# Optical LAN Equips Marines to Address NetworkingDemands of Today and Tomorrow

The primary responsibility of the Marine Corps Recruit Depot (MCRD) in San Diego is to make Marines out of all male recruits who come from the western half of the United States. Day in and day out, drill instructors across the 388-acre base put each batch of recruits through a 12-week course, focusing on classroom instruction, martial arts and weapons, and field training. Each year, nearly 18,000 newly minted U.S. Marines graduate from MCRD.

One of the largest employers in San Diego County, MCRD has more than 900 civilian employees; about 1,200 Marines, 500 of whom are drill instructors; 100-plus sailors and about 120 members of the U.S. Coast Guard.

In today's interconnected world and with the need for near-real-time coordination, the staff of MCRD San Diego requires access to voice, video and data to support the recruit training mission. The depot currently provides this mission support with 1,200 workstations, 300-plus peripheral devices such as printers and scanners, 1,200 phones, 36 projectors and 12 videoconferencing devices. A staff comprising 29 Marine civilians, 2 Marines and 13 contractors supports these capabilities.

## Leading the Marine Corps March to Passive Optical Networking

The aging telecommunications infrastructure at Marine Corps installations is inadequate for supporting current and future telecommunications requirements, according to a 2010 Statement of Need from the USMC Base Telephone Infrastructure (BTI) organization. First installed in the 1940s, the original structured cable at MCRD San Diego, still in use, consists of multistrand copper encased in lead shielding. While this was state-of-the-art technology 75 years ago, the passage of time has compromised the integrity of the lead shielding, leading to signal degradation and loss. As a replacement for the poorly performing copper, many sites, including MCRD San Diego, began installing single-mode fiber optic cabling to support their data services. The BTI program has begun to take advantage of the existing single-mode fiber optic backbone by deploying a Passive Optical Networking (PON) solution for the Marine Corps Unified Communications network.

The driving force behind this effort is the Joint Information Environment (JIE), a modernization framework announced by the U.S. Department of Defense (DoD) in 2012. Still evolving, the JIE ultimately will converge all U.S. military communications, computing and enterprise services onto a single platform that can support all DoD missions. According to the DoD, the primary goals of JIE are "to make the Department more effective and secure against cyberthreats … and to reduce the cost associated with the Department's overall information technology infrastructure by simplifying, standardizing, centralizing and automating infrastructure at the enterprise level."

In response to a JIE directive issued by the DoD and the result of transitioning from the Navy Marine Corps Intranet (NMCI) to Next Generation Enterprise Network (NGEN), the Marine Corps developed its Marine Corps Enterprise Network (MCEN) Unification Plan, which specifies optical networking as one of the foundational technologies. The future MCEN must support unified capabilities, which the Unification Plan defines as the integration of voice, video and data services delivered across an interoperable, secure and highly available network infrastructure that is technology agnostic. Interoperability means the ability of systems, units or forces to provide data, information, materiel and services to other systems, units or forces and accept exchanged data, information, materiel and services to enable them to operate together effectively. National Security Systems

(NSS) and Information Technology System (ITS) interoperability includes both the technical exchange of information and the end-to-end operational effectiveness of that exchanged information as required for mission accomplishment. (CJCSI 3170.0G1).

In 2014, the Director C4 and Deputy Commandant, Installations and Logistics determined that optical networking is the preferred technology for satisfying the requirements for future infrastructure IT projects.

Within the past year, MCRD San Diego has led the Marine Corps transition from Marine Corps Enterprise Network (MCEN) traditional active-Ethernet technology to GPON-based Optical LAN (OLAN) technology. While not alone in this endeavor, it is the first active Marine Corps base to make the data transition, following the OLAN deployment at Marine Corps University and a number of Navy hospitals. The long-term objectives for this Marine Corps-wide transition mirror those of the JIE, that is, to 1) integrate current network technologies with future technologies to provide unified capabilities; 2) reduce capital expense (CapEx) and operating expense (OpEx) costs; 3) enhance cybersecurity and 4) ensure that Marine Corps personnel in both garrison and tactical environments have seamless access to information.

