



## **“Last Mile” Connectivity – The Optical Solution**

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Here in U.S., the regulatory door has cracked open allowing a couple of the incumbent local exchange telephone monopolies into the highly competitive long distance market. In addition, these incumbents have been diligent in their pursuits of other fast growing market telecom segments and in partaking of the merger mania of the past few years. While corporate management of these giants have devoted its energies and resources to these seemingly lucrative pursuits, attention to core businesses and constituencies has suffered. Regulators are levying fines and calling some of these incumbents to task for poor service quality and lack of responsiveness to customers looking for basic local exchange telephone service.

The incumbents of course deny there's a problem or blame it on a lack of qualified skilled workers in today's tight telecom labor markets. Whatever the reasons, the problems confronting those in need of “last mile connectivity” for basic phone service are exacerbated for large corporate and institutional users. As the need for ever greater amounts of communications capacity continues unabated, driven by the explosion of e-commerce, the ability of the incumbents and their newer competitors to satisfy that demand is increasingly being challenged. Large users as a result are being frustrated in satisfying their needs for high bandwidths to connect not only to public and private global networks and the Internet, but to their own satellite offices or dispersed premises on their own corporate campuses.

Much of the problem centers on the traditionally worse problem area for telecommunications networks, the infamous “last mile” into the customer's premises. Synergy Telecommunications Corporation (Syntelco), a provider of metro-edge optical solutions, and infrastructure technology services and products, has focused efforts to provided end-to-end solutions that address this problem and to provide a solution that is easy and quick to deploy, capable of delivering capacity up to the OC48 levels, cost effective and scalable into multi-point networks. The technology used is not new – optical lasers, but harnessing its efficiencies and capacities has been developed to the point where its integration into today's communications network environments is a reality.

Until now, the choices for broadband connectivity have been limited to installing additional fiber lines, using leased lines or deploying microwave radio systems. These options however come with a variety of disadvantages including installation delays and errors, construction and installation problems (not the least of which include finding on and off-premise space to house the necessary equipment and facilities), spiraling costs, predetermined term and volume commitments, and dependency on large bureaucratic

organizations whose managements' focus is not on service quality, reliability or responsiveness to customer need.

In countries with less developed telecommunications resources, access to networks is further impeded by the lack of an established infrastructure, making the increasing demand for timely delivery of communications services all the more frustrating and difficult to solve. In these situations, attempts to provision connectivity using the typical wired infrastructure often prove to be less of a solution and more of a problem. Syntelco has found what it believes to be a far more promising solution, one that is based on wireless last mile access.

### **Optical “Free-Space” Technology**

Syntelco's selection of the optical laser technology, Laser Transmission Systems or “LTS,” as the preferred solution to these problems is driven by the critical considerations of location, application, time to deploy, bandwidth demand, and regulatory involvement. Currently, Laser Transmission Systems are manufactured in Germany, the United States, Canada and England. These systems operate in “optical free-space” spectrum providing high capacity data transmission links without wire or optical fiber connections.

Free-space laser communication systems using laser beams of light operating in the near infrared range of the spectrum are limited to line-of-sight transmission. Their signals traveling at extremely high frequencies will not penetrate solid objects trees, buildings or other obstacles. However, advances in the fabrication process of high-quality laser modules, in digital processing and in the understanding of light propagation through the atmosphere have dramatically enhanced the ability of lasers to provide high capacity, secure connectivity.

Point-to-point connections are established in line of sight configuration by installing one or more laser-based optical transmitters/receivers on customer premises at optimal clear path locations.

A complete transmission link consists of two optical generators (OGs) with one OG mounted at each location to be connected to the network. The signal to be transmitted is converted from an optical into an electrical signal inside the generator.

Full duplex operation allows both sites to transmit and receive information at the same time. Two single-mode or multi-mode fiber optic cables terminated with SC or ST connectors are used to interconnect the networking interface to transmit and receive optics incorporated into the optical generators. Amplified electrical signal drives the high-powered laser diodes and is sent out through free-space towards its sister location. The receiving site OG converts the electrical to optical signals that can then be interconnected to a single-mode or multi-mode fiber optic cable. Multiple OGs can be interconnected to provide expanded network coverage.

Today's OGs from quality manufacturers have improved laser-based technology that will tolerate all types of weather conditions - rain, hail, snow or fog. Beam attenuation, depending upon bandwidth configuration, will easily cover distances up to 2.5 miles (4000 meters), with data transmission rates up to 1.25 Gigabits per second. In establishing design parameters, the LTS system can and should be configured to permit protocol transparent transmission of data, voice and video applications at full network speed.

