COMPRESSED DIGITAL COMMERCIAL INSERTION: NEW TECHNOLOGY ARCHITECTURES FOR THE CABLE ADVERTISING BUSINESS

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Abstract

Advances in compressed digital audio/video technology have paved the way for the introduction of a new technology platform for commercial insertion. These concepts embodied in digital video production, transmission, storage, and playback will redefine cable advertising sales operations in the 1990's. The basic concepts of a compressed digital commercial insertion network (CDCINet) are explored in conjunction with highlighting the various benefits this digital platform should provide.

Introduction

The cable industry is uniquely positioned to implement an architecture which enables advertisers the ability to "precision market" its products on the basis of geographical and demographical boundaries. Cable's growing slice of the advertising expenditure pie has demonstrated this unique capability, however there are technological and operational hurdles which impede further significant growth in this important revenue stream [1].

The use of tape-based video cassette player (VCP) technology coupled with the various forms of interconnects (hard, soft, hard interconnect/soft playback) has been the historical technological platform for cable ad sales operations [2]. However, new technology platforms based on integrating compressed digital video mass storage systems and powerful communication network architectures should allow an infrastructure which supports future revenue growth for cable advertising sales. This compressed digital commercial insertion network (CDCINet) will be a critical element of adding value to products and services (e.g., ability to deliver "on the fly" insertions) and supporting cable operators in reducing costs of operations (e.g., significant reductions in cost of tape duplication and tape distribution).

Cable Television Laboratories, Inc. (CableLabs) believes that dramatic improvements in the cost/performance ratios of mass storage and network technologies will allow for the realization of a CDCINet. Recently, it was reported that proponents of compressed digital commercial insertion systems are costing between $2,000 to $5,300 per insertion channel [3] for random-access style systems. Contrast these digital system costs to VCP random-access style systems currently priced at $8,000 to $10,000 per insertion channel.

The majority of the cost for today's random-access style system is centered around the need to allocate up to four VCP's to a single network. Therefore, if VCP's are costing around $1,500 each, an operator spends approximately $6,000 for spot storage for each random-access network. Compressed digital storage for 200 30 second spots is currently costing between $1,600 to $2,000. With the advancements in storage technology, it is conceivable that tens of GBytes of storage will be available, thereby driving spot storage costs to a few cents per spot. This follows "Moore's Law" where the cost of computing is theorized to half every three years.

It can also be argued that the cost of tape duplication (editing,compiling, dubbing, and generating multiple copies of each spot) and the associated cost of physically transporting these tapes to cable headends can be significantly reduced by utilizing the "electronic highway " for spot distribution to a digital storage medium.

Therefore, to analyze the creation of a CDCINet, there are at least three critical elements to explore:

- the network architecture(s) necessary to create an "electronic highway" which transports local, regional, and national spots to cable headends;

- the evolutionary needs of integrating existing VCP-based systems with new compressed digital playback systems, and;

- the need to establish interface guidelines for "front-end sales software", traffic and billing software, and electronic verification software.

Architectural Overview of a CDCINet

In proposing the creation of a CDCINet, which focuses on the general distribution of digitally encoded information, we create the need to examine the network requirements from both an architectural and transport protocol point of view.

Remember, the purpose of creating this network is to promote the interconnection and interoperability of hardware and software which subsequently allows advertisers to buy local, regional, and national spot avails easily and conveniently. Ideally this environment would allow several vendors of hardware and software to coexist; contrast this environment to today's

Layer 7	**Application**	Provides access to the OSI environment for users and also provides distributed information services.
Layer 6	**Presentation**	Provides independence to the application processes from differences in data representation (syntax).
Layer 5	**Session**	Provides the control structure for communication between applications; establishes, manages, and terminates connections (sessions) between cooperating applications.
Layer 4	**Transport**	Provides reliable, tranparent transfer of data between end points; provides end-to-end error recovery and flow control.
Layer 3	**Network**	Provides upper layers with independence from the data transmission and switching technologies used to connect systems; responsible for establishing, maintaining and terminating connections.
Layer 2	**Data Link**	Provides for the reliable transfer of information across the physical link; sends blocks of data (frames) with the necessary synchronization, error control, and flow control.
Layer 1	**Physical**	Concerned with transmission of unstructured bit stream over physical medium; deals with the mechanical, electrical, functional, and procedural characterics of the access medium.

