

## Industry Overview

### Optical Networking Market

The past decade has witnessed an explosive growth in the volume of data traffic largely due to the soaring popularity of the Internet and related bandwidth-intensive applications. According to information technology industry analysts, the number of Internet users around the world is expected to increase from 400 million in 2001 to nearly one billion, or 15% of the total population, by 2005. In addition, users are increasingly seeking applications that require a great deal of bandwidth such as video conferencing, video-on-demand, HDTV, e-commerce and rich media streaming.

The dramatic increase in Internet users and in bandwidth-intensive applications has created a tremendous need for high-capacity communication networks. To meet this increasing demand for bandwidth, many telecommunication carriers are designing and installing new networks based on optical fiber, deploying additional fiber within their existing networks or using advances in optical technology such as Dense Wavelength Division Multiplexing, or DWDM. DWDM involves combining beams of light of slightly different wavelengths through a single fiber, with each wavelength carrying its own stream of information. DWDM has wide market acceptance because it incorporates technologies that greatly reduce the cost of optical transmission over long distances and because it provides network flexibility in access and metropolitan areas. According to Kessler Marketing Intelligence (KMI), the global DWDM Transport Equipment Market is expected to increase from \$7.1 billion in 2001 to \$23.2 billion in 2005.

Although the long-term outlook for the telecommunications industry remains robust, 2001 was marked by a slowdown in the overall economy and reduced capital spending in the optical networking market. On the carrier side, we observed a trend towards maximizing existing networks by increasing transmission rates and adding DWDM channels, while delaying deployment of new fiber cables. For optical component and system manufacturers, the slowdown in the buildout of new networks resulted in excess inventories throughout the industry. Despite this over-supply of optical components, the most established component and system manufacturers did not significantly slash their R&D budgets in order to remain competitive in designing next-generation products. As a result, new production lines are still being rolled out in significant numbers.

### Optical Test, Measurement and Automation Equipment Market

Fiber-optic test, measurement and automation equipment is essential for research and development, manufacturing, network installation and maintenance as well as network monitoring.

Conventional test and measurement instruments used by telecommunication carriers and manufacturers of communications equipment were designed for electrical transmission systems and are unsuitable for optical networking. Unlike traditional electrical transmission systems, which transmit electrical signals along copper wires, fiber-optic transmission systems use pulses of light along glass or plastic fiber, often referred to as optical fiber. When light travels along optical fiber and through the optical components and systems that link optical fibers together, it is subject to unwanted effects such as reflection, attenuation, noise and various types of dispersion, all of which degrade signal quality and reduce transmission performance. Fiber-optic test and measurement equipment is critical for measuring these effects and helping carriers and manufacturers of optical components, value-added optical modules and optical networking systems ensure network performance, efficiency and reliability.

Data sent along an optical network must respect transmission protocols, such as ATM, SONET, SDH, Ethernet and Gigabit Ethernet, and fall within accepted data transmission rates from 64 kb/s to 10 Gb/s. Otherwise, the information sent from a transmitter will not be understandable to the receiver. Fiber-optic test and measurement equipment like a bit-error rate tester is used to ensure data integrity.

Optical components and value-added optical modules, which make up an optical network, are typically assembled by hand on the production floor. Yields are inevitably low and costs are high. As a result, optical component vendors are increasingly looking for ways to increase efficiency and reduce costs by adopting automated manufacturing solutions. They either build these complex solutions in-house or turn to equipment manufacturers to help them automate critical steps in the manufacturing process such as alignment, curing and optical testing. The latter option enables optical component vendors to devote their scarce technical

resources to developing next-generation products instead of manufacturing tools.

The fiber-optic test, measurement and automation market has not been immune to the challenging conditions in the optical networking sector. However, vendors with extensive product portfolios that include advanced optical test instruments were still able to market their products to carriers, who need to upgrade their networks to higher transmission rates or add DWDM channels. Likewise, test, measurement and automation vendors, whose products increase efficiency and reduce costs on the production floor, still attracted the attention of optical component and system manufacturers, who kept investing in their R&D programs to stay ahead of the competition.