

Cable Television 2.0

Cable operators weigh strategies for launching an all-digital service

By Bruce Davis

While digital television is a relatively new concept to the consumer, it represents a technology that has been fundamentally important to the cable television industry for more than a decade. Since the mid-1990s, cable operators have used digital compression technology to launch hundreds of digital video networks and audio services. Using MPEG-2 (Moving Picture Experts Group) standards for encoding and compressing analog television, the industry can deliver up to 12 digital networks using the equivalent capacity of one 6 MHz analog channel.

In fact, various forms of digital technology have been inherent in virtually all of the services that have been introduced by the cable industry over the past decade. High-speed Internet service, video on demand, high definition television and the rollout of digital or IP telephony services are all examples of digital technologies that ride along the digitally endowed cable plant.

Cable's success in marketing these newer services has dramatically increased the number of digital households. According to the research firm Strategy Analytics, nearly half of all cable households currently subscribe to digital cable service, and the percentage of U.S. households that receive digital cable services is expected to increase to more than 70 percent in 2009.

Simulcast solution

The growth of digital cable is helping to set the stage for migrating the basic and expanded basic channels from analog to digital. By converting this remaining spectrum of cable infrastructure to digital, cable system operators can reclaim and repurpose this capacity for expanding their offerings.

For example, a number of cable system operators are rolling out a digital simulcast service as part of the migration to an all-digital solution. Digital simulcasts of analog channels allow homes with digital set-top boxes or digital cable-ready TV sets to receive the entire channel lineup in digital formats.

These simulcasts initially require the capacity for replicating the existing analog services in digital. For example, a cable system with 70 analog channels would initially need to allocate the equivalent of six or seven analog channels for digital simulcasts these TV networks. Cable operators will reclaim this capacity as they begin to remove the analog signals.

Cable systems serving larger metropolitan areas typically have adequate capacity for launching all-digital simulcasts. These systems have been rebuilt with a combination of fiber optics and coaxial cable, giving them the equivalent of 750 MHz or greater analog capacity. Most use MPEG-2 digital compression technology that incorporates 256 QAM (quadrature amplitude modulation), a technology that grafts digital data onto a traditional analog TV channel. The combination of a bigger pipe and digital compression technology allows these metro-area operators to offer hundreds of digital channels and advanced video services, such as video on demand and HDTV, as well as high-speed data and telephony, the other services in cable's "triple play" lineup.

However, a significant number of cable systems serving smaller markets will require a more aggressive all-digital migration strategy. The FCC estimates that approximately 8 million cable households are served by systems with less than a 36-channel capacity. While this may be a relatively small percentage of the cable universe, it represents most of the country's 7,926 cable systems. In fact, fewer than 120 cable system clusters serve more than 80 percent of all cable households in the U.S., according to estimates published by the FCC.

Weighing alternatives

Once of the greatest challenges facing cable operators serving these smaller markets is the expense associated with launching an all-digital simulcast. With a smaller universe of customers served by these cable systems, the cost per subscriber for the central headend equipment required for introducing new services can be substantially greater than the allocation in cable systems serving substantially more customers through a regional headend. (A headend is a local operations center that receives, process and retransmits TV channels and other services.)

An alternative to headend-based investments is to centralize as much of the process as possible, allowing the capital and operating expenses to be allocated across multiple cable headends as opposed to each one. This was the premise behind "Headend in the Sky" (HITS), a service launched by the Comcast Media Center (CMC) in 1994 when it operated as the National Digital Television Center. Rather than installing the digital encoding and compression technology in each local cable headend, HITS affiliates select from a lineup of more than 150 digital video and audio services that can pass

through their headends with minimal operator involvement.

HITS currently has over 400 cable MSO (multiple system operator) affiliates and serves more than 3,000 local cable headends with 13 million digital customers. For many of these affiliates, HITS provides the best solution for cost-effectively launching the video service packages that have allowed them to compete effectively against the all-digital lineups of the country's direct broadcast satellite providers.

Working with satellite carrier SES Americom, the CMC recently launched a transport service for delivering digital feeds for the most widely carried basic and expanded basic cable channels. When fully deployed, the basic and expanded basic channels aboard the CMC/SES Americom Total Digital Solution will combine with the HITS digital overlay platform to provide a choice of more than 200 video and audio services encompassing the majority of programming services currently offered by cable system operators.

Hybrid approach

Centralized services such as the Total Digital Solution represent a hybrid alternative for launching an all-digital service. While the local system can duplicate the majority of its current analog lineup using the centrally managed service, there will still be local content, including local broadcast and PEG (public, education and government access) channels that will need to be encoded locally. Cable systems also will take advantage of DPI (digital program insertion) triggers embedded in the centrally encoded channels to accommodate local advertising insertion.