## **LTS Applications**

The most widely used applications in which LTS systems are deployed are in congested metropolitan and campus network environments. The following are some of the network access applications ideally suited for an LTS solution to broadband connectivity needs – High capacity point-to-point connections; alternative last-mile connectivity; private WAN or LAN networks; Ethernet, Fast Ethernet, Token Ring, FDDI, ATM networks; single E1/T1, multiple E1/T1, DS-3 and more up to 1.25 Gigabit applications; redundant and/or back-up network connections; disaster recovery; and temporary network connectivity.

## **LTS Advantages**

Essentially, LTS systems are compact, portable, units providing rapid bandwidth deployment (variable data rates from 1megabits per second (Mbps) to 1.25 Gigabit per second) for instant market penetration. LTS system advantages, compared to typical wired solutions, include: wireless interconnection points over distances up to 2.5 miles; little or no regulatory interfaces required; superior system security; protocol transparency and operation at full network speeds; simple installation with telescope, acoustic alignment and signal strength meter all built-into the units; micro-alignment for precise beam (signal integrity) adjustment; built-in heater and lens defroster for counteracting weather changes; RS-232 Optical Management Interface allowing for remote diagnostics; SNMP support; availability of integrated redundancy; and immunity to EMI and RF interface; and financial savings.

## **License Free**

Infrared-based Laser optical transmission systems are not subject to any licensing requirements in the United States. Hence, these systems can be installed and used without any regulatory interfaces. In addition, no frequency coordination is required as with radio wave based systems. An installed LTS solution is simply an extension of the transmission network with seamless interface and interference-free operation.

## **Safety**

The international standard IEC 825-1 regulates health issues and especially eye-safety of optical sources used in laser communication systems. This classification is based on concerns for the potential risk to human health (specifically eye damage) caused by systems incorporating high power optical transmission sources. Correspondingly, the identical standard for the European countries is EN-60825-1. The ratings may vary depending upon the manufacture's design and the system being viewed. Typically, at 155 Mbps systems has been classified as a Class III laser system; but new technology offerings are setting an improved level of safety with systems that are "eye-safe" at all transmission capacity levels. System providers, like Syntelco, and/or their customers can check the classification of any system deployed to assure that eye safety is maintained.

## **Transmission Security**

Another of the many Laser Transmission System advantages is its security feature. LTS offers virtually interception proof transmission methodology that far exceeds methods employed in microwave or copper cable products to provide secure transmission.

## **Location Selection**

Laser systems require a clear line-of-sight between to two link ends. This is usually easily accomplished by the options available for site locations on the roofs or sides of multi-story buildings. It is necessary to remember however, particularly in the fall and winter seasons, to make sure the site path is actually clear of trees as leaves will impede signal transmissions when they return in the spring.

## **Installation**

Ideally, each Optical Generator (OG) should be mounted on the corner or the wall of the building to which they are attached and preferably to masonry construction or a brick wall. In all cases, the base of the mounts must be attached to a supporting structure. To ensure proper operation, the OGs must be within a clear line of sight of each other. A solid mounting is key for reliable operation of the OG link.

The OG is connected to the network by using 62.5/125 mm or 50/125 mm optical multi-mode or 9/125 mm single-mode fibers depending upon the manufacturer's design. Today, a 10 Mbps system may be connected via twisted pair with a standard RJ45 connector. Typically, systems providing capacities up to 155 Mbps will use multi-mode or single-mode fiber optic cable. Systems with 622 Mbps and higher capacity will feature single-mode fiber connections. New free-space offerings, by a Canadian manufacturer, feature all product offers with eye-safe single mode fiber connectivity. At the OG side the fibers will be terminated with a standard SC or ST connector.

## **Remote Monitoring**

It is very important that the LTS system is capable of interfacing with the user's Network Operations Center monitoring system. Optical Management Interfaces will vary based upon the manufacturer selected but typically they will have the capability to be monitored via a computer, dial-up remote access, and/or SNMP-Management. Typical points monitored include received optical input power, temperature in the beam head, and presence of the network interface signal, transmitter status, test mode status, and loss of signal.

## **Financial- 6-month payback!**

An LTS solution can be deployed in a matter of hours without the need for a long-term leased wire-based connection (fiber), which typically requires a 3-5 year commitment. The typical payback on a Syntelco provided Laser Transmission System is six months compared to a conventional connectivity solution and sometimes even less. But for those who prefer continued management and network oversight of their installed systems, Syntelco has a leasing option available.

## **End-to-End Solutions**

Syntelco is excited about the high capacity LTS systems available today. With capacities ranging from 10Mbps to 1.25 Gigabit per second, optical free-space point-to-point communication technology provides an excellent solution for short-range connectivity with a broad range of applications requiring bi-directional symmetric transmission of data, voice and/or video.

Syntelco has sold and installed systems for users such as a major U.S. Internet Service Provider, financial institution credit card real-time system applications, and is currently working with major carriers, real estate concerns with multi-building management ventures, and corporate campus environments.