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White Paper

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Brief Introduction to Cable Express

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Broadband Service

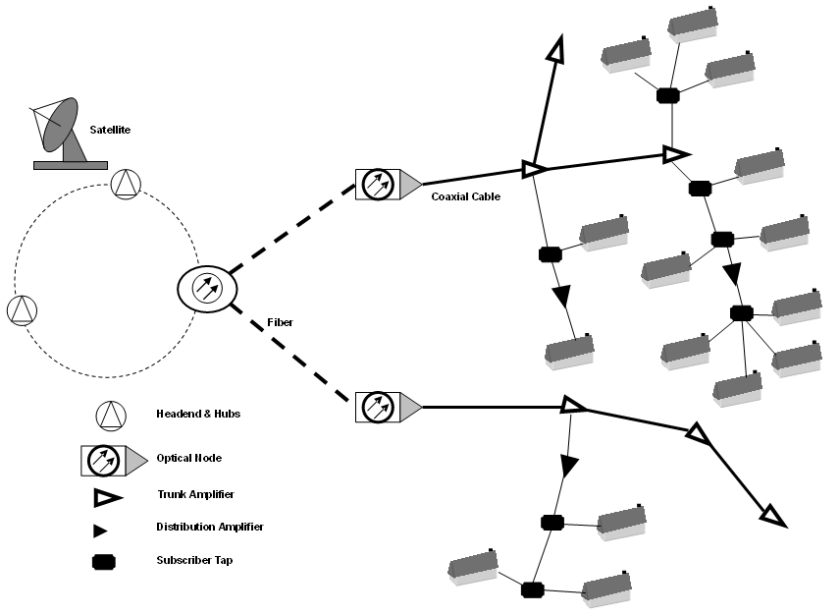
Networks based on packet technology were first presented in 1964. Since then, and through numerous evolutionary steps, the Internet as we know it today was brought into existence. Today, packets are transmitted over most any media. Broadband represents the second generation of Internet access, because of its high bitrate of data transmission.

Nowadays broadband is available by way of cable lines, telephone lines, and wireless. The FCC definition of broadband is 200 kbit/s (0.2 Mbit/s) in one direction, and advanced broadband is at least 200 kbit/s in both directions. The Organization for Economic Co-operation and Development (OECD) has defined broadband as 256 kbit/s in at least one direction. The International Telecommunication Union Standardization Sector (ITU-T) recommendation I.113 has defined broadband as a transmission capacity that is faster than primary rate ISDN, at 1.5 to 2 Mbit/s and this bit rate is the most common baseline that is marketed as "broadband" around the world.

As the bandwidth delivered to broadband subscribers increases, they can enjoy a variety of Internet services, such as viewing video, participating in interactive multimedia games, communicating peers by VoIP, downloading music and images, and accomplishing everything that Internet users can do. However, the more Internet applications are running, the higher data rate is required. For example, video conferencing application using H.264/MPEG-4 AVC requires bitrate at 2 Mbit/s at least, which usually needs a more high-end, costly Internet access equipment to provide such performance.

Hybrid Fibre-Coaxial (HFC) Cable System

One of the broadband access services is established over existing cable television (CATV) networks for serving the Internet to every home. Hybrid fibre-coaxial which incorporates both optical fiber along with coaxial cable to create a broadband network has been commonly employed by cable TV operators. See diagram below for a typical architecture for an HFC Network.



The fiber optic network extends from the cable operator's master headend, sometimes to regional headends, and out to a neighborhood's hubsite, and finally to a fiber optic node which connects to the coaxial portion of the network where 25 to 2000 homes (500 is typical) are linked in a tree-and-branch configuration.

Radio frequency amplifiers are used at intervals to overcome cable attenuation and passive losses caused by splitting or tapping the cable. Those amplifiers over cable boost the signals to keep the power of the television signal at a level that the TV can accept. The distribution line is then "tapped" into and used to connect the individual drops to customer homes. The tap terminates into a small coaxial drop using the standard screw type connector are known as an “F” connector. Depending on the design of the network, the signal can then be passed through a splitter to multiple TVs. If too many TVs are connected, then the picture quality of all the TVs in the house will go down.

Cable Modem

Broadband cable services were introduced in the mid-1990s, a few years before the commercial introduction of broadband over telephone and wireless technology. Subscribers are equipped with a cable modem that provides the link between the cable system and the subscriber’s computer. However, result shows that as wide deployment of cable modem, the system has demonstrated that the combination of IP over CATV is not as good as IP over any other high-speed media.

