tellabs™

Tellabs™ Passive Optical LAN Teams with DAS and Wi-Fi to Deliver a Modern LAN

The flood of employee smartphones, tablets, eReaders and other wireless devices is overwhelming enterprise IT departments.[1] In fact, chief information officers expect that mobile communications will be the most disruptive force in the enterprise in the coming year.[2] Globally, the number of wireless devices by year-end 2014 will exceed the number of people on Earth.[3]

The extraordinary growth of wireless communications, along with the associated demand for bandwidth, is putting a lot of pressure on LANs [Figure 1]. However, a high-performance fiber-based Tellabs™ Optical LAN (OLAN) infrastructure can relieve much of the strain caused by the wireless phenomenon.

Introduction

The proliferation of wireless devices and the resulting strain on the modern LAN are major concerns for CIOs and the IT staff members who manage Enterprise LANs. This paper offers an in-depth explanation of how a Passive OLAN — a simple, secure, stable, scalable, sustainable and smart option — can help improve enterprise wireless communications. The following major topics are included:

- Impact of Passive OLAN and wireless technologies on the modern LAN
- OLAN and DAS
- OLAN and Wi-Fi

Impact of Passive OLAN and Wireless Technologies on the Modern LAN

The services and applications supported by the Enterprise LAN have changed significantly over the past several years. As a result, LAN traffic patterns have shifted to reflect the rapid adoption of cloud computing and the dispersed geographic locations of home-based, regional, global and virtual employees [Figure 2].

While corporate hardware and software resources have relocated to the cloud and mobile employees now work remotely from almost any location, LAN infrastructure has remained the same. Racks and stacks of equipment still fill data centers and telecommunications closets; a tangled mesh of cabling still interconnects all of that equipment; and the complexity, intelligence, functionality and management of legacy copper-based LANs remain scattered across all the disparate endpoints [Figure 3].

Figure 1: Wireless networks challenged by extreme growth of devices and growth of bandwidth

Highlights

- By increasing the return on investment and lowering the total cost of ownership, a Passive OLAN helps offset the high cost of a distributed antenna system (DAS).
- The inherent advantages of the Tellabs OLAN solution, including lower costs and smaller energy and space requirements, help balance the impact of DAS.
- A Passive OLAN and a DAS Network can share the same power plant, power backup, fiber infrastructure and fiber management.
- Partnering with best-of-breed OLAN and Wi-Fi companies ensures a state-of-the-art LAN.
- A Passive OLAN enhances a Wi-Fi network's density and reach, thereby improving Wi-Fi performance and coverage.

1 http://www-935.ibm.com/services/us/gbs/thoughtleadership/softwareedge/
2 http://www.fiercemobileit.com/press-releases/gartner-executive-program-survey-more-2000-cios-shows-digital-technologies
3 http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white_paper_c11-520862.html

Modern Enterprise LAN Services/app	Optical LAN and Wireless Similarities
Resources, services and applications are shared (e.g., cloud, private cloud)	Shared Point to Multipoint Architecture
Resources, services and applications are centralized (e.g., cloud, private cloud)	Centralized Intelligence (thin client endpoints) and Management is Centralized
Employees access corporate resources remotely (e.g., located at home, regional, international, virtual)	Shared Resources Software Defined Dynamically Allocated, based on Real-Time Requirements
Corporations fight security threats both internally (e.g., BYOD) and externally (e.g., Malicious Attacks)	A combined architecture of both OLAN and Wireless can result in the highest LAN security
Corporations seek to reduce energy, space and costs through the simplification of the LAN infrastructure	Reduced amount of cabling, equipment, space, energy and cost to build LAN infrastructure

Figure 2: OLAN and Wireless similarities relative to new Enterprise services and applications

CIOs and IT professionals have to deploy a new LAN infrastructure, one that is designed to keep pace with continuously evolving enterprise services and applications. The ideal LAN infrastructure combines wireless communications and Passive OLAN technology to simplify and centralize LAN intelligence, functionality and management.

