Issues to be Considered—The Implementation of a Digital Distribution System by the Commercial Broadcast Networks

By Brent L. Stranathan

The national commercial broadcast networks' program origination and distribution/transmission infrastructures have gone through various technological and operational changes since the inception of the centralized network-to-affiliate interconnect systems were first developed in the 1950s. The networks now face what is probably the most technologically challenging and far-reaching change in their history—the migration to a digital distribution system. This paper will review the various technical, operational, and economic/business issues that the networks will be examining as they develop their digital migration plans. The issues will be reviewed in the context of how the distribution systems currently function and how the features and functions could operate in the digital world.

The digital distribution migration strategies that the commercial broadcast networks will be developing and implementing over the next several years will be key components to their future survival. The migration process will touch the very core of each network's operation. Their ability to adapt to the accelerating digital revolution will affect their ability to compete with entertainment services already in the digital world. Critical governmental policies already enacted and those that will be developed over the coming months by the regulatory, and business and manufacturing communities must provide the networks with the opportunity to continue to compete against emerging services. Now, the networks' challenge will be to embrace these policies and creatively but diligently implement digital technology while maintaining their unique national service.

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Key Issues

Several key factors loom large for the transition planners. The cost and availability of capital is one. Competition for the networks' core audience by other entertainment and information services is growing steadily. Cable, direct broadcast satellite (DBS), the Internet, and other consumer devices such as the videocassette recorder (VCR) and video games continue to grow. In addition, the three long-established networks (CBS, ABC, NBC) have been emulated several times over, with Fox now taking a strong marketplace position and Warner Brothers and Paramount (UPN) also attempting to build national distribution systems. The resulting effect of this growth is that advertising dollars, the networks' main source of revenue, is being spread further across more services. While the networks have collectively been able to maintain record annual advertising revenues—primarily because they still provide the only immediate nationwide exposure for advertisers—the overall share of the television audience the networks once dominated, at over 80% five years ago, has slowly decreased to near 60%. These factors, plus the recent marketplace consolidation of media companies create added pressure on the process of obtaining the internal capital expenditures it will take to complete the various phases of the digital transition. Many believe the broadcast networks must make the transition to survive, and I happen to agree with this assessment. However, the exorbitant costs to be incurred without clearly apparent economic benefits must be met with innovative thinking toward new business opportunities. Ultimately, the digital transition must be about more than just "pretty pictures" and marketplace survival.

Another key issue looming large for the networks is the narrowing window of opportunity to begin the transition without currently having the required hardware to do it. Much of the existing NTSC analog transmission equipment that supports the networks' current systems is at or beyond its technological life cycle. The only component to have been replaced is the satellite. Much of the supporting equipment, in particular the affiliate downlink equipment, would need to be replaced regardless of the digital revolution. The equipment's continued serviceability during the transition period will be a challenge.

Preparing for Digital Television

One of the biggest factors for network planners is preparing for the advanced digital television system. The facts are that the broadcast industry and others have been working diligently with the Federal Communications Commission (FCC) for over eight years to develop the new advanced television digital transmission standard. The standard was adopted this past December by the FCC. The last major hurdle to be

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worked out is the allotment and assignment of new channels to eligible parties. This action means that the networks must now move quickly to replace their existing NTSC analog distribution service with a digital system. This first step must be taken in order to reallocate and to dedicate satellite distribution resources for beginning phases of the ultimate conversion to HDTV during the next six to ten years. The window of opportunity to begin this important "first phase" of the transition is upon us. The challenge now for both the network planners and the digital video transmission equipment manufacturers is to produce the required technical and operational system feature sets that the networks are requesting so that they can begin implementation while maintaining their competitive edge. The broadcast networks' needs and the current state of the available hardware—which has been primarily developed for the cable and direct-to-home (DTH) marketplace—are not in sync yet. Recent testing conducted by several of the networks brings this point to light. In order for the networks to meet the anticipated advanced digital television system transition timetables being proposed by the FCC, a good deal of work, particularly by the manufacturers in meeting the demands of the networks, will need to be accomplished in a relatively short time frame.

Be prepared Manufacturers! The network planners will be pushing you for product development results because their window of opportunity to "get digital" with phase one is narrowing.