Hybrid solutions that incorporate centralized content management services such as the Total Digital Solution provide substantial savings over headend-based approaches, particularly with respect to equipment and maintenance costs, technology upgrades and 24/7 quality-of-service monitoring. For example, cable system operators can purchase six satellite receivers that can acquire as many as 72 TV networks from a centralized platform such as the CMC's Total Digital Solution for the expense involved in encoding one channel locally.

Capital costs for launching all-digital can be significant for cable MSOs with numerous headends or cable operators serving smaller markets that don't provide an adequate economy of scale. Similar to the expenses faced in launching local packages of digital TV programming networks, cable MSOs can choose between purchasing encoders for re-encoding the same national channels at each of their headends or taking advantage of centralized encoding for these commonly carried networks.

Equipment maintenance and upgrade expenses also are minimized by using a centralized service. For example, the CMC has made five forklift upgrades to its HITS platform over the past eight years alone, most recently upgrading to fifth-generation encoders using Motorola's "PurePixel" processing enhancements. These types of ongoing investments could be cost prohibitive for many of the country's cable headends.

In addition, the CMC can create multiplexes of digital channels that can achieve higher levels of bandwidth efficiency. From the perspective of cable programming networks, this capability represents a cost-effective and complementary method for increasing the alternatives available to affiliates for receiving their digital networks.

Both cable operators and programming networks benefit from quality assurances that can be more easily implemented and monitored from one location as compared to each cable headend. Every modification to source content, such as re-encoding or grooming, will impact the overall quality the cable customer experiences. By eliminating additional compression activities at the headend, such as rate-shaping, centralized content management removes a content touch point and helps to ensure optimum quality.

These quality touchstones begin with the process for ingesting and aggregating the source content, by using high-quality satellite downlinks to receive the network's direct feed. Prior to beginning the encoding process, headend or centralized approaches need to incorporate external and on-board digital noise reduction and temporal filters. The best way for experiencing the highest quality output is by beginning with the best possible input.

Multiplexed with care

Because the encoded channels are going to be packaged into bandwidth-efficient "statistical multiplexes," another quality issue that can arise is the potential for one channel to adversely affect all of the other channels in the multiplex. For example, the CMC conducted extensive analysis of each channel, paying particular attention to the nature of the content, the overall incoming quality of the channel and any changes across the entire programming schedule (as opposed to just daypart) before it creates the multiplexes.

For digital encoding, high-end, closed loop encoding systems with dual pass encoding and on-board preprocessing represents the best strategy currently available for ensuring optimum bandwidth utilization. In a hybrid headend solution, the challenge is to manage competitive and comparable video quality across multiplexes that include content from the nationally delivered sources, along with local broadcast channels and PEG content.

In addition, a centralized solution will likely be able to provide dedicated and trained on-site engineering and around-the-clock technical support, as compared to local headends that may not be staffed to that extent. These well-equipped content distribution centers can also more readily invest in capital infrastructure to maximize redundancy, monitoring and control systems that result in very high levels of service availability. Comparatively, replicating this infrastructure investment across multiple headends often may result in shortfalls such as a single “shelf spare” encoder for each multiplex. This can result in larger service impacts when a second spare is needed.

In addition to headend investments, cable system operators must also look for the most efficient means to convert analog households to digital. Consumer electronics manufacturers are responding to the challenge with lower-end set top boxes that are ideally suited for serving cable’s basic-only customers and allowing systems to reclaim and reallocate analog bandwidth.

Game-changer

One of the greatest advantages for migrating to all digital, especially in cable markets that may not have 750 MHz or greater capacity, is to offer competitive digital video services, such as HDTV.

HDTV is today’s counterpart to the fight for multi-channel customers that the market experienced with the advent of robust digital channel offerings by the satellite television industry a decade ago. According to a news report in the trade publication *Multichannel News*, Pali Research analyst Rich Greenfield wrote in a recent industry review that “We continue to believe consumers who buy new HDTVs will migrate toward whichever multichannel provider offers them the deepest HD programming.” In the same report, Greenfield pointed out the important connection between rolling out HDTV and all-digital, noting that moving to all-digital will free up the bandwidth necessary for expanded HDTV offerings, *Multichannel News* reported.

By offering a competitive HD lineup that viewers want most, cable operators are finding they can attract and retain customers who are upgrading to HDTV sets. Combined with cable’s ability to offer a bundle of high-speed Internet, advanced video and telephone services, HD is truly a game changer. Keeping the industry ahead in this game requires operators to weigh the benefits of cost-effective centralized solutions in developing the all-digital strategies that will allow them to further expand cable’s video, voice and data offerings.

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