The ongoing proliferation of mobile devices means that the LAN must support wireless communications. By doing so, the LAN is more scalable, consumes less energy, is simpler, takes up less physical space, requires fewer materials and helps reduce infrastructure costs. Passive OLAN technology, with its underlying fiber cable, can both backhaul wireless traffic and offload much of that traffic from the wireless network. Further, Tellabs OLAN technology, with its unparalleled stability, scalability and security, strengthens and enhances Enterprise communications.

The following section details the ways in which Passive OLAN technology augments both DAS and Wi-Fi networks to satisfy the requirements of modern LAN services and applications.

Passive OLAN and DAS Technologies

Rather than pairing a single large, powerful antenna with one baseband unit, DAS technology uses multiple, smaller and less powerful distributed antennas to transport a signal back to the baseband unit; low-power radio nodes provide network access for wireless traffic. Commonly used to provide 3G/4G/LTE wireless coverage in targeted locations such as large buildings and campus environments, both indoors and outdoors, DAS technology moves radios and subscribers closer together.

Responding to subscriber demand for reliable wireless coverage, regardless of their location, inside or outside, DAS technology originally appeared in facilities such as sports stadiums and airports. DAS technology also delivers additional capacity in those facilities for voice and data calls. As a result, it now is expanding into other areas that have a concentrated demand for wireless communications, including convention centers, shopping malls, hotels, hospitals and college campuses.

Globally, DAS-related expenditures grew by 20 percent in 2013, with even higher growth rates in North America where service providers, such as Verizon, Sprint and AT&T, are leading spenders.[4]

Optical LAN and Wireless Similarities	Compared to legacy Copper-based LAN
Shared Point to Multipoint Architecture	Fixed Point to Point Architecture
Centralized Intelligence (thin client endpoints)	Distributed Intelligence (thick client endpoints)
Centralized Management	Local Management at disparate equipment locations
Shared Bandwidth Software Defined Dynamically Allocated, based on Real-Time Requirements	Fixed Dedicated Bandwidth
Shared Resources Software Defined Dynamically Allocated, based on Real-Time Requirements	Fixed Dedicated Resources

