Development of an OADM-Ring System

This OADM\textsuperscript{1,} ring system was developed to operate as the backbone of optical communications networks for use in urban areas, where IP traffic is expected to increase enormously in the future. This system multiplexes 20 wavelengths in the 1550-nm band, each with a throughput of 2.4 Gbit/s, over an SMF\textsuperscript{2}. The system can be equipped with optical amplifiers to achieve long-distance transport, so this has made it possible, for the first time in Japan, to transport signals over 100 km without repeaters. The nodes in the ring consist of central nodes and local nodes. Central nodes can add and drop up to 20 wavelengths. Local nodes can add and drop up to four wavelengths. Each wavelength path can form a logical star network. NE-OpS\textsuperscript{3} can operate the ring as a whole via a digital communications network.

The main attributes of the system are as follows.

1. The system achieves a large cost reduction because of the reduction in the number of OS/OR\textsuperscript{4} modules at each node and handling add/drop processing of the optical signals.
2. The system makes it possible to set up equipment easily to suit the demands of traffic.
3. 1+1 path protection, which can change the path immediately in case of problems, provides the system with good characteristics in terms of maintenance and operability.

This OADM was built using components from NTT Green Procurement Guideline, so it also represents an eco-friendly communication network.

NTT West introduced the system as a backbone of the optical IP communications service in Osaka on 30 November 2000, and field trials began in December 2000. Field trials also began in Nagoya, Hiroshima and Fukuoka in March 2001. The OADM-ring system is a promising basic system because of its independence from the upper layer in the ever-changing IP-signal environment. Extensions for even higher transfer speeds, such as expansion of the number of multiplexed channels and a 10-Gbit/s interface are expected in the near future. These will make it possible to adapt to the expanded demand for communications that the expansion and addition of various IP services will bring. It is expected that OADM will make a strong contribution to the IP networks of the future.

(NTT West, NTT Laboratories)

\textsuperscript{1} OADM: Optical Add/Drop Multiplexer
\textsuperscript{2} SMF: Single Mode Fiber
\textsuperscript{3} NE-OpS: Network Element Operation System
\textsuperscript{4} OS/OR: Optical Sender/Optical Receiver

Example of the structure of OADM

Development of a Large-Capacity WDM Transmission System

The dramatic rise in data traffic especially on the Internet in recent years has brought about an increasing demand for greater capacity and cost efficiency in the trunk network. To this end, the WDM transmission system has been promoted as a means of achieving a significant jump in the transmission capacity of the trunk network, and its deployment is now moving forward. Up to now, however, 1.3-μm SMF has been used as the transmission fiber in WDM transmission systems, and dealing with DSF\textsuperscript{1} used in the long-haul network has been an issue.

NTT Laboratories have succeeded in developing WDM-2 transmission systems to achieve the world’s first transmission system that can handle both SMF and DSF. In WDM transmission over DSF, crosstalk caused by FWM\textsuperscript{2} occurring in the fiber must be suppressed. The developed system can overcome the distance limitations imposed by this FWM crosstalk through utilization of the following new technologies. The first is an unequally spaced wavelength arrangement in the C-band (1530-1565 nm), the wavelength band normally used. Also, considering the variance in dispersion characteristics of laid DSF, the optical power level has been optimized and high-quality bit-error-rate characteristics have been achieved. The second new technology is the use of the L-band (1570-1610 nm) as a new wavelength band to supplement the conventional C-band. The L-band features moderate dispersion, which enables the generation of FWM to be suppressed. These new technologies realize the transmission of more than 48 wavelengths over a maximum distance of 320 km (three repeaters). They also enable a transmission speed of 10 Gbit/s per wavelength in addition to existing speeds of 600 Mbit/s and 2.4 Gbit/s.

Deployment of this system in NTT Communications’ backbone network began in 2000 and the deployment area is expanding throughout Japan.

(NTT Development Laboratories)

\textsuperscript{1} DSF: Dispersion Shifted Fiber
\textsuperscript{2} FWM: Four Wave Mixing

Example of the structure of OADM

Configuration of type-2 WDM transmission system