Figure 1: Seven Layer OSI

airline reservation system where several hardware and software systems coexist.

Therefore, it is beneficial to discuss the attributes of a CDCINet in terms of the OSI model. The International Organization for Standardization (ISO) established a subcommittee to develop an architecture for these communications tasks. The result was the development of the Open Systems Interconnection (OSI) reference model, adopted by ISO in 1983 and endorsed by the CCITT in 1984. The OSI model is a framework for defining standards for linking heterogeneous computers. The term "open" denotes the ability of any two systems conforming to the model and the associated standards to connect these systems together [4].

Traditionally the OSI model has used a "layering" concept to promote this interconnection capability. Figure 1 shows a seven layer OSI model protocol suite. From layer 1 (the lowest) to layer 7 (the highest), we can see that interconnection and software interfacing is described.

Realizing that compressed digital commercial insertion is only one application within an architecture that interconnects cable headends, the Advanced Network Development Subcommittee at CableLabs has described a network architecture plan which has interconnectivity and interoperability at its center.

The importance of utilizing an OSI model approach to developing a new "connectivity" infrastructure within the cable industry is illustrated by viewing the Advanced Network Subcommittee's network architecture plan as shown is figure 2.

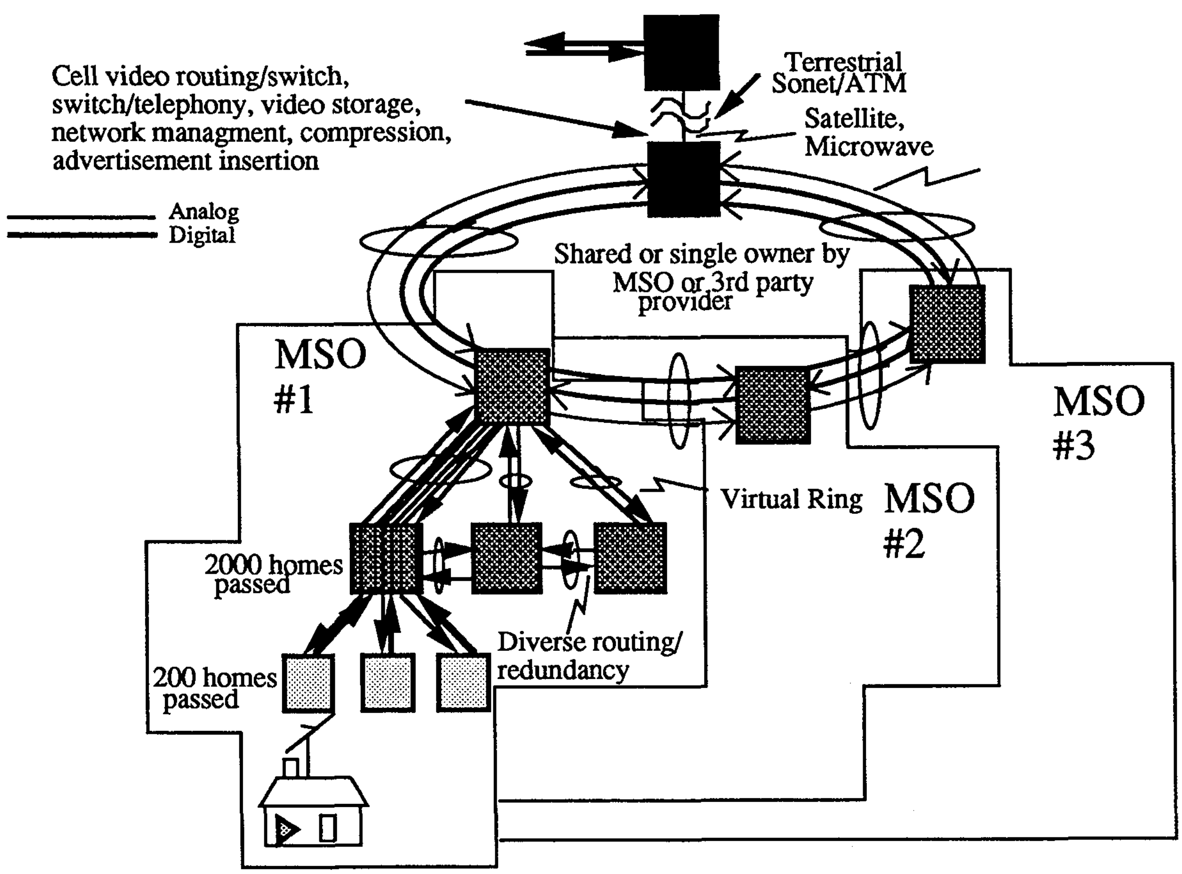

Figure 2: Advanced Network Development Subcommittee's Network Architecture Plan

It is clear that current developments in compressed digital video technology will soon be used for program delivery via satellite. This delivery of satellite delivered programming and the creation of some type of CDCINet should be some of the first applications deployed under the Advanced Network Subcommittees network architecture plan. When combined with non-video applications (alternative access, datacomm, PCN, and other non-entertainment services) the need for this network to migrate via an "open architecture" approach is evident.

Architectural Complexities of Local, Regional, and National Spot Delivery Systems

One of the challenges of maximizing revenue from the advertising community is to integrate the insertion needs of the local, regional, and national spot buyer. Each buyer has unique requirements and there are competing forces at play in cable operations when determining what percentage of avail time should be allocated to local, regional, national, and even cross-channel promotional insertions. Obviously each cable market is different and the cable operators in these markets will need to determine the appropriate "mix" of local, regional, and national ad spots which maximize revenue. Therefore it is recommended that any technological platform for commercial insertion should have scheduling capability which is controlled by the local operator.