Figure 3: OLAN and Wireless in contrast to a legacy copper-based LAN option

[4] http://www.fiercewireless.com/story/madden-das-under-hyped/2013-09-25

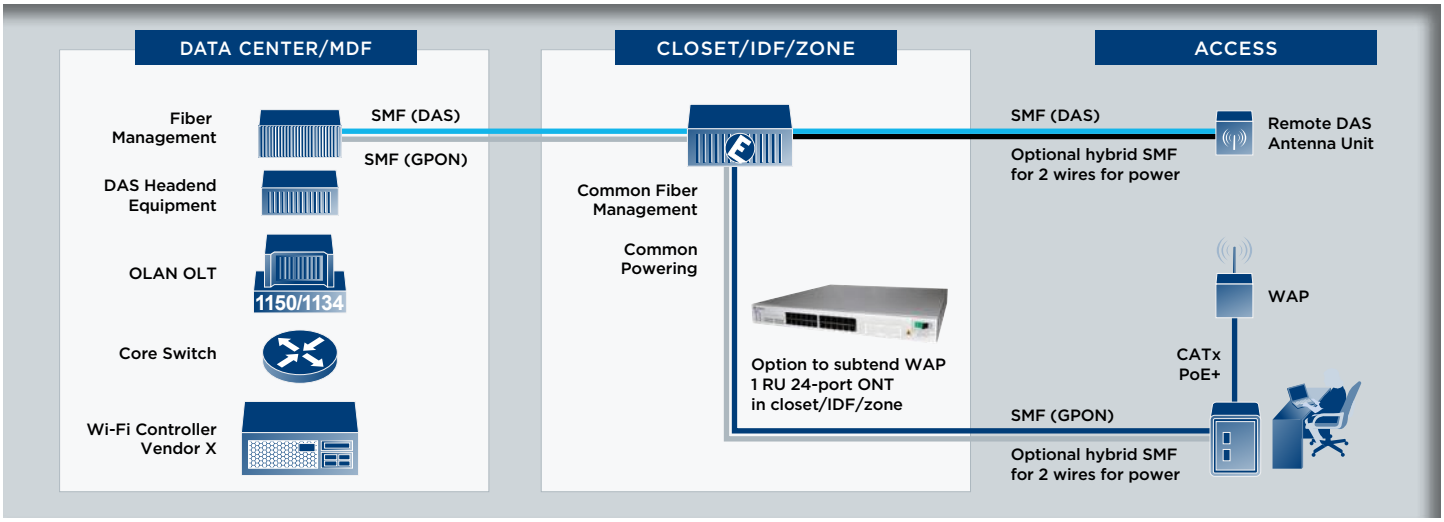

Figure 4: Fiber-based DAS solutions and Optical LAN architecture

Although DAS technology enhances the reliability and coverage of wireless communications, it also presents some challenges. 1) It is expensive to install. 2) A DAS network only does one thing — provide additional coverage and capacity in targeted locations; it is not possible to converge other LAN services onto a DAS network. 3) Facility owners clearly understand that a) their customers expect reliable wireless coverage outside and inside the facilities, and b) if they do not get it, they will blame the facility owner. Nevertheless, most, if not all, facility owners argue that paying for a DAS network deployment is not their responsibility.

How can a Passive OLAN help a DAS Network?

The DAS network is evolving from an infrastructure based on rigid coax copper cable to one based on single-mode fiber (SMF) — the same fiber infrastructure used by the Passive OLAN. Consequently, the Passive OLAN and the DAS network not only can leverage the same SMF cabling but also can use the same bulk power plant, power backup and common cable management, thereby delivering additional cost savings for the facility owner. The facility owner also can combine the powering and power backup because a 56 VDC bulk N+1 AC-DC rectifier serves both the ONTs and DAS remote units. Further, both the ONTs and the DAS remote units can use the same battery backup and/or backup power generation.

Note that composite SMF, which includes two copper wires for power, can be used to power both the ONTs and DAS remote units. Because the enterprise already has cost-justified the OLAN's optical distribution network, the incremental real estate required for the DAS network's fiber management is more reasonable. The two technologies can share the main distribution frame, intermediate distribution frame and other fiber-management enclosures.

How Does a Passive OLAN + a DAS Network Help Businesses?

The inherent advantages of the Tellabs OLAN solution help counterbalance the overall costs of deploying and operating a DAS network. Relative to a legacy copper-based LAN, the Passive OLAN uses less energy, occupies less space and incurs lower CapEx and OpEx costs [Figure 4]. By bundling the Passive OLAN and the DAS network, the enterprise can take full advantage of an all-fiber infrastructure.

Specifically, if the enterprise can cost-justify the SMF infrastructure for a Passive OLAN, then the enterprise can use the excess fiber to install the DAS network as an overlay to the Passive OLAN. Note that the 3G/4G/LTE wireless traffic does not travel over the Passive OLAN's optical network terminals (ONTs) and across the optical line terminal (OLT). Rather, the 3G/4G/LTE wireless traffic uses spare fibers to travel over the DAS equipment.

As noted earlier, the Passive OLAN-plus-DAS network combination delivers cost efficiencies in terms of using the same SMF cabling, bulk power plant, power backup and common cable management. These cost efficiencies enable the enterprise to achieve a higher return on investment (ROI) and a lower total cost of ownership (TCO) for the DAS network than would have been possible without the Passive OLAN. The higher ROI and lower TCO, in turn, help offset the high costs of the DAS network's fiber infrastructure.

Passive OLAN and Wi-Fi

Wi-Fi is a LAN wireless solution, implemented mainly to untether employees from their desktop computers and give them mobile access to Enterprise LAN resources, services and applications. Other corporate resources, such as building security, automation and environmental controls, also use the Wi-Fi network. In addition, Wi-Fi is the foundation of the enterprise Bring Your Own Device (BYOD) policy, which allows employees to use their own computers, tablets, smartphones and eReaders on the enterprise premises.