The replacement and modernization effort seeks to maintain versions that the original equipment manufacturers (OEMs) will support and that maintain current Defense Switched Network (DSN) interoperability and Information Assurance (IA) certifications, as tested by the Joint Interoperability Test Command (JITC) under the authority of the Defense Information Systems Agency (DISA). To ensure future interoperability, contract language requiring that OLAN equipment have JITC certification is required under DoD Instruction 8330.01. With JITC interoperability certification, Tellabs equipment fully complies with these stringent requirements.

## Why Pay for Older Technology When Optical LAN Is More Cost-Effective?

MCRD San Diego completed an infrastructure study resulting in a cost of $3.6 million to upgrade the base's existing copper-based active-Ethernet LAN using a traditional approach in order to support the Unified Communications (UC) requirements. However, the Assistant Chief of Staff for Communications, Infrastructure and Services Directorate and the IT staff recognized GPON technology's inherent UC capabilities and its ability to save money, compared with traditional LAN technology. They challenged the Marine Corps plan to invest in traditional technology, given that GPON technology could achieve the same objectives but at a much lower cost.

Subsequently, the Marine Corps not only approved the change but also looked to MCRD San Diego to become the proving ground for complete deployment of GPON on a Marine Corps base. To date, 18 Marine Corps facilities worldwide have received GPON technology, but MCRD San Diego is the first to use it to meet all of its data requirements; thus far, most of the other 17 installations have only used it for voice service.

## A Simpler Network Delivers a Wide Range of Benefits

A fiber-based GPON solution is a simpler, more secure and easier-to-provision network than an active-Ethernet LAN. Basically, the OLAN collapses the traditional LAN architecture to reduce the amount of required equipment and cabling while also converging voice, data and video services into a single [fiber] medium. With its central management, the OLAN allows IT personnel to make adds, moves and changes more securely, quickly and easily than they could with a traditional LAN.

In terms of sustainability, a Tellabs OLAN providing fiber connectivity to the desktop produces fewer thermals and therefore delivers energy savings of up to 80 percent compared with traditional copper-based LANs. Its passive architecture requires no power within the *optical* distribution network, i.e., the physical fiber and optical devices that distribute signals to end-users. Further, the OLAN's need for less equipment than a copper-based LAN has a domino effect on many other power-related areas, including distribution and switching gear, conversion, backup, fire suppression and HVAC.

Although MCRD San Diego has deployed a closet-based OLAN solution, a desktop-based OLAN solution can reduce cabling, floor, rack and telecom closet requirements and therefore can save a lot of physical space as well. For example, a typical copper-based LAN serving up to 2,000 users requires 90 rack units of space. Active-Ethernet LAN switches require one full rack for the switches and two additional racks for terminating the large bundles of copper cables associated with the switches — for a total of 18 seven-foot-tall equipment racks.

By contrast, a single Optical Line Terminal (OLT) chassis can serve up to 8,000 users, and because the OLT features 90 percent greater density than active-Ethernet switches, an OLAN requires only one equipment rack and a total of 11 rack units within the equipment rack. As a result, the OLT takes up less space to serve the same number of ports. Further, by reducing the amount of physical space required, an OLAN brings with it fewer UPS, fire suppression and HVAC requirements, which in turn reduce overhead costs. The PON splitters, if located in a wall-mounted fiber distribution hub (FDH) rather than in the telecom closet, can reduce the amount of required floor space even more.

In short, by reducing CapEx, OpEx and power costs, and by eliminating the need to refresh equipment and cabling, the Tellabs OLAN offers military and other government agencies, as well as civilian enterprise organizations, a significantly lower total cost of ownership (TCO) over 10 years, compared to a copper-based LAN.

## Technology That Enhances Secure Communications

Compared to a traditional LAN, the OLAN architecture is far more secure. With fewer nodes to manage, a centralized management design and the fact that there are no craft interfaces in the telecommunications closets, the OLAN significantly reduces the risk of network misconfiguration caused by human error. In addition, optical fiber is not susceptible to the electromagnetic radiation and interference concerns associated with copper wiring, and Optical LAN electronics are far more secure from intrusion than edge switches.