It is necessary therefore to integrate the distribution technologies for these different insertion situations. Local cable advertising in many markets is targeted to community businesses which have consumers within a defined geographical boundary. For example, a neighborhood hardware store owner realizes it most likely draws customers to this store because of its geographical proximity to consumers. For this hardware store owner it is important that its advertising dollars are spent effectively within its geographical sphere of influence. A broadcast style ad insertion which covers a large metropolitan area and costs several times more than a "localized" insertion would probably be a waste of money.

Now contrast the needs of these geographically defined businesses to other firms which desire entire metropolitan coverage. Many businesses will still want broadcast style coverage and the current insertion systems are typically structured to meet this need. The majority of the $600 million the cable industry received in 1991 was from this type of advertising buy [5].

However, cable advertising executives realize that significant revenue growth opportunities will come from the national spot delivery business. The cable industry received approximately $150 million from this market segment in 1991 against total advertising expenditures of approximately $16 billion [5]. Many operators feel that cable's fair share of this market should be in the $4 billion to $5 billion range.

Therefore the architectural design of a compressed digital commercial insertion network (CDCINet) should look at the needs of local segmentation, regional distribution (via these hard, soft, hard distribution/soft playback techniques), and national spot market interconnection.

CDCINet Concept

A comprehensive end-to-end compressed digital commercial insertion network (CDCINet) which covers the need of local, regional, and national advertisers would likely need the following platforms:

- A national/regional distribution center(s) which utilizes both satellite and fiber optic based communications architectures. Both analog and compressed digital delivery of spots would be delivered to cable headends.

One would expect this platform to migrate to an all digital delivery system within the next five to ten years. These types of distribution centers would facilitate more efficient advertising buys for regional and national accounts.

- Coexistence of current VCP based insertion systems and new all digital systems at the local headend (or playback facility) which have "intelligent switching" integrating both. However, most operators should realize the advantage of storing spots digitally and subsequently begin phasing out VCP systems. Because spots don't need to be delivered to these headend storage devices in "real time", cost effective transmission schemes can be developed for locally produced ads.