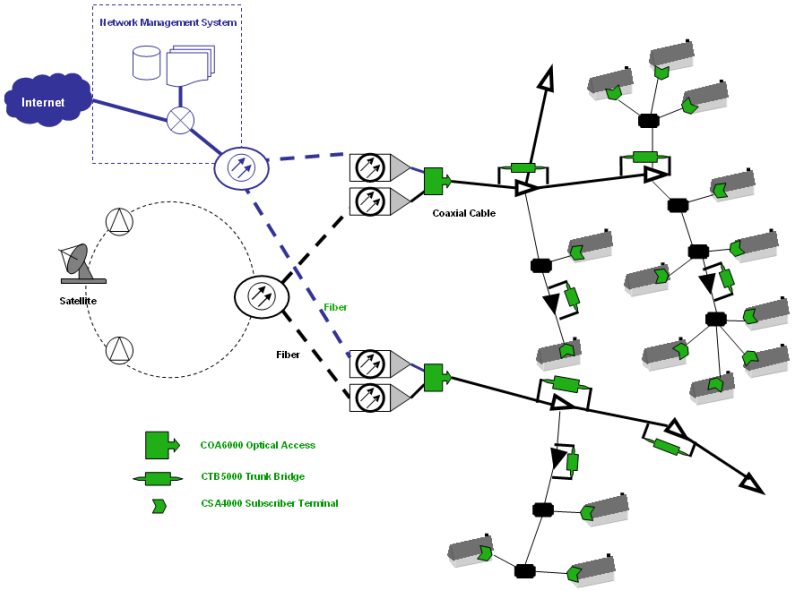
Cable modem speeds vary widely. Although cable modem technology can theoretically support up to about 30 Mbps, the bandwidth most cable operators offer for upstream usually ranges from 128 Kbps to 768 Kbps, and for downstream between 1 Mbps and 6 Mbps.

A major reason causing the asymmetrical throughput problem is that cable modem is much more susceptible to ingress and impulse noise. As noise is an inherent part of CATV plants, cable operators must be able to solve the transient impairment issues that constrain upstream bandwidth in the return path.

When the subscribers require more data rate to enjoy interactive, peer-to-peer, and streaming Internet services, whereas comparing to other broadband technologies, cable operators deploying cable modem over their television system seem not able to support higher and symmetrical data rate for both downlink and uplink as required. That will lead subscribers to change Internet access service providers instead as a result.

Cable Express Solution

Cable Express provides a complete, noise-resistance and low total-cost-of-ownership solution for cable operators to deploy broadband services over existing HFC CATV system in a budget-controlled and time-constrained manner. Cable Express solution transforms the HFC CATV system from one-way, directional to two-way, bi-directional system with higher and symmetrical data rate but without distorting the quality of TV signal. It coexists with CATV, DBS and HDTV signals, without changing the infrastructure of cable network. See diagram below for a typical architecture for a deployed Cable Express over HFC Network.



In the CATV space, the downstream direction (cable head-end to subscribers) is a point-to-multipoint channel. This does have very similar characteristics to transmitting over an Ethernet segment where one transmitter is being listened to by many receivers. In the upstream direction (subscriber cable modems transmitting towards the head-end) the environment has many transmitters and one receiver. Since the upstream direction is like a single receiver with many antennas, the channels are

much more susceptible to interfering noise, which is the major problem causing the uplink throughput of cable modem much lower than that of downlink.

All of the challenges that cable modem cannot solve are overcome by Cable Express. Cable Express runs over the frequency from 800MHz to 1500 MHz, capable of delivering the maximum data rate up to 270Mbps at physical layer and 135Mbps at MAC layer. To overcome the noise issue and improve the upstream data rate, Cable Express uses the advanced multi-tone modulation over 50MHz bandwidth with very sophisticated adaptive signal processing and forward error correction (FEC). Moreover, for precise scheduling of packet transmissions to achieve high utilization, Cable Express uses cutting-edge mechanism such as TDD burst generation and detection, mixed signal conversion, and TDMA/TDD-fully coordinated MAC which guarantees the packet delivery through the link at 1e-9 BER without collisions.

Significantly, Cable Express is the ideal solution for cable operators to offer high-speed Internet service over existing HFC CATV system. It not only provides several times the uplink speed of cable modem by using state-of-the-art technology, but also has advantages including higher reliability, strong anti-interference, manageability, enhanced security, full quality of service, easy installation and more cost-effective maintenance.

As the Internet becomes the important part of daily life to everyone, well-established coaxial cable network is ideally suited as the medium to deliver multimedia applications. With low-cost deployment but high-speed performance, Cable Express solution is the best alternative for DOCSIS cable modem and allows cable operators to compete effectively against other broadband technology.

Cable Express Products

CSA4000 Cable Express Subscriber Terminal Adapter
CTB5000 Cable Express Trunk Bridge Device
COA6000 Cable Express Optical Access Device
CNM7000 Cable Express Network Management System

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