Some of the key feature sets needed by the networks include having an encoder product that meets the newer MPEG-2 Studio profile at main level with 4:2:2 bit sampling rate in order to deal with the multiple levels of program signal concatenation that the broadcast networks encounter. The timing of this product development is critical to the networks. Based on recent subjective and qualitative measurement tests, the 4:2:2 profile, not surprisingly, provides a higher level of picture quality than the Main Level/Main Profile. The networks do not want to be in a position of delivering less picture quality than today's analog systems. Full support of the entire vertical blanking interval (VBI) is another feature critical to broadcasters. A more flexible and enhanced design of the current integrated receiver decoder (IRD) that can provide multiple radio frequency (RF) inputs and switched baseband outputs could help reduce or eliminate external RF and baseband vertical interval switching matrixes, thus enabling the networks to continue providing quick and seamless on-air reconfigurations of program feeds.

In addition, the issue of maximizing each new digital bitstream payload through the satellite transponders (bits per hertz) with the best available, most cost-effective, modulation technology is something the broadcast networks are looking at closely. So far, a widely available, cost-effective, product that is easily integrated has not yet surfaced.

Network Operating Practices

To understand in more detail some of these key issues, it may help to look at some of the background and current operating practices.

The networks first developed their affiliate distribution systems from central origination points using terrestrial analog facilities provided by AT&T. Initially, they were the only distribution game in town. The topology of the distribution systems during both the early and growth years of the 1960s were primarily geographic point-to-point terrestrial interconnects whereby each affiliate city was added to the network feed via a local loop channel connected via the nearest AT&T central office. As the networks grew, and AT&T's regulated tariff cost structure increased, the networks brought in other transmission companies to provide competition. They included Midwest Relay (MRC), Western Telecommunications (WTCI), and Communications Properties (CPI). These companies were all regionally-based microwave companies that serviced the networks in the specific areas of the country where they each had a strong presence. This arrangement existed throughout the 1970s into the early 1980s.

By the mid 1980s, the networks migrated off of the terrestrial systems and onto the satellite. This transition was due primarily to the continued escalating tariff costs of the terrestrial carriers, and the networks' demand for cost containment, added operational flexibility, and increased technical quality. This decision meant satellite distribution had come of age for the networks. They were making a big technological leap of faith in order to remain competitive; but more importantly, the move allowed the networks to take over more direct control of their distribution future. The new-found freedom and technical system creativity that was displayed by each network during the migration to satellite will again be particularly important for the digital migration process.

Once the networks were able to reach an entire national audience, the advertisers and national professional and college sports packagers who

made programming rights deals, demanded that the networks provide regional programming capability and product split diversity for commercials into specific areas of the country. In answer to these demands, the networks initially developed crude, but effective, switching methods with their common carrier partners in support of sports league coverage and commercial drop and insert "roll-in" capability by using various key affiliates along the network.

When the networks moved their feeds to the satellite, they quickly found that the point-to-multipoint topology of the satellite service provided better distribution flexibility than the old point-to-point "domino chain" terrestrial system. It is not uncommon in today's operational environment for the networks to provide an advertiser with a simultaneous eight-way commercial split across the country, or to provide the NFL or NCAA college basketball or football conferences with six or seven simultaneous but separate switchable feeds to different parts of the country, or to provide program time shift and update insert capability for their news shows.

The big challenge for the networks upon their break away from the terrestrial common carriers was to develop internal computer control systems to manage the flow of programming to their affiliates' earth station downlink systems. Each network spent many man hours developing these systems. For the most part, each system provides similar functionality. This functionality will need to be preserved and greatly embellished by network planners for the migration to digital-based systems. The primary reason will be because the networks will have additional channel capacity to develop new and improved services for their affiliates. Also important is the fact that the networks will, for some time to come, be distributing both a digital NTSC service while bringing the advanced HDTV service on line. In addition, the digital systems bring along various built-in encryption and receiver decoder control functions that network planners will need to thoroughly investigate.

