Fiber to the Home

Definition

Fiber to the home (FTTH) is the ideal fiber-optics architecture. In this architecture, fiber deployment is carried all the way to the customer™s home (premises).

Overview

Today it seems that everyone wants high-speed data, dependable voice service, and high-quality video. Whether these services are delivered by digital subscriber line (DSL), cable modems, or wireless architectures is insignificant as long as the service is fast and dependable.
Providing these services, however, presents a number of challenges, including how to get lines out to each customer and how to future-proof the architecture put into the ground today. This tutorial will address one possible solution, which is a fiber-optics architecture called FTTH.

Topics

1. Introduction
2. Evolution of FTTH
3. Meeting Today™s Needs and Anticipating the Future
4. How FTTH Works
5. The Advantages of FTTH
6. Level of Penetration and Acceptance in the Market
7. The Future of FTTH
8. FTTH Suppliers
9. FTTH: The New Industry Standard?
Self-Test
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1. Introduction

FTTH has been developed in response to several residential access market drivers, including the following:

- The Internet explosion, second line growth, the desire for higher speeds, alternative strategies such as voice over DSL (VoDSL), voice over IP (VoIP), voice over ATM (VoATM), and cable modems
- The increased competition in the market due to the growing number of competitive local-exchange carriers (CLECs), an increase in services offered by application service providers (ASPs), and deregulation and pending Federal Communications Commission (FCC) rulings
- Turn-up complexities that affect ease of deployment and maintenance
- The declining costs of optical equipment
- Technology life cycles that dictate a need to deploy the right technology at the right time and to future-proof existing networks

This tutorial will discuss these issues, as well as how well FTTH addresses them. Topics include the following:

- The evolution of FTTH in the industry
- The needs it meets
- How FTTH works and how it relates to other services
- The advantages of FTTH
- Its level of penetration and acceptance in the market
- The probable future of FTTH
- Equipment suppliers offering FTTH
- Whether FTTH is or will become the accepted industry standard

2. Evolution of FTTH

Fiber-based networks in general evolved in response to consumer demand for a vast assortment of multimedia services and applications. In order to meet this demand, service providers need a robust, broadband networking solution such as

fiber technology, which offers unlimited bandwidth and the flexibility to meet customer demand for two-way, interactive, video-based services.

3. Meeting Today's Needs and Anticipating the Future

FTTH enables service providers to offer a variety of communications and entertainment services, including carrier-class telephony, high-speed Internet access, broadcast cable television, direct broadcast satellite (DBS) television, and interactive, two-way video-based services. All of these services are provided over a passive optical distribution network via a single optical fiber to the home. In addition, an FTTH solution based on wavelength division multiplexing (WDM), or a λ-based architecture, allows for additional flexibility and adaptability to support future services.

The full-service access network (FSAN) initiative, whose objective is to obtain cost-effective solutions to accelerate the introduction of broadband services into the public network, is also testing asynchronous transfer mode (ATM)–passive optical network (PON) technology for FTTH, which transports network services in ATM cells on a PON. This mode of transport provides key service features, such as multiple quality-of-service (QoS) guarantees, which enables the successful transmission of integrated voice, video, and data services by prioritizing traffic. It also permits statistical multiplexing for bursty traffic, such as Internet access and data transfers.

4. How FTTH Works

In an FTTH system, equipment at the head end or CO is interfaced into the public switched telephone network (PSTN) using DS–1s and is connected to ATM or Ethernet interfaces. Video services enter the system from the cable television (CATV) head end or from a satellite feed.

All of these signals are then combined onto a single fiber using WDM techniques and transmitted to the end user via a passive optical splitter. The splitter is typically placed approximately 30,000 feet from the central office (CO). The split ratio may range from 2 to 32 users and is done without using any active components in the network. The signal is then delivered another 3,000 feet to the home over a single fiber. An ideal FTTH system would have the ability to provide all of the services users are currently paying for, such as circuit-switched telephony, high-speed data, and broadcast video services.

At the home, the optical signal is converted into an electrical signal using an optical electrical converter (OEC). The OEC then splits the signal into the services required by the end user. Ideally, the OEC will have standard user interfaces so

that special set-top boxes are not needed to provide service. These interfaces would include RJ11 jacks for telephony, RJ45 jacks to high-speed data, and 75 ohm coax ports for CATV and DBS service.

5. The Advantages of FTTH

There are several advantages associated with FTTH, including the following:

- It is a passive network, so there are no active components from the CO to the end user. This dramatically minimizes the network maintenance cost and requirements, as well as eliminating the need for a DC power network.
- It is a single fiber to the end user, providing revenue-generating services with industry standard user interfaces, including voice, high-speed data, analog or digital CATV, DBS, and video on demand.
- FTTH features local battery backup and low-power consumption.
- FTTH is reliable, scalable, and secure.
- The FTTH network is a future-proof architecture.