A University of Washington Wi-Fi study illustrates the proliferation of mobile devices accessing the LAN via Wi-Fi [Figure 5]. In the fall of 2013, a total of 112,639 unique devices accessed the campus Wi-Fi network, marking a 26 percent increase in handheld devices over the preceding year. During the same time period, the University of Washington Wi-Fi network hosted 65,000 new users. The combination of these two data points reveals that each user had more than one Wi-Fi-enabled device, i.e., 1.7 devices per user. These statistics are not limited to the University of Washington campus; the same trends are apparent across all commercial enterprises, government organizations, healthcare facilities and hospitality businesses.

Wi-Fi is standardized in the IEEE 802.11 specification, with IEEE 802.11 a/b/g/n evolutions providing bandwidth ranging from 6 Mbps to 54 Mbps [theoretical capacity] and design guides calling for 24-Mbps backhaul for such wireless application protocols (WAPs). The high-capacity IEEE 802.11 ac/ad evolutions [dual radio state] provide bandwidth ranging from 88 Mbps to 600 Mbps [theoretical capacity] and design guides calling for 300-Mbps backhaul for such WAPs.

Note that gaps exist between theoretical and real-world performance. The IEEE 802.11n theoretical air interface maximum is 54 Mbps, and design/planning guides call for 24-Mbps Ethernet backhaul throughput. The IEEE 802.11 ac/ad [dual radio state] theoretical air interface maximum is 600 Mbps, with backhaul throughput expected to be 50 percent. Improving Wi-Fi performance is not simply a matter of shrinking the service area by increasing the number of WAPs. Because Wi-Fi is highly susceptible to interference from Wi-Fi signal overlap, radio frequencies, lights and other electronics, optimizing the network to minimize interference requires a balancing of these factors.

Another concern is Wi-Fi's inherent security vulnerability. It is relatively easy to break into Wi-Fi networks and even to use them to hack into wireline networks. Consequently, LAN operators must deploy strict wireless security safeguards and practices.

Finally, Wi-Fi's inconsistent connectivity reduces overall network stability. Wi-Fi connectivity issues stem from too many devices simultaneously accessing the Wi-FI network, their distance from an antenna and/or interference. Regardless, whether one employee is affected or all employees are, network downtime costs businesses money.[5]