Also, Tellabs recognizes the need for secure communications within all military and government installations. Consequently, Tellabs has designed the OLAN to provide a comprehensive set of security options, ranging from advanced end-user authentication, deep packet filtering and optical encryption to secure remote management with IPSEC, IPv4/v6, SNMPv3, role-based access and security audits.

As mentioned above, Tellabs equipment is JITC certified, which means that it complies with the Secure Technical Implementation Guides (STIGs), a minimum security baseline established by DISA. In its deployment plan, MCRD San Diego satisfied these security-control requirements by using the element management system (EMS) central management console to establish a FIPS 140-2 encryption algorithm. The algorithm uses 128-bit Advanced Encryption Standard (AES), service segmentation throughout the network, consistent authentication and authorization policy through profiles/templates, port access control (PAC), Dynamic Host Control Protocol and built-in Intrusion Detection to protect against unauthorized device activity.

## Military Plans and Budgets Guide the Move to Full Optical LAN Capabilities

While the GPON-based OLAN allowed MCRD San Diego to avoid nearly 50 percent of the proposed $3.6-million outlay to upgrade its traditional LAN, the base is using the new infrastructure initially to support only data services. In the near future, either the Navy Command Telephone Service (NCTS) program or the BTI program will integrate a UC-compliant

voice solution with the GPON infrastructure so that MCRD San Diego can take full advantage of the OLAN's ability to converge multiple services on the fiber. Until that new equipment comes online, the base's aging, problem-plagued infrastructure must continue to deliver voice services.

At other bases that have OLANs, the Marines first deployed new voice switches and then installed PON networks — but only to support voice at first, with convergence of data to come later. MCRD San Diego, however, is using its OLAN only to support data at first because of the plan to install a new voice switch in the near future. Given the base's aging copper infrastructure, it would have been futile to deploy that new voice switch without the appropriate infrastructure to support it.

By installing the OLAN first, the Navy and Marine Corps now have positioned MCRD San Diego to deploy both voice and data on the converged OLAN infrastructure and logically separate them, as required, which is one of the reasons that they wanted to make MCRD San Diego a GPON proving ground for the Marine Corps.

Although MCRD San Diego was the first Marine Corps installation to deploy the MCEN data network over a GPON-based OLAN and in the near term will converge its MCEN voice services onto the same infrastructure, the Marine Corps Unification Plan calls for installations ultimately to converge all services onto their OLANs, including coaxial cable-based video, telepresence and wireless.

## Overview of the MCRD GPON-based OLAN

Two Tellabs® 1150 OLT redundant chassis anchor the MCRD OLAN. A high-density OLT, the Tellabs 1150 supports up to 64 GPON service ports, as many as 2,048 Optical Network Terminals (ONTs) and more than 8,000 users per base. In terms of scalability, the two Tellabs OLTs can support more than 16,000 users. The platform's IP/Ethernet architecture supports the scalable delivery of multiple services simultaneously, including plain old telephone service (POTS) and Voice over Internet Protocol (VoIP) voice service; high-speed Internet access; transparent LAN data services; video and WiFi services.

For voice services, the Tellabs 1150 delivers IP PBX via local session controllers (LSCs) and unified communications (UC) systems, and when bundled with the Tellabs® 1000 Voice Gateway, it can also support TDM analog voice service to the same VoIP UC LSC.

The two Tellabs 1150s at MCRD currently support about 120 ONTs across 80 buildings, and those ONTs serve about 1,200 workstations and 300-plus peripheral devices, such as printers and scanners, across the meshed network.

The Tellabs 24-port 729GP ONT accounts for the majority of the ONTs, while most of the rest are the Tellabs 4-port 709GP ONT. While both models support data and IP video, the 729GP ONT supports both VoIP and POTS via Assured Services SIP (AS-SIP). Given the new voice switches that will be coming online within the next year or two, along with the capabilities of the Tellabs ONTs, the Marine Corps is proposing to implement both VoIP and POTS service on the GPON-based OLAN.

