WHITE PAPER

MOTOROLA

Passive Optical LAN

The Architectural Choice for Eco-friendly, Low Cost, High Performance Building Networks

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Increasing the use of renewable resource materials while decreasing reliance on petroleum-based materials in new construction is a major concern of today's architects. Strategies for improving energy efficiency, reducing CO2 emissions, improving indoor environmental quality and protecting the natural resources of the world have become so important in construction that there are internationally recognized certification organizations dealing with these subjects.

To address these concerns, architects are constantly looking for opportunities to reduce electrical and fuel consumption, increase air quality, and use more eco-friendly materials in building construction. The low-voltage communication and control system that includes Local Area Networks (LAN) supporting voice, data, and video delivery is one of the places where architects and design engineers can realize substantial improvements in energy conservation.

Motorola's Passive Optical LAN, an all-fiber LAN solution that operates on a Gigabit Passive Optical Network (GPON), is a leading alternative to the traditional LAN network that enables architects and design engineers to increase the use of eco-friendly materials while significantly reducing energy consumption and significant costs associated with traditional LAN architectures.

Traditional Local Area Network (LAN)

Traditional copper-wire based Local Area Networks (LAN) (copper LANs) send high-speed radio frequency signals between a hub and individual computers. In turn, the signals from the multiple hubs are accumulated at a switching/processing machine at a main communications room. The multiple hubs are generally Ethernet switches connected by copper wires to the computers. The main accumulator is an Ethernet switch with fiber optic or copper connections to the hubs. Altogether these devices comprise a LAN.

The speed of data transfer used by copper LANs has increased from 10 Megabits per second (10 Mbps) to 100 Megabits per second (100 Mbps) to new systems of 1000 Mbps (= 1 Gigabit per second, 1 Gbps) and beyond. In order to accomplish these speeds of signal communication, the systems have gone from using 10 Megahertz (10 MHz) radio frequencies to now using 400 Megahertz (400 MHz) signals. Also, these systems now use four pairs of wires for their communication, and the newest systems use sophisticated noise-cancelling processes. The noise-cancelling processes filter out their own induced cross-talk interference caused when the outgoing signal overwhelms the incoming signal on the copper wires.

High frequency signals that travel on copper wires require more sophisticated cable constructions and physically larger cables than lower frequencies. Consequently, the amount of plastic and copper required to build a copper-based LAN wiring system in new buildings is continually increasing.

The high frequency signals in current copper LANs also require significant consumption of electrical power in the switches at the intermediate hub locations and in the main switches. These high frequency signals cannot travel more than 300 feet from the switch to the computer on copper wires. These considerations which include power consumption and distance, along with the additional need to provide space for the intermediate electronics equipment, have been incorporated into building designs by architects, including the addition of telecommunication closets separate from electrical closets.

In effect, architects have been restricted in building design by the distance and space needs of the copper-based LAN. They have also been forced to include unwanted extra non-renewable plastics and copper for these traditional LANs in their building designs.