- Interfaces and interoperable software packages which allow for efficient buying, scheduling, billing, and verifying of local, regional, and national ads. Sales oriented front-end packages should interface into traffic and billing systems, thereby creating the "paperless" environment so desired by both ad agencies and cable operators. It is important to look at common data exchange formats and integrate these into software systems to maximize advertising revenue.

When integrated, the various components of a CDCINet might resemble the architectural description in figure 3. These components: local ad production/sales facilities, regional interconnection facilities, and national uplink facilities, are diagrammatically shown to coexist.

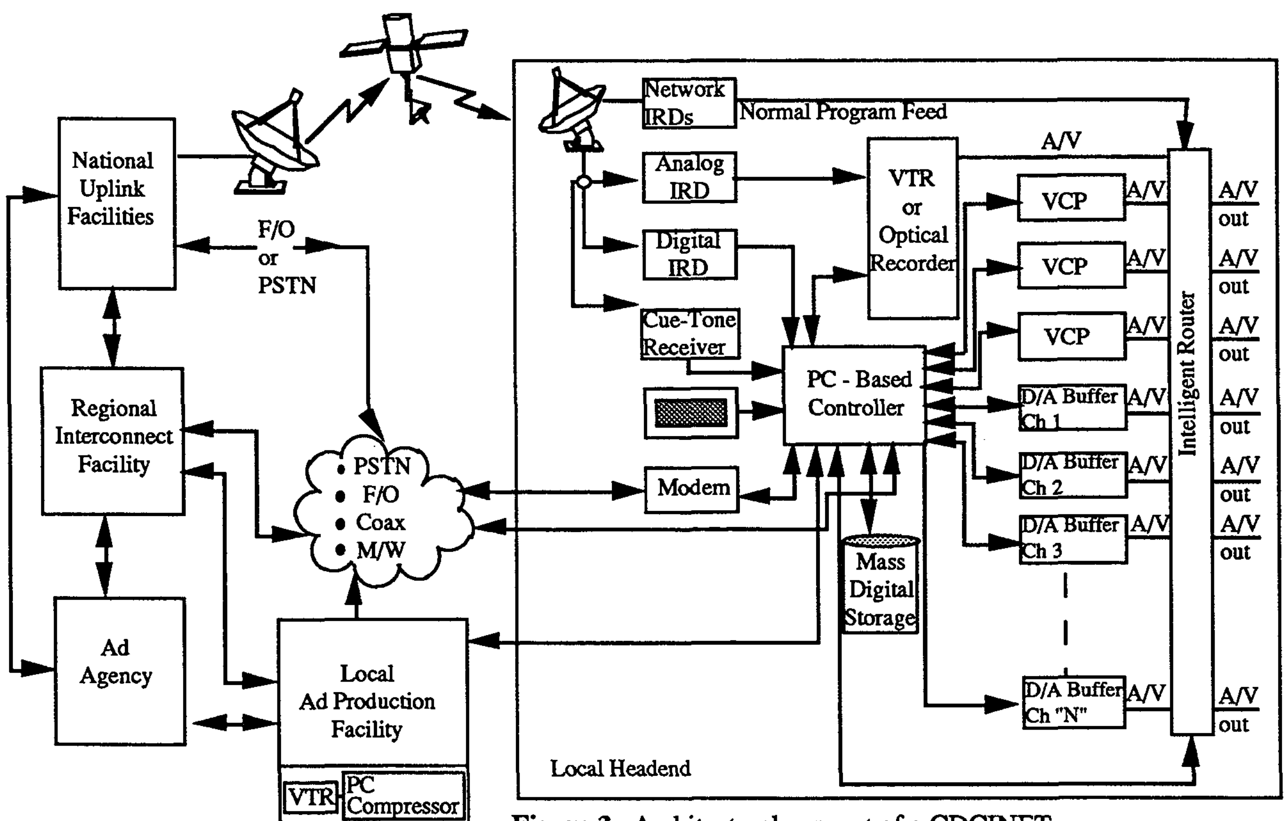

Figure 3: Architectural concept of a CDCINET co-existing with VCP based technology