The MCRD San Diego OLAN also includes a few of the Tellabs 2-port 120 Mini ONTs, which support VoIP, data and IP video. The smaller ONTs serve warehouse data applications, such as order processing and inventory as well as the homes for the Commanding General and the Commanders for Headquarters and Service Company, and Recruit Training Regiment. The flexibility of these smaller ONTs allows technicians to deploy data services to nearly any location that has fiber optic connections.

## Obtaining Scalability Now to Satisfy Future Requirements

The Tellabs OLAN in general and the Tellabs ONTs in particular will provide MCRD San Diego with significant benefits going forward, including cost savings, ease of deployment and scalability.

The Marine Corps determined that the cost of the Tellabs 729GP ONTs is about one-half to one-third of the cost of a new active switch and that technicians can install them easily without needing to do significant configuration.

In terms of scalability, the two Tellabs OLTs can support more than 16,000 users. The Marine Corps wanted the MCRD San Diego OLAN to replicate the number of ports in each existing communications closet, plus provide another 20 percent to support growth. To obtain that port count and to minimize cost, the Marine Corps decided to mix and match the Tellabs 709GP ONTs and the Tellabs 120 ONTs instead of buying all Tellabs 729GP ONTs.

## Benefits of the New OLAN Already Evident

Although the MCRD San Diego OLAN has been up and running for only a short time, the base already has realized some concrete benefits in addition to the cost savings of the GPON-based OLAN relative to traditional LAN. One of the biggest benefits that MCRD has obtained is power savings. Because the OLAN does not generate much heat, IT technicians can start to shut down the air conditioning systems in many of the communications closets.

In fact, MCRD San Diego has quantified some of the power savings delivered by the OLAN. With the traditional active-Ethernet LAN, a typical communications closet at the base contains a switch, a pair of UPS systems and an HVAC system. On a monthly basis, that communications closet consumes 5,334 kilowatt hours, 1,500 of which are associated with the air conditioning system. To power the network infrastructure across 81 communications closets, MCRD spends an average of $482,267 for IT power.

The new GPON infrastructure significantly reduces IT power requirements by reducing the load associated with redundant power supplies, HVAC and power distribution. The communications closets now contain one to three 729GP ONTs and a single UPS system, which together consume about 1,387 kilowatt hours of power each month. That means that MCRD San Diego's expected annual cost for IT power now is $188,743, or a 60 percent cost reduction.

Although the Tellabs OLAN can save a lot of physical space by reducing cabling, floor, rack and telecom closet requirements, MCRD San Diego is not yet able to leverage that benefit. The MCRD San Diego implementation, driven by financial limitations, determined that the least costly plan would take advantage of the existing copper horizontal infrastructure by replacing existing active-Ethernet switches with OLAN equipment. The barrier to using the existing horizontal cabling is the 100-meter distance limitation, which in turn limits the ability to collapse communications closets in each building and floor. Without that constraint, MCRD San Diego could have put ONTs on the desktop and collapsed a great deal of the existing infrastructure, including the fiber plant.

## More OLAN Benefits to Come

The Marine Corps expects the GPON-based OLAN technology to deliver even more benefits, including easier centralized network management and the ability to establish priorities for various types of traffic.

Although evolving Marine Corps policies and funding issues have prevented MCRD San Diego from exploiting the full range of PON capabilities so far, the OLAN positions the base to do so as soon as policy and budgets allow. It also enables MCRD San Diego to continue its leadership role in the Marine Corps transition to the MCEN and in the DoD's evolution to the Joint Information Environment.

## Tellabs

In today's competitive market, enterprises and service providers want to cut costs and improve services by doing things more efficiently. Tellabs is responding to their needs with a new approach to network design and service definitions. For example, we purpose-built Tellabs Optical LAN solution to leverage the cost, power and space benefits of an all-fiber infrastructure in providing high-capacity, high-performance networks.

Compared with legacy copper-based Ethernet networks, Passive Optical LAN offers more reliable and secure delivery of data, voice and video services on one platform. In addition, it eliminates future infrastructure upgrades and provides an environmentally sustainable solution.

## Next Step

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

**Take the next step. Contact Tellabs today.**

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