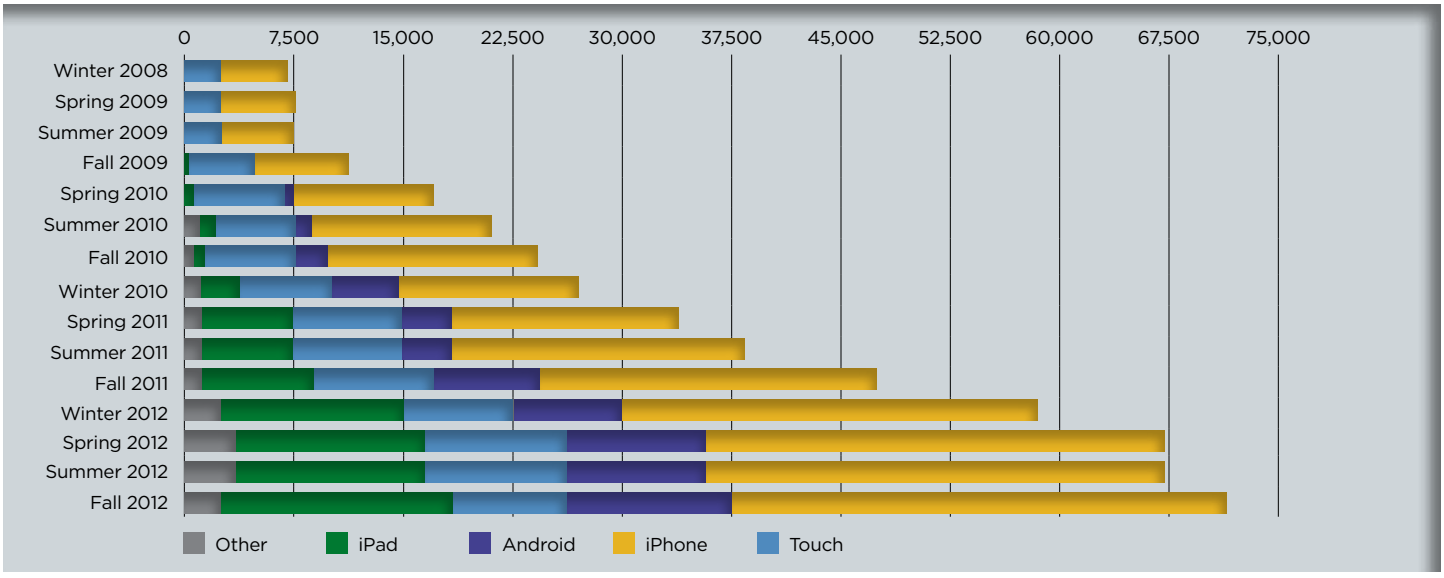

Figure 5: University of Washington Wi-Fi study illustrates the proliferation of mobile devices accessing the LAN via Wi-Fi.

[5] http://www.emersonnetworkpower.com/documentation/en-us/brands/liebert/documents/white%20papers/data-center-costs_24659-r02-11.pdf

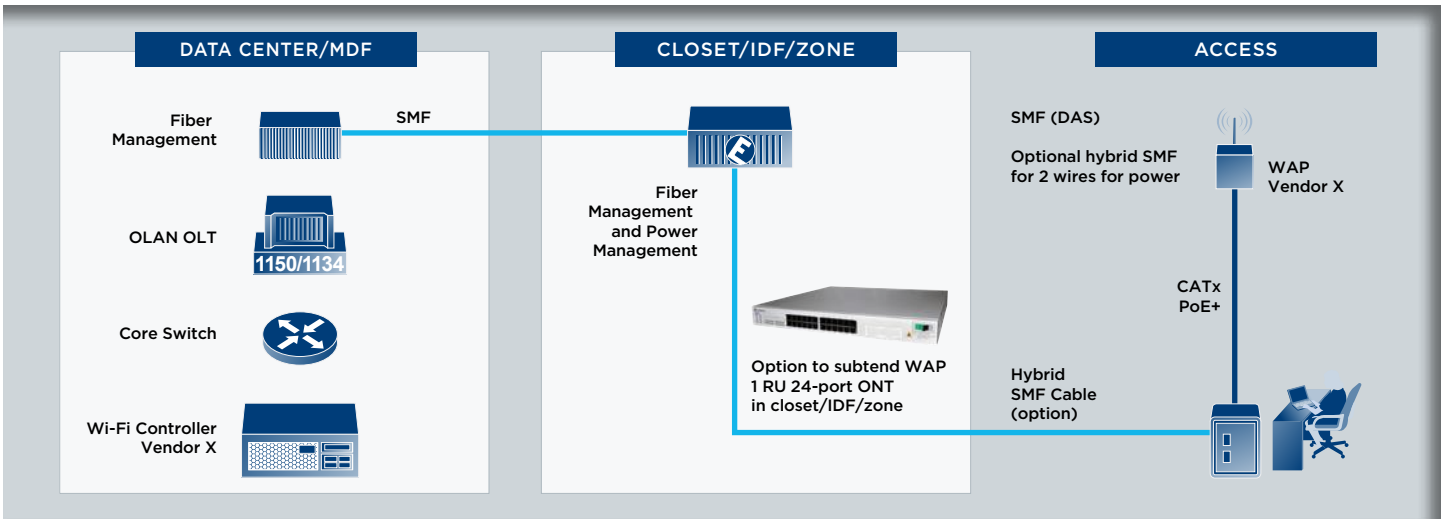

Figure 6: Fiber-based Wi-Fi solutions and Optical LAN architecture

How Can a Passive OLAN Help a Wi-Fi Network?

