Enabling smart service delivery in fiber-to-the-home networks

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The development of cost-effective equipment for the customer and related management systems are both key to successful implementations.

With the ever increasing demand for bandwidth, access networks are migrating towards optical fiber, and the number of initiatives to roll out fiber-to-the-home (FTTH) networks is growing. Service penetration and user-satisfaction are important parameters for a successful FTTH roll out, so it’s of major importance to optimize delivery to the end-user.

The quality of services is strongly determined at the edge of a network, where the ‘customer-premises equipment’ (CPE) forms the interface to the end-user. An effective CPE provides for all possible services to the end user with great flexibility. However, it should also create a network with the lowest cost-base using simple yet powerful management tools.

Flexible and open service delivery
Our research has focused on delivering a range of services from multiple service providers to numerous users. We selected an architecture with multiple managed Ethernet ports in combination with voice and CATV ports to provide open access to services. Services are separated using virtual local area network (VLAN) technology, and quality of service (QoS) is controlled by the CPE. The VLAN approach enables transparent connections between the end-user and the service providers. In this way, an open service delivery platform can be created.

The Ethernet ports support a variety of services, including broadband data, Internet Protocol (IP) telephony, and IP-TV. This design approach can also be used to develop ‘triple-play CPEs,’ which typically feature two standard telephony lines and a CATV output for broadcast video services. As consumers subscribe to different services, the relevant ports on the CPE are activated.

The CPE layout was engineered to not only support current broadband Internet applications, but also to be prepared to handle next-generation health-care, security, communication, and infotainment FTTH services. Flexibility is key for a CPE to anticipate the needs and requirements of new services, whatever they are.

FTTH management
The main cost factor in FTTH operations is managing the large number of services delivered to end-users. Network management is necessary to guarantee that customers receive the correct services with the right bandwidth and QoS. In order to satisfy this requirement, our design can be managed remotely, enabling control and monitoring of all properties of the CPE user ports. Our work also led to the development of a provisioning system that could offer a simple and easy-to-use interface combined with a powerful database to control the CPE. In our approach, configurations and changes that are processed by the network operator are automatically communicated to the CPE without user intervention. The CPE status can then be monitored remotely, with firmware upgrades occurring quickly. Another consideration for the provisioning system was to ensure that it could be integrated into existing network management environments.

Reducing the cost-base of the network
When designing equipment for FTTH, it is important to take an in-depth look at lowering customers’ operational and capital expenditure. One way is to enable easy and cost-efficient installation and upgrading. Integrating fiber management with active user modules enables a robust and predictable installation process. For example, with a single wall-mount unit with a variety of active service-delivery modules, the operator can match individual end-user service requirements, accommodating customized combinations of services.

Other important factors in the cost-base of the network are stability and reliability. If a system is based on modular software and hardware, additions and modifications in functionality can be performed without compromising existing functionality. Together with a powerful provisioning system, the CPE becomes a fully managed and controlled open-service delivery platform.

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The successful roll out of FTTH requires optimized service delivery to the end-user with the flexibility to combine services and content providers in an individualized way. In our work we have found that, with easy-to-use and powerful provisioning systems in combination with flexible and upgradable CPEs, service delivery can be matched to end-user requirements.

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References