6. Level of Penetration and Acceptance in the Market

With consumer demand for high-speed bundled services, FTTH has been recognized as the ultimate solution for providing these services to the end user. Twisted pair, coax, and hybrid fiber/coax (HFC) networks are not as robust or future-proof as FTTH architecture. And with the continued declining costs of optical equipment, FTTH has proven to be a technology to watch as it gains the interest of service providers. Today, FTTH is just beginning to penetrate the market with numerous service providers starting to deploy small networks.

7. The Future of FTTH

The desire for two-way, video-based services such as interactive television, distance learning, motion picture–quality videoconferencing, and videophones is expected to continuously increase. In fact, some observers believe that there is already a worldwide demand for these futuristic services today. The capability to meet this demand and continuously add new services at mouse-click speed is creating enormous competitive pressures.

Such capability also offers tremendous revenue potential. Service providers who are able to offer these services to an ever-growing customer base can double or even triple their revenue in a short period of time.

As a result, demand for fiber technologies such as FTTH are on the rise. Technology advancements in the area of WDM are expected to further refine and enhance the technology, enabling more service providers to justify the investment in FTTH.

8. FTTH Suppliers

Several communications companies are already selling FTTH technology. These companies range from small start-ups to major communications equipment companies. The majority of deployments to date have been small networks, but this is expected to change over the next 12 months.

9. FTTH: The New Industry Standard?

FTTH is poised to become the new networking industry standard due to the following factors:

- The reduction in costs associated with fiber deployment
- The absence of active components from the end user to the CO
- An increasing demand for voice, data, and video services on a single fiber
- Its superior reliability, scalability, and security
- Its status as a future-proof architecture

Forward-thinking vendors are working with a broad range of innovative fiber technologies that will bridge the gap effectively between network transmission and access and provide them with the opportunity to add new features and services at lightning speed, while generating vast new revenue streams.

Self-Test

1. Generally, fiber-based networks evolved in response to the following factors:

    a. consumer demand for a vast assortment of multimedia services and applications

b. the demand for lower bandwidth networks

c. increase in cost of copper or coax-based networks

d. all of the above

2. Carrier-class telephony, high-speed Internet access, broadcast cable television, DBS television, and interactive, two-way video-based services cannot be provided via a single optical fiber to the home.

a. true

b. false

3. In an FTTH system, all signals are combined onto a single fiber using _____ techniques and are transmitted out to the end user.

a. POTS

b. WDM

c. CATV

d. SDH

4. In an FTTH network, the optical signal is split by a passive optical splitter and sent to multiple homes approximately 30,000 feet from the CO.

a. true

b. false

5. In FTTH, the optical signal is converted into an electrical signal using a(n) _____.

a. ATM

b. DBS

c. OEC

d. DS1

6. Some of the advantages of FTTH include the following:

a. It is a passive network.

b. It is a single fiber to the end user.

c. It features local battery backup and extremely low-power consumption.

d. all of the above

7. Twisted pair, coax, and HFC networks are as future-proof as FTTH.

a. true

b. false

8. FTTH is becoming economical to deploy due to technology advancements in the area of WDM.

a. true

b. false

Correct Answers

1. Generally, fiber-based networks evolved in response to the following factors:

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b. the demand for lower bandwidth networks

c. increase in cost of copper or coax-based networks

d. all of the above

See Topic 2.

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See Topic 4.

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c. It features local battery backup and extremely low-power consumption.

d. all of the above

See Topic 5.

7. Twisted pair, coax, and HFC networks are as future-proof as FTTH.

a. true

b. false

See Topic 6.

8. FTTH is becoming economical to deploy due to technology advancements in the area of WDM.

a. true

b. false

See Topic 7.

Glossary

ASP
application service provider

ATM
asynchronous transfer mode

CATV
cable television

CLEC
competitive local-exchange carrier

CO
central office

DBS
direct broadcast satellite

DSL
digital subscriber line

FCC
Federal Communications Commission

FSAN
full-service access network

FTTH
fiber to the home

HFC
hybrid fiber/coax

IP
Internet protocol

NGDLC
next-generation digital loop carrier

OEC
optical electrical converter

PON
passive optical network

POTS
plain old telephone service

PSTN
public switched telephone network

QoS
quality of service

VoATM
voice over ATM

VoDSL
voice over DSL

VoIP
voice over IP

WDM
wavelength division multiplexing