While national and regional spot delivery are accomplished by transmitting analog and digital signals to addressable headend storage and playback systems, the delivery of geographically segmented local advertising will likely be based on AM-VSB fiber optic nodal architectures. Figure 4 diagrammatically shows routing different spots to different areas of the community even though the same program source will be viewed in both parts of the system. The first systems deployed for this type of market segmentation will likely be point-to-point FM or digital fiber optic hubs. Further research and development will be necessary to cost-effectively switch a large number of different commercials into the same program source when using AM-VSB fiber optic transmitters. However a system might find it economically viable to deploy a few channels of geograghically/demographically segmented commercial insertion.

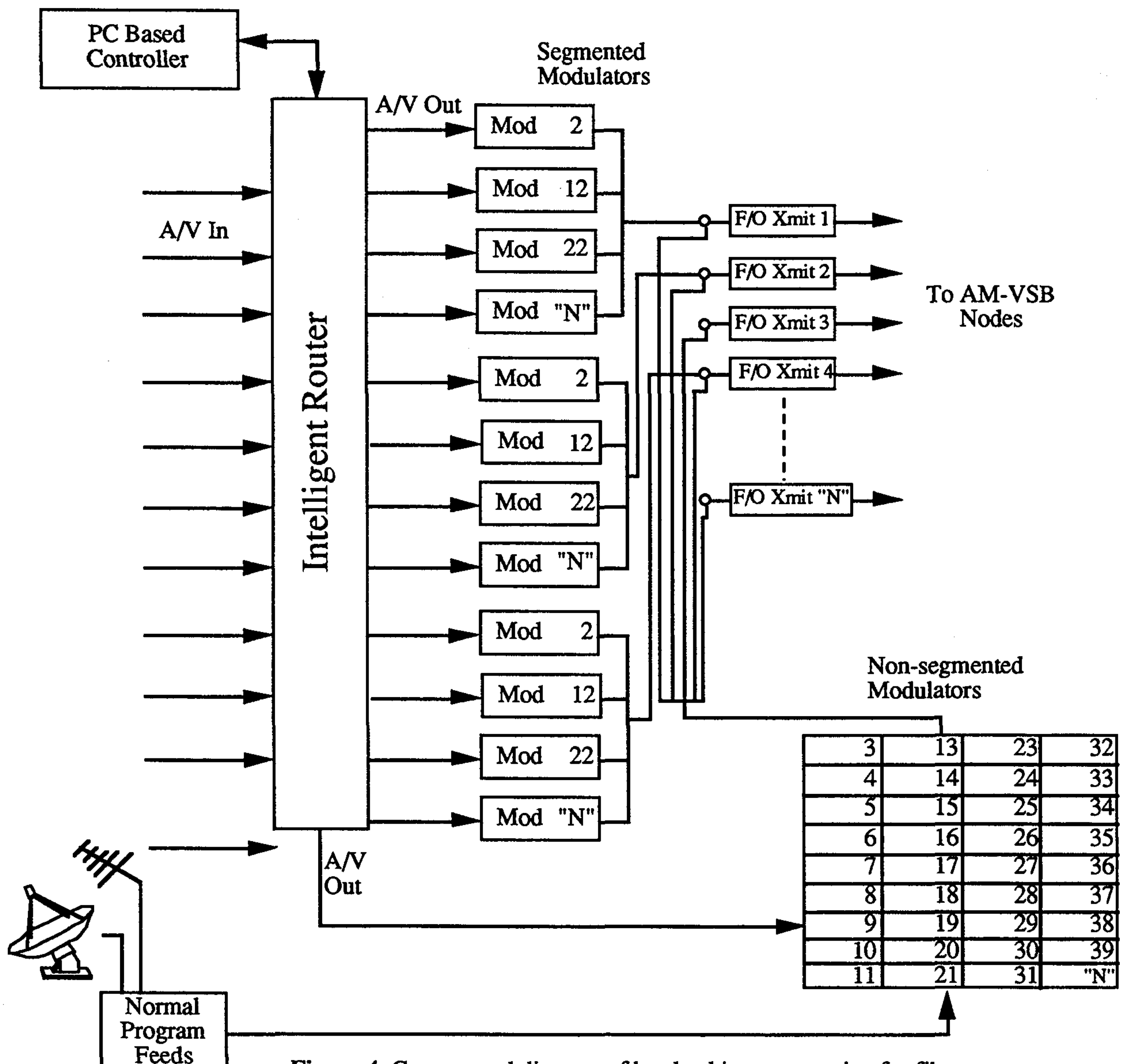

Figure 4: Concept and diagram of headend interconnection for fiber optic nodal segmentation

Order Entry, Traffic, Billing and Verification Issues

While the hardware portion of this CDCINet is an integral part of the solution to maximizing advertising revenue, the software requirements of this network is often cited as the greater challenge for the industry to grapple with.

It is recognized within the national spot advertising community that buying and coordinating multiple avails across multiple headends is difficult. Tom Winner, from the ad agency of Campbell, Mithum and Esty's, recently intimated this difficulty in the November/December, 1991 issue of CableAvails magazine. In this article he indicated that,

"I see selling spots on cable as terrifically difficult". When told of the electronic wizardry slated to eliminate difficulty, he responded flatly: "We'll believe it when we see it." [6]

Many MSOs and industry service providers are beginning to address these limitations. In his 1991 white paper on local advertising sales, Larry Zipin, vice president-advertising sales for Warner Cable Communications, Inc., says:

"The other half of the Commercial Insertion Technology issue is defined by the Software that drives the Process. This two-part software is usually referred to as the Traffic and Billing System. Traffic is the component that is fundamental to the creation of revenue potential, because it is within this software that the degree of Accessibility to the commercial insertable inventory is determined. In other words: if the combination of ad insertion hardware and Traffic software enables the maximum assessibility to individual spots (i.e., fixed positions), then revenue potential is increased; as compared to random rotations (i.e., ROS) in which revenue potential decreases significantly.." [1]

