Implementation of Internet Access via the FTTH Used for CATV

Optical fiber’s most significant feature is its broadband capacity. FTTH\(^1\) has thus been initially developed and deployed, in many areas, for the CATV\(^2\) service. The upgrading of HFC\(^3\) to have a bi-directional capability allows broadband Internet access and this attracts consumers, so this feature is vital for the further deployment of FTTH.

Internet access via the CATV transmission system is currently quite common. This is based on the STM-PDS\(^4\) and SCM-PDS\(^5\) systems. In the STM-PDS system, a conventional phone service (PSTN\(^6\) or ISDN) is provided along with broadband IP connectivity by which Ethernet packets are carried between the homes and the CATV center. The bandwidth for IP connectivity can be configured by which Ethernet packets are carried between the homes and the CATV center. The bandwidth for IP connectivity can be configured in 64 kbit/s increments, up to 10Mbit/s, and is shared among customers. To stop customers setting up services that the CATV operator and ISP\(^7\) do not want, such as the sharing of files and printers among customers, packets from customers only travel to and from the CATV center, and not to and from other customers.

The SCM-PDS system provides unidirectional video-signal transmission over the wide frequency region from 90 to 770 MHz. By employing the FM-conversion technology, it is possible to avoid the deterioration in signal quality caused by the reflections at connectors and the chromatic dispersion of the optical fiber. A 1.3-\(\mu\)m optical signal is used in the STM-PDS system and a 1.5-\(\mu\)m signal is used in the SCM-PDS system. WDM\(^8\) technology allows both systems to be run independently on the same fiber.

The Access-Network Operations System (AcNOS), currently at ver.5, has been developed for the management of this FTTH system. This system helps the operator to configure and maintain the system. (Access Network Service Systems Laboratories)

\(^1\) FTTH: Fiber To The Home
\(^2\) CATV: Community Antenna Television
\(^3\) HFC: Hybrid Fiber/Coaxial Cable
\(^4\) STM-PDS: Synchronous Transfer Mode-Passive Double Star
\(^5\) SCM-PDS: Sub-Carrier Multiplex-Passive Double Star
\(^6\) PSTN: Public Switched Telephone Network
\(^7\) ISP: Internet Service Provider
\(^8\) WDM: Wavelength Division Multiplexing

Photonic Transport Network System that Supports Broadband Access Services

As the Internet continues to penetrate every aspect of our daily lives, it is reshaping the way we do things, and bringing into existence a fully evolved information distribution society. In a few short years we have seen the emergence of an environment where people can quickly and easily obtain all sorts of information by accessing the network from their personal computers and cell phones. Once broadband access becomes available, anyone will be able to download very-high-quality images and enjoy super realistic networked games with players who are located on the other side of town or on the other side of the globe.

We are already witnessing a remarkable increase in data traffic to accommodate this growth and penetration of the Internet into our daily lives. The expansion of data traffic has exceeded all expectations, even outstripping Moore’s Law, the notion that the number of transistor on integrated circuits has doubled every year since the integrated circuit was invented. A radical new kind of network system based on unprecedented technology is essential to meet the needs of this vast increase in data traffic that even exceeds the projections of Moore’s Law.

It is clear that optical communications technologies—an area where NTT is preeminent—and IP technologies will be indispensable for next-generation network systems. NTT is an acknowledged leader in lightwave communications, with dramatic breakthrough achievements in everything from optical devices to photonic transport technology.

Photonic transport technology is evolving very rapidly, and was brought much closer to practical deployment with the implementation of optical cross-connect switching. Optical cross-connect switching permits light signals to be differentiated by wavelength and routed across the network to a destination as light, and not converted to electrical signals. Using the relatively simple mechanism of the optical cross-connect switch, vast amounts of bursty traffic data can be bundled and sent over pre-set routes. NTT has now developed a fully-functioning network system based on optical cross-connect switching.

In another recent development, a high-speed photonic router that operates very efficiently was implemented by combining wavelength routing and IP routing technologies. Efforts are now underway to develop and deploy a photonic transport network system based on this rugged high-performance photonic router. (Network Innovation Laboratories)

Growth of photonic network intelligence

Overview of CATV video transmission system with Internet access capability

[Diagram: CATV video transmission system with Internet access capability]

<table>
<thead>
<tr>
<th>Customer’s house</th>
<th>NTT</th>
<th>CATV center</th>
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<tbody>
<tr>
<td><strong>NTT facilities</strong></td>
<td></td>
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<tr>
<td><strong>SCM-OLT</strong></td>
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<tr>
<td><strong>STM-OLT</strong></td>
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<tr>
<td><strong>Internet</strong></td>
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<td><strong>Flow of video signal</strong></td>
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<tr>
<td><strong>Flow of Ethernet packet</strong></td>
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</tbody>
</table>

[Diagram: Network innovation]

- **Fast optical burst data routing network**
- **OPXC based network**
- **WDM ring network**

**Time**

- **1990’s**
- **2000’s**
- **2010’s**

**Network innovation**

- **Next generation photonic router enabling optical burst data transferring**
- **Optical path static control**
- **Point-to-point WDM transmission**
- **Next generation photonic router**

**Network innovation technologies**

- **OADM**: Optical Add/Drop Multiplexer
- **OPXC**: Optical Path Cross-Connect
- **MPLS**: Multi-Protocol Label Switching