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Next-generation optical fiber research for the ultrahigh-speed, high-capacity era

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Abstract

This article introduces cost-effective highly functional ultrahigh-speed ultrahigh-capacity optical transport network technologies that use optical paths to provide safe and secure diverse services cost-effectively.

Introduction

The diffusion of the Internet, the penetration rate of mobile phones and smartphones, and all the services that utilize networks—such as video distribution services like YouTube, terrestrial digital television (TV), three-dimensional TV, online shopping, and e-government—have exceeded expectations for communication network services and continue to grow. These types of broadband services are supported by terrestrial and wireless communication networks: fiber to the home (FTTH) has brought the optical era to peoples homes, with subscriber contracts in Japan exceeding 20 million as of March 2011, and LTE (Long Term Evolution) enables wireless communication speeds in excess of 70 Mbit/s (as of Dec. 2010). High-speed high-capacity transport technology has contributed greatly in the configuration of these communication networks by cost-effectively accommodating the vigorous 1.5-fold annual increase in traffic. The technological trends in transport technologies to date are shown in **Fig. 1**.

Transport networks are generally classified into three types: core networks connect major cities throughout the country, metro networks connect major areas within prefectures, and access networks provide connections to subscribers. In particular, there is a need to connect core and metro networks using high-speed signals, and we have constructed cost-effective transport networks based on cutting-edge optical transport network technology such as high-speed transmission technology. At present, there are cost-effective low-power consuming systems such as the 1.6-Tbit/s dense wavelength division mul-tiplexer (DWDM)*1 transmission system [1] that multiplexes 40 wavelengths each carrying a 40-Gbit/s signal and the 800-Gbit/s (10 Gbit/s × 80 wave-lengths) reconfigurable optical add/drop multiplexer (ROADM)*2 transmission system that is used to construct 10-Gbit/s optical signal add/drop optical ring networks. However, as shown in **Fig. 2**, even these systems will have difficulty in the future in dealing with the boom in traffic volume, so even-more-cost-effective low-power-consuming optical transport network technology will be in demand. NTT Innovation Laboratories is vigorously pursuing the research