To further illuminate this issue, Zipin goes on to say:

"At the present time, most of the major ad agencies that control the Spot Market transactions are not willing to deal with Cable's fulfillment limitations. As a result, the Spot Cable opportunity will not be realized until a multi-market, commercial insertion/delivery system coupled with multi-market spot scheduling/traffic software is in place.

This Spot Cable opportunity, however also has the added complication of requiring that its fulfillment technology be able to interact and interface with the Local Ad Sales technology so that the Local Ad Sales owner maintains control over its inventory. (the airline industry's reservation system has been cited as being analogous to the ad sales situation)." [1]

Again we see the convergence of cost-effective computing plus the use of cost-effective communication networks can be the enabling architectures for an integrated software solution to the above challenges.

Therefore, as it was shown to be necessary to promote interfaces between hardware, the "open architecture" approach to software interoperability is also needed to accomplish this "multi-market" capability. Hopefully industry leaders can recommend an "interface platform" that allows multiple developers of front-end sales software, traffic and billing software providers, and electronic billing and verification providers to coexist within this CDCINet.

Conclusion

The cable advertising industry has an opportunity to develop and construct an integrated network system (CDCINet) which allows for the coordination of local, regional, and national advertising avails.

It is critical for the cable industry to develop interoperable hardware and software systems at and between each level of this advertising network: the local level, the regional level, and the national level. This physical network, when coupled with powerful sales, research, traffic, billing, and verification systems, can do what advertisers want it to do: delivery the right message to the right group of consumers cost-effectively.

References

[1.] Larry Zipin, "Local Cable Advertising Sales: 1992 and Beyond," white paper, 1-19, 1991.

[2.] Bill Killion, "Specifying Ad Insertion Equipment," Communications Technology, 1-8, August 1985.

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[5.] Thomas McKinney, Cable Advertising Bureau (CAB), conversations about cable advertising revenues, February 28, 1992.

[6.] Staff Reporter, "The Insertion Quandry," CableAvails, 33-37, November/December 1991.