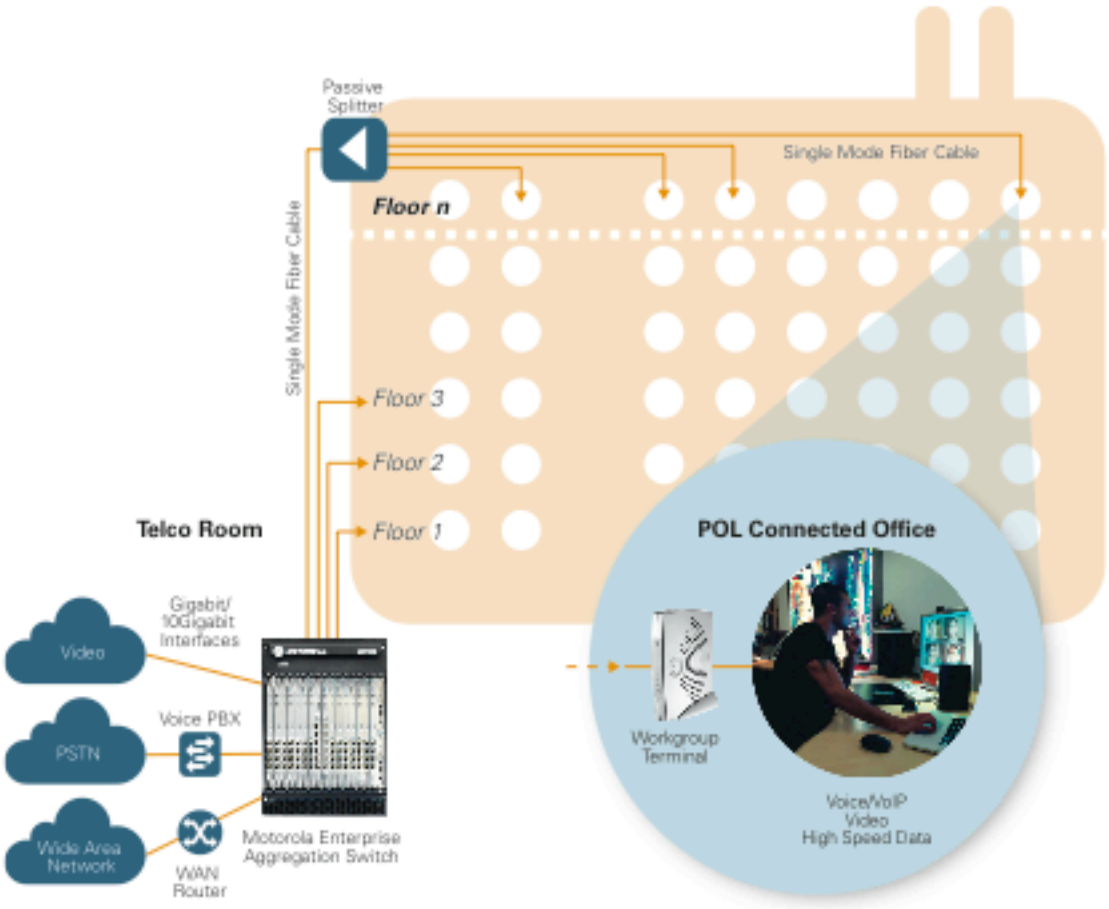
The New Passive Optical LAN by Motorola

Motorola offers an alternative LAN solution to copper-based systems. This new system, known as Passive Optical LAN (POL), is based on proven Passive Optical Networking (PON) technology that is deployed by leading service providers around the world and provides triple play services to subscribers. POL provides enterprises with fiber optic connectivity to any Ethernet end point such as end user devices, access points and wireless controllers, application servers, and printers. POL greatly simplifies the enterprise LAN by replacing copper-based cables and devices in the traditional LAN setting with fiber optic equipment.

With Motorola's POL, the customer will have a highly reliable solution that is simple to deploy and manage, and is more environmentally responsible than a traditional LAN architecture.

The POL network consists of a high density aggregation device in the main telecommunication room that delivers converged services over a Gigabit Passive Optical Network (GPON) that extends to the desktop or cubicle and terminates at a Work Group Terminal (WGT). The WGT provides 10/100/1000BaseT Ethernet connectivity to desktop equipment such as desktop computers, laptops, voice-over-IP phones, and video phones using regular copper patch cords.

POL uses small passive fiber optic splitters which are placed in enclosures in a building, usually at every floor, although theoretically they could be anywhere or just at the main room. These splitters and their enclosures, typically 2 to 4 cubic feet in size, require no power, produce no heat, and can be installed in electric closets, in their own dedicated closets or behind access doors in walls or ceilings.



The POL system also reduces overall power and cooling requirements, and reduces the need for construction materials that are not environmentally friendly. This allows the architect to deliver a structure and interior with extra advantages to both the customer and to the environment, at a significantly reduced cost.

Some Architectural Concerns for LANs

The list below enumerates various architectural concerns regarding POL. The subsequent sections will specifically address those concerns and prove that POL is a much better technology than traditional copper based LAN network.

- How does the POL affect energy efficiency and green building certification points?
- How does POL affect costs or make more funds available for extra design features?
- How does POL affect available floor space?
- How does POL affect the fill and fire load in ceilings?
- How does POL affect the chances of construction problems?
- Does POL provide any extra advantages for my customer for no added cost?
- Is POL technologically superior at no added cost?

An Example Research/Office Facility Used for Comparisons

The following example structure will be used throughout this paper to compare Motorola's POL with the traditional copper based LAN in a building. The example is a theoretical six story research and office facility built for a hospital or university. In this building, there is one main distribution frame (MDF) communications closet and 12 intermediate closets (two per floor, stacked at each end). The structure is 320 feet by 120 feet, with about 250 feet between north and south IDF closets. There are 2000 faceplates and 4000 Ethernet jacks/outlets, about 350 feet from each IDF closet. The building also includes 100 wireless LAN units.