A Passive OLAN can backhaul WAP traffic, transporting the Wi-Fi traffic over the Passive OLAN's ONTs and back to the OLT for hand off to the Wi-Fi controller [Figure 6], with Gigabit Ethernet interfaces, for example, RJ-45, providing the connections. Using advanced VLAN functionality, the Passive OLAN segregates the Wi-Fi traffic and applies strict traffic-management parameters with hard quality of service (QoS). The Passive OLAN's support for Link Layer Data Protocol (LLDP) allows software-defined, automated configuration, power management and power monitoring for the subtended Wi-Fi WAP. Further, the ONT powers the WAPs via power over Ethernet (PoE) (IEEE 802.3af) and PoE+ (IEEE 802.3at), including Class 4 negotiations. By taking advantage of the Passive OLAN's capabilities, the Wi-Fi network can achieve better density and greater reach for improved performance and coverage. In addition, when compared to legacy copper-based LANs, this converged network reduces both CapEx and OpEx costs.

How Does a Passive OLAN + a Wi-Fi Network Help Businesses?

A principal Tellabs business strategy is to partner with Wi-Fi experts — established vendors of advanced controllers. By working closely with best-of-breed wireless equipment providers, Tellabs satisfies the requirements of the most demanding markets, such as healthcare, hospitality and education. Tellabs conducts interoperability testing with the leading Wi-Fi manufacturers to confirm that voice, data, video, automation, security and environmental services perform flawlessly. For example, having completed interoperability testing with Aruba Networks, Tellabs now is conducting the same testing with Ruckus Wireless.

The Wi-Fi controller, the brains of an intelligent Wi-Fi network, provides several crucial functions, including:

- Detection and avoidance of interference,
- Load-balancing multiple access points for better coverage and throughput,
- Coverage hole detection and correction, and
- Access authentication.

Today, the Tellabs Passive OLAN solution is functioning in commercial deployments, along with equipment from Cisco Systems, Aruba Networks, Ruckus Wireless, Meraki (now owned by Cisco) and Meru Networks.

A Passive OLAN can help improve enterprise communications efficiencies and costs by offloading traffic from the Wi-Fi network, i.e., both the number of subtended devices and their associated bandwidth. By taking on this traffic, a Passive OLAN can enhance the stability and security of the offloaded Gigabit Ethernet connections.

Further, by providing "five 9s" (99.999% uptime) network availability, a Passive OLAN significantly improves network stability, resulting in an annual unplanned downtime average of only 5.26 minutes. When deployed with an Optical Distribution Network architecture that includes full service access network (FSAN)-type-B PON redundancy, a Passive OLAN can provide "six 9s" (99.9999%) network availability, or only 30 seconds of unplanned network downtime per year.

Traffic is more secure on a Passive OLAN than on Wi-Fi because fiber is not susceptible to interference. Physically tapping fiber is more difficult than it is with other media, and stateful OLAN protocols preclude undetectable malicious taps. Robust security, including encryption, protects a Passive OLAN at the physical, data and user layers.

Summary

The skyrocketing growth of wireless communications, combined with the associated demand for more and more bandwidth, is straining the capabilities of today's Enterprise LAN. Although implementing a DAS and/or Wi-Fi network is a potential strategy for strengthening and modernizing the LAN, each of these technologies presents its own challenges. However, by combining the Tellabs Passive OLAN technology with DAS and with Wi-Fi, the enterprise can overcome these challenges and deploy a state-of-the-art, end-to-end LAN capable of supporting current services and applications. A simple, secure, stable, scalable, sustainable and smart option, a Passive OLAN lays the foundation for the modern LAN.

Next Step: For more information about Optical LAN being simple, secure, stable, scalable and costing less, please contact your local Tellabs sales representative or local Tellabs sales office at the phone numbers below, or *visit www.tellabs.com/solutions/opticallan/*.

Take the next step. Contact Tellabs today.

+1 800 690 2324
+1 630 798 9900
www.tellabs.com

1415 West Diehl Road
Naperville, IL 60563
U.S.A.