Analog Channel Re-Creation Using the Digital Service Access Node

The All-Digital Network Migration Challenge

Broadband service providers are under constant pressure to provide the bandwidth required to deliver an ever-growing list of services that their customers demand. Operators today must be in a position to provide extensive high-definition (HD) content, reliable voice service, and high-speed data access to retain and grow their customer base. Ever-increasing competition from fiber-based telecom companies and aggressive Digital Broadcast Satellite (DBS) providers has caused many cable service providers to rethink their approach to bandwidth management, resulting in increased focus on an all-digital system migration.

For years, cable service providers have been able to increase spectrum to support analog channel and services growth by upgrading or replacing equipment in the headend and access network. Today, transmission technology has evolved to support 1 GHz of bandwidth, helping to pave the way for digital set-tops, embedded multimedia terminal adapters (EMTAs), and cable modems. This capacity growth has made digital services in the home a reality.

With a digital set-top in the home, the operator can take advantage of digital compression in the network to compress 10 or more digital video signals for delivery in the spectrum traditionally allocated to one analog channel. This 10:1 increase in content capacity has created an opportunity for cable service providers to now convert to a more efficient, all-digital network. As cable service providers reclaim analog bandwidth by migrating to all-digital, as shown in Figure 1, they can use the reclaimed bandwidth to support additional customers, content, and services.

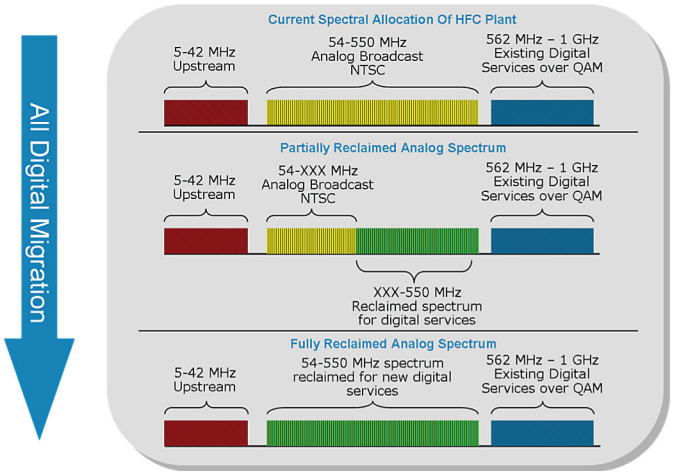

Figure 1

In many cases, this migration to all digital includes moving analog channels exclusively to the digital tier. While this transition solves many of the bandwidth problems, it continues to present its own list of challenges. For example:

- Content providers have contractual agreements with service providers to place their content in the most watched, analog tier
- Shrinking analog tier is inflexible and limited in content
- The support of bulk analog contracts is with multiple dwelling units (MDUs)
- Potential for increased churn: limited or no offering opens the door for competition
- The requirement to deploy digital set-tops where none were needed before
- The incremental cost of adding digital terminal adapter (DTA) and set-top box equipment

Despite these challenges, many cable service providers have decided that the all-digital migration is a primary strategy to address the growing challenge of bandwidth capacity.

The Value of Analog and MDU Customers

Analog programming's widespread subscriber penetration has delivered benefits to broadband cable operator providers over the years, especially when negotiating advertising pricing agreements. In addition, when televisions were sold "cable ready," cable operators had an inside track to customers and an automatic advantage over competitive video services from DBS.

The delivery of analog services to important bulk MDU customers is also crucial. MDU operators have unique requirements for delivering services to their residents. In many cases, they do not want to deploy digital service and the corresponding set-tops for cost, support, or cosmetic reasons. MDUs also represent unique set-top challenges because of the rate of resident turnover and equipment theft. Ease of use is also important to many MDUs, especially those housing older residents who do not want to self-install a new box or add an additional remote control. All of these factors make analog service to MDUs a vital service to maintain for their customer base.

Now that the FCC has mandated access to all service providers within an MDU, contracts for MDUs will become an increasingly competitive space. Cable operators will need to support existing bulk agreements with their MDU customers and continue to provide competitive services as they transition to all-digital networks.

Until recently, cable providers have had few options to easily meet the terms and conditions of existing analog service contracts with MDU operators as they transition to all-digital networks. The elimination of analog service in the cable plant has required the creation of a video headend at a location within the MDU complex and retransmission of an analog signal throughout the premises. The required space, expertise, maintenance, and cost present challenges that the MDU owner has been reluctant to assume. For bulk MDU accounts, there is a need for a more flexible and easily deployed solution to provide analog service to their customers.

The DSAN Overview

The Cisco® Digital Service Access Node (DSAN) provides a cost-effective, flexible, easy-to-deploy solution for serving the needs of MDU and bulk analog accounts. The DSAN regenerates up to 82 analog channels of National Television Systems Committee (NTSC) video at the customer premises through the use of bulk decryption and bulk decoder technology. The environmentally hardened node product is designed to operate transparently within a cable television (CATV) network for setup, provisioning, and billing, fitting easily into existing hybrid fiber-coaxial (HFC) installations.

Specifically designed for MDU deployment, the DSAN supports two auxiliary inputs, allowing MDU owners to provide up to eight customized local channels for their tenants (for example, security cameras, DVD players, local bulletin boards, and so on). The channel lineups for each DSAN can also be configured independently to support specific customer needs, allowing service providers to offer a wider variety of content. Additionally, the DSAN supports digital passthrough, making DSAN an extremely flexible platform that is ideal for those customers who want additional services such as high definition, video-on-demand (VoD), data, and voice.