The program origination component of the evolving distribution systems has remained tape-based for the most part using various technical standard formats. Most, if not all of the broadcast networks, have reduced their primary program origination location to one city—either New York or Los Angeles. This operationally efficient change came about as a result of the networks' move to geostationary satellite technology and the end of the life cycle of aging equipment. The origination process has migrated from what was primarily a single tape machine source run in a parallel configuration to one that utilizes multicart/multipath output technology. Analogous to the affiliate satellite earth station downlink switching and control systems, each network has developed, with various industry vendors, their own unique in-plant computer automation source switching systems to support the multiple channel output for sports regional program time shift features and commercial insertion capability. Generally, the in-plant program origination source switching systems provide similar functionality.

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Video servers are also beginning to emerge in network operations. They will play an even greater role as more of the programming content is digitally produced and the cost to operate and control the server systems within the complex multisource broadcast network infrastructure is worked out.

The key point to remember is that the current broadcast network distribution services and operational flexibility have developed over many years. They are key components of the larger system that give the national broadcast networks their signature and competitive edge. It is important for transition planners to retain and to improve upon these capabilities while going forward.

New Equipment Requirements

Probably the biggest logistical challenge and most costly part of the digital transition will be to replace the current satellite downlink receive equipment—not including the antennas—at each affiliate. At some point in the future, replacement of the video interconnects between those affiliate downlink sites that are remotely located away from the station's master control will also need to occur. The timing on their replacement is currently under review by each network. Issues such as whether this change should occur during the NTSC digital change, to wait until each affiliate begins HDTV broadcasting to convert these links, and who should pay the expense are among key considerations.

What began in the early terrestrial years as common carrier owned video di-plex equipment located in the station's telephone closet near master control evolved after the conversion to satellite transmission into two outdoor satellite antennas with at least one dish being steerable, a redundant RF switching and downconversion matrix, baseband output receiver equipment, a custom software control system capable of both local and

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remote control by the network, and video encryption equipment. This package of analog satellite receive equipment provided a cost-effective, operationally sound, and technically compliant solution to the network distribution process following the move to the satellite in the mid 1980s. The networks, advertisers, and sports league franchises have all been well-served by these systems.

The new equipment rack design and equipment configuration will very much depend on how the manufacturers respond to the networks over the next six to eight months. To date, no video compression manufacturer has provided the networks with a new IRD design that meets the requested features. This issue should be interesting to watch. Once this step is completed, however, the actual field equipment implementation schedules must be coordinated very precisely between the networks and their respective vendor/integrators. Critical to the network's budget planning, will be how quickly the new systems can be installed and how error free they will be. Whether the existing analog transmission equipment and program feed patterns will remain on line once the digital systems are individually installed is open for debate. This option may be necessary for a given network depending on a combination of available satellite transponder capacity and regional program and advertiser commitments during the transition period.

Implementation Process

The actual network NTSC digital implementation process is anticipated to take between 14 and 20 months to complete.

One additional factor that could affect the ease of the implementation is program syndication distribution. In recent years, a majority of an affiliate's syndication product—particularly that produced close to or on the day-of-air—is delivered by satellite on common analog receive equipment with that of the broadcast networks. Once the networks go digital, it will be interesting to see how quickly the program distribution companies that service syndicators will react. My guess is that affiliate and independent stations as well as program producers will demand a common digital platform. The question will be who will pay for it?

Conclusion

The broadcast networks are clearly not the first communication service to begin making the digital transition. Services already there include the national telecommunications networks, voice and data, computers, and recorded audio. Many of our direct competitors are rapidly moving through the transition process or have started their services from their inception using a digital platform.

Efforts to establish the digital technological ground rules for the broadcast industry, the networks, and their affiliate partners are taking shape. The network planners must now aggressively complete their top to bottom review of current operations and then focus on how they can continue providing the best of their unique distribution service. They must retain those competitive edge features that the American public continues to rely on and create new business opportunities as they begin implementing the most fundamental technological change to come along since the invention of color television.

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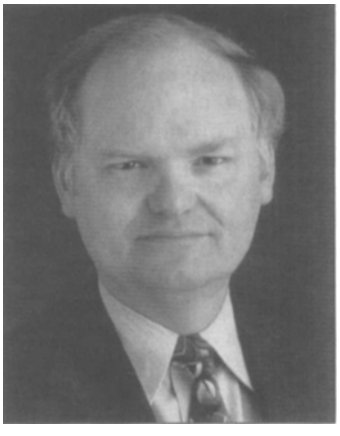

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