NEWS RELEASE

NTT

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Operation, Administration, Maintenance and Provisioning Information Added to LSI for 10 Gigabit Ethernet
- Reliability improvement of optical large-area Ethernet networks -

Nippon Telegraph and Telephone Corporation (NTT; Head Office: Chiyoda-ku, Tokyo; President: Norio Wada) has succeeded in adding the operation, administration, maintenance and provisioning (OAM&P) information to the standard LSI for 10 Gigabit Ethernet. The reliability of the Ethernet network is improved by mounting this LSI on an optical transceiver module. It had been assumed that applying Ethernet, a general-purpose LAN technology, to long-distance networks would be difficult in terms of reliability. Therefore, NTT adopted Inter-frame Link Signaling (ILS[*1]) technology, which inserts the optical network OAM&P information between the inter-frame gaps of the Ethernet frames, and was thereby able to achieve a reliability comparable to that of SDH/SONET[*4], a general-purpose technology for WANs[*2] or MANs[*3].
Ethernet service with ILS functions has already been introduced. To spread the service more widely, the module can be mounted on general network equipment, such as switches, routers, and media converters, by adding the ILS functions to the standard LSI for 10 Gigabit Ethernet on a detaching-type optical transceiver module. Therefore, it is possible to construct a large-area Ethernet network with ILS functions for monitoring transmission quality with the optical fiber, finding defect locations in the optical network, and changing lines because of failures.

Background
For data communication, Ethernet has mainly been used in short-distance networks, such as LANs, while SDH/SONET has mainly been used in long-distance networks, such as WANs and MANs. Therefore, for signal transmission between LANs separated by a long distance, a method where the Ethernet frame is wrapped in that of SDH/SONET has mainly been adopted. However, this causes two major problems. The signal frame processing increases cost and delay time, and the total Ethernet bandwidth is not used.
In using Ethernet for long-distance transmission, because of the lack of OAM&P information, the customer had to construct an extra network just for maintenance and monitoring. And in the case of specifying the defect location exactly, people could not help trusting to intuition.
On the other hand, inexpensive high-speed electronic devices and increased Internet demand has brought down the price of network equipment for high-speed data rate transmission, such as 10 Gbit/s.
To make good use of both the generality of Ethernet and the high reliability of SDH/SONET, NTT selected ILS technology, which inserts the OAM&P information of the optical network between the inter-frame gaps of the Ethernet frames, and added the ILS functions to the standard LSI for 10 Gigabit Ethernet. A highly reliable Ethernet

network can be easily constructed by mounting this LSI on a detaching-type optical transceiver module.

Overview of Techniques

Figure 1 outlines the features of ILS technology. ILS adds a signal transmission channel, which monitors a physical layer*5, to an Ethernet optical interface. A LAN/WAN seamless network environment can therefore be constructed simply by using Ethernet frames. This signal transmission, or link signaling, uses the inter-frame gap between the Ethernet frames to guarantee the user bandwidth completely and is compatible with the 10 Gigabit Ethernet standard. As a result, as shown in Figure 2, OAM&P information, such as defect detection in the maintenance domain, remote loopback, dying gasp signaling, and DCC*6 bandwidth securing, can be realized.
Figure 3 shows an optical transceiver module with the ILS functions. General-purpose Ethernet equipment, such as layer-2 or layer-3 switches, routers, and media converters with the modules, can offer excellent large-area Ethernet service with high reliability at a low price. Moreover, it is possible to transmit 10 Gigabit Ethernet signal in optical networks, such as WDM*7 networks, without signal format conversion.
Concrete features are as follows.
- OAM&P information can be added with the user bandwidth completely guaranteed.
- The optical link management function is the equivalent of that of SDH/SONET provided in the LAN/WAN seamless network.
- Ethernet service with high reliability at a lower price can be offered even in WANs or MANs.
- ILS is compatible with the 10 Gigabit Ethernet standard (10GBASE-R series*8).

Application Field (See Figure 4)
- Super-high-speed Ethernet service
- Large-area Ethernet service
- Ethernet solution business

Future Prospects

Commercial products of the LSI and of the optical transceiver module are planned. In addition, services and systems using this technology will be proposed.

Explanation of Terms

*1 ILS (Inter-frame Link Signaling)
A technology for inserting OAM&P information into the inter-frame gap, or the unused area between Ethernet frames, and enabling signal transmission in the network. It was developed by NTT.

*2 WAN (Wide Area Network)
In general, a network that extends throughout the country or internationally.

*3 MAN (Metropolitan Area Network)
A regional network covering a city-scale area (tens of km).

*4 SDH/SONET (Synchronous Digital Hierarchy / Synchronous Optical Network)
SDH is mainly used for high-speed networks, and was established by International Standard. It provides a suitable signal transmission for maintenance in optical fiber networks. It is called SONET in the United States.

*5 Physical layer (PHY)
The first layer of the Open Systems Interconnection (OSI) reference model. It provides

the physical connections and transmission method of a network, such as cable material and connector shape.

*6 DCC (Data Communication Channel)
Mainly used to transmit the control signal besides the user bandwidth.

*7 WDM (Wavelength Division Multiplexing)
A technology that enables many optical signals with different wavelength to be transmitted in one optical fiber, thereby increasing the optical signal transmission capacity and the number of channels.

*8 10GBASE-R series
Consists of 10GBASE-SR, 10GBASE-LR, and 10GBASE-ER of the 10 Gigabit Ethernet standard. Also called LAN-PHY. (See http://www.10gea.org/)

Figure 1. Features of ILS Technology.
Figure 2. Typical ILS Functions.
Figure 3. Optical Transceiver Module with ILS Functions.
Figure 4. Service example using ILS Functions.

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