The DSAN Solution

The DSAN is a device that converts a pure digital plant spectrum to a combined spectrum containing both digital and analog output, as shown in Figure 2. The analog output is re-created from portions of the digital plant spectrum and occupies the frequency range designated for CATV analog channels (54–552 MHz). The combined digital output (564 MHz–1 GHz) is available for use by compatible receiving equipment, such as a set-top, EMTA, cable modem, and so on.

In addition to providing the combined analog plus digital output, the DSAN provides a pure digital passthrough output port that is identical to the input (minus attenuation) for servicing those customers who want the full service provider offerings.

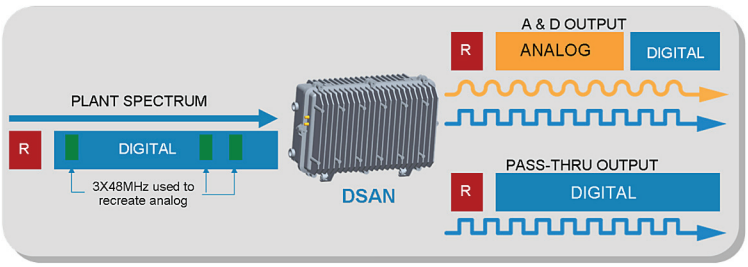

Figure 2

Designed for HFC

The DSAN solution is a powerful platform that gives service providers the ability to manage the complexities of delivering analog service at the MDU, while easily integrating into an existing HFC network. To simplify deployment, the provisioning and control software was based on existing Cisco set-top software currently in use. The product also transparently interfaces with existing cable modem control systems and support equipment.

One of the most useful features of the DSAN product is that it was designed to be provisioned and managed remotely at the headend: no need to send a technician into the field to make channel lineup adjustments. The provisioning software allows for custom channel lineups to be downloaded on a per building basis. For those occasions where onsite control and diagnostics are desired, an easy-to-use status monitoring and configuration interface is provided through the local craft interface (LCI) port.

Analog Channel Recreation

In order to recreate the 82 channels of analog content, the DSAN takes in three blocks of 48 MHz quadrature amplitude modulation (QAM) signals, representing 16 digital channels. As an example, at 10:1 compression, the DSAN has 160 channels of analog channels from which to select. These QAM signals can be located almost anywhere in the 1 GHz HFC spectrum, giving service providers extreme flexibility.

Figure 3 shows an example of the regeneration process for an analog spectrum of 54 to 552 MHz that is reconstructed from a portion of the digital tier, which can span from 54 to 1002 MHz.

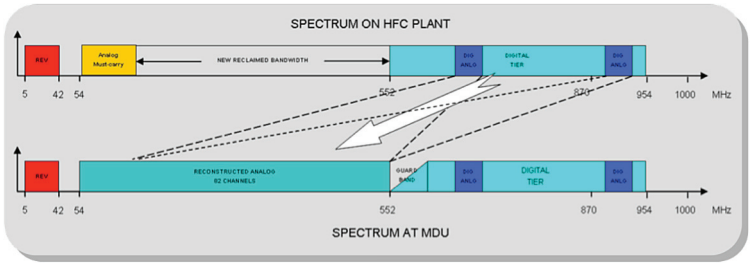

Figure 3

As shown in Figure 3, a 12 MHz guard band is provided in the output spectrum between the reconstructed analog and the low end of the digital tier. A dedicated “brick wall” high-pass filter in the DSAN creates this guard band, which is needed to isolate the recreated analog channels from existing channels on the plant.

Custom Channel Lineups

As service providers migrate toward an all-digital network, the analog tier shrinks, reducing the number of channels available to bulk accounts. With the DSAN product, the entire 1 GHz spectrum is now effectively available for an infinite number of custom channel lineups. Service providers now have the power to create special packages that meet the unique needs of individual bulk account customers. Table 1 shows a few examples.

Bulk Account Customer	Channels
Hotel near theme park	Disney, Nogin, Discovery, Weather
Sports bar/restaurant	MLB, NFL, ESPN, Fox Sports
University/community college	CNN, Fox News, Discovery, TLC, Food
Apartment complex	Local ABC, NBC, CBS, Fox

Table 1

Local Channel Insertion

Two Asynchronous Serial Interface (ASI) auxiliary input ports are included in the DSAN as an added feature for bulk MDU applications. Most often, these ports will be used for the insertion of local bulletin boards, onsite security cameras, or DVD players into the standard channel lineup. Used in conjunction with the companion digital auxiliary input (DAXI) product, service providers can add up to eight channels of locally generated content.

Output Port Flexibility

Each DSAN unit has two output ports that allow the customer to choose between a split analog and QAM option, similar to the existing cable plant, and an all-QAM version for maximum video content and service distribution. Providing these two options gives service providers additional flexibility and opportunities to upsell additional services to the MDU owners.

Environmental Hardening

The physical environments into which the DSAN product will be deployed are not consistent and are potentially harsh. The ideal MDU cabinet is frequently mounted in an outdoor location that is subjected to wide variations in temperature and humidity. As a result, the unit must be capable of industrial performance ratings of –40C to +60C and humidity up to 95 percent. Additionally, a robust level of surge protection must be built onboard to help ensure product reliability in lightning strike zones. The DSAN meets or exceeds these requirements and is also rated to the stringent IP68 standard.

Conclusion

As broadband service providers begin to migrate to an all-digital network, the Cisco DSAN is the ideal platform to support the analog channel lineup needs of bulk MDU customers. Its HFC-ready design, environmentally hardened enclosure, and output port flexibility provide service providers with the right product for maintaining analog service to its bulk MDU customers. With 82 channels to populate, 8 of which can be locally generated, service providers are sure to be able to meet even the most demanding custom channel lineup needs.

For more information about the Cisco Digital Service Access Node (DSAN), go to **www.cisco.com/go/dsan** or contact your local Cisco account representative.

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