a limited workforce, and there was and continues to be a lot of vendor finger pointing. The vendor finger pointing is derived most frequently from the network fragmentation and the difficulty of diagnosing

the mix of intelligent core and rats nest of physical distribution. The best troubleshooting tool is elimination of the copper and distribution switches and a transformation of the skills to services that users are demanding. When was the last time a vendor sat down for a voice discussion and talked about fixed, mobile, portable, and vehicular capability? Have any of your vendors really had a discussion relative to use of PBX, use of Open Source such as Asterisk, Virtual Voice services, or integrated push to talk with two way radio interoperability? Have any of them had a rational discussion about IP Video, Broadband Video, and/or Digital Signage to include Facial and badging biometric systems that integrate with building automation and other services that are currently limited by the data only characteristic of switched networks?

Point 6: Too Many Single Points of Failure

A 2 inch loopback cable installed in a switched network wallplate can disrupt an entire network and in some cases damage the core. A new fluorescent lamp or power run can cause attenuation. Any 200 foot or 1200 foot at a time switch or any uplink in the 4 repeater run of switches can go down. Any power supply can go down taking with it all of the ports that operate from the switch. Every network – Water, Electricity, GAS, Sewer, Switched, and GPON, Cable TV, Twisted Pair has points of failure. PON networks are the choice of carriers today and that is truly where the discussion stops. If PONs were not dependable, did not reduce cost, and did not provide reliable service, the carriers would not be relying upon them as they do today.

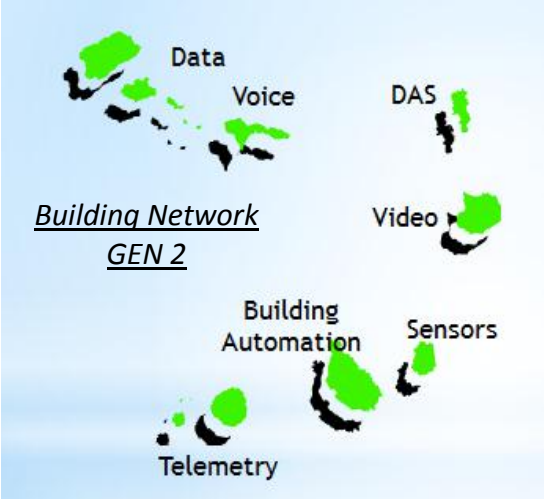
➔ Closing Remarks

Budgetary pressure starts with a hard look at personal budgeting. Communications and related technologies consisting of Cellular, Telephone, Cable TV, and Internet services consume the bulk of an individual budget today. Each of these technologies has arrived in the last 25 or so years. Your personal budget is a microcosm of your business, state/local, and federal budget. GPON represents a transport medium that consolidates these expensive and fragmented services while opening the market to converged services, new monies for competitive service acquisition, and reduced consumption. GPON is lower in capital acquisition cost, power consumption, cooling requirements and overall operational cost. In a business environment with a 3-5 year depreciation schedule a GPON network will become free while switched networking will continue to erode your budget and limit your ability to shift monies from consumption to services. Troubleshooting tools and technician skill sets are evolving in the same manner that skills for switched networking have evolved over the last 20 and more years.

Switched networks limit the user to Ethernet based data while GPON opens new vistas for converged multiservice network capabilities. Monies that have formerly been spent on consumption and fork lift upgrades can be freed up for use in core consolidation and high performance cloud and edge solutions that provide services across the domains of fixed, mobile, portable, and vehicular access.

GPON is an Ethernet transport architecture and happens to support more capability due to the scalability and capacity of the fiber plant that interconnects the edge user to the core system.

Today's Networks are costly and wasteful "islands of connectivity"



Since 1970 budgetary decision makers have been conditioned by technical complexity, incremental innovation, and availability barriers to pay for communication and other "service layer" networked services as those services were desired and justified by lines of business, staff, and citizen demand. During this period, technologists evolved to building switched networks in support of client/server systems while other services were implemented using various types of cables and systems hardware. Switched networks have provided very efficient data communications and voice or VOIP was added in the very late 90s. Current CAT5,6, and 7 structured cabling networks provide data, voice, and IP Video for wired and wireless devices which are demanding more and more bandwidth. Broadband video services use thicker coax cabling. Switched networks helped to alleviate LAN traffic congestion but are limited in terms of carrying capacity, physical switch capability, and distance. Keeping up with increasing bandwidth requirements requires more money, more hardware, and more staff time chasing fragmentation, inefficiency and on-going forklift upgrades. Today's networks are limited by 300 to 1200 foot distance limitations and capability to support data. Other services are forced to operate on overlapping cable plants and this increases weight, risk, and cost for customers. GPON is limited to 20KM today, infinitely scalable and it just makes more sense in the long run.

I am GPON Enabled Today

Conclusion

Fiber Optics are the less costly investment for your local area and campus network because of its nearly limitless bandwidth capacity and ease of upgrade. LANvisn™ Passive Optical LAN technology is the next generation of network technology. It delivers significant cost reduction, energy reduction, and environmental benefit to customers choosing to move forward. For many, we are helping to address the question of how to move forward, while our customers make decisions on when.

We provide the capability to complement the migration to public or reduced cost sustainable wired and wireless technologies. We work with individual site and campus customers who seek to reduce acquisition, operations, and maintenance costs while delivering an increased level of performance services. In an era of budgetary consciousness, our team is focused on solutions that reduce budgetary consumption – or we are not having the right conversation.

IP UtiliNET is committed to maintaining leadership in multi-service optical networks through its "LANvisn™ Clouds" solutions program and it's "Academy for Industry" human capital certification and development program. IP UtiliNET's proven technologies, design expertise, quality driven processes, and operational depth ensure that its in-building and campus-wide multiservice networking solutions will enable customers to cost effectively reduce current switched network complexity, cost, and inefficiency.

For More Information

IP UTiliNET Network Services

PO Box 1802
Buford, GA
30519
USA

Email:
sales@iputilinet.com

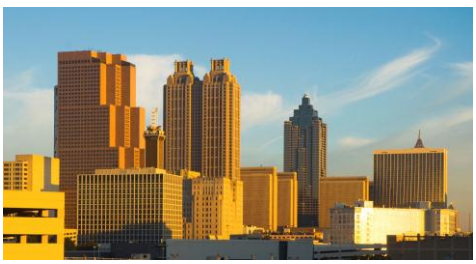
Website:
www.iputilinet.com

Tel: 877-901-6947

Fax: 678-954-6915

We are focused on solutions at the campus and individual building level. With a widening range of Federal, State & Local, and Enterprise customers we continue to excel through focused services to our customer base.

With a GO decision, we conduct the work and remove the excess for environmentally beneficial disposal.



Simple, Sustainable, Smart ….