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Cable Technology to Enhance Service to a Metropolitan Area

Cable and wireless cable systems can play an important role in providing cost-effective distance learning and other informational services in a metropolitan setting. This article outlines the technical and organizational steps that have been taken to exploit cable technology in the metropolitan Detroit area. The article validates observations made in the pages of* Metropolitan Universities *that a metropolitan university can leverage its resources and expand its services through cooperative arrangements.

Cable systems are being used successfully for educational purposes. There are two sources of programming for this usage. First, cable operators are obliged to provide one or more channels for educational purposes, and local educational institutions have taken advantage of this possibility to provide distance learning and various information services. Second, some cable service providers, such as Cable News Network (CNN), have recognized the potential in providing programming for use by educational institutions, usually as a supplement to otherwise traditional classrooms. The availability of educational channels to educational institutions makes for an inexpensive and straightforward means of delivering video programs, by a local institution, to thousands of homes and businesses in its vicinity.

However, for a metropolitan university, with its constituency scattered throughout a large metropolitan area, access to this essentially free resource is neither straightforward nor inexpensive. In a large metropolitan area there are many different cable systems governed under different rules and with head ends scattered around the metropolitan area. The university's problem is to secure access to all these cable systems, in possible competition with local educational institutions, and find an inexpensive means of getting its television signal to the head ends of these cable systems.

Wayne State University has managed to overcome these two problems. To deal with the access issue, some twenty local educational institutions were invited to participate in the university's television transmission efforts. In this way, they are able to broadcast their own programming on the university frequencies. In return, they helped to arrange for channel space with their local cable operators. To deal with cost, video signals generated at the university were broadcast on two of the university's Instructional Television Fixed Service (ITFS) channels, picked up at many cable head ends, and rebroadcast on the cable systems. With the support of public station WTVS, the educational institutions were organized as South Eastern Michigan Television Education Consortium (SEMTEC). Initial programming consisted of twenty-five hours of educational television broadcast on WTVS's channel 56 before arrangement was made to create a cable/ITFS-based television network.

The above arrangement served the university well for nearly fifteen years. The major drawback was the limitation on the number of channels that were available at a given time. To be able to build a credible distance learning system, used by several institutions, the system must provide multiple channels of programming. To overcome the channel limitation, the university helped create a consortium to build a wireless eighteen-channel cable system. The effort began in 1985 and resulted in the creation of a wireless system in December of 1990. The system has all the benefits of the earlier system, in that its signal can be picked up and rebroadcast on cable systems. In addition, the new system allows for high-quality cable signal within a fifty-mile radius of Detroit. Furthermore, at properly equipped schools, factories, government buildings, churches, etc., all channels can be received directly and selectively displayed.

This article describes the organizational and technological steps that were taken to create this system. The purpose is not to provide a detailed description of the system, but to point out the potential and the advantages that exist in a metropolitan area to leverage the resources of metropolitan universities.

Wireless Cable Technology

Cable systems have a major advantage over broadcast television: the audience has a larger choice of programs to watch at any given time. This advantage is gained because a single cable can carry more than a hundred different channels. This is achieved by selecting a portion of the possible spectrum available on the cable and dividing it into frequency bands each of which can carry a full video program. In order to receive the desired channel, a convertor is used. A cable company can send digitally coded signals to the convertor and program them to disable or enable the reception of any channel. Wireless cable systems work exactly the same as a cable system, except that the wire is replaced by a portion of the airwave spectrum. The portion of the spectrum that lends itself to this application is in the microwave region. The frequency range in this region, dedicated to educational and other public uses, is referred to as Instructional Television Fixed Services. A portion of ITFS channels were reallocated by

the Federal Comunications Commission (FCC) for commercial use in the early 1980s as Multi-channel Multi-point Distributed Service (MMDS). MMDS-based wireless cable systems for entertainment do exist, but for the most part they have not proven to be financially successful.

The ITFS frequencies are located in the microwave region of the spectrum at six megahertz spacing. They work almost exactly the same as broadcast television. In order to receive these frequencies, special antennas are required. The antennas are lightweight dishes, three feet across. They are inexpensive and easy to install. The signal requires line-of-sight access between the transmission antenna and the receiving antenna. In flat terrains this could translate to thirty to fifty miles or more with a reasonably tall transmission tower. The transmission power is much lower than broadcast television and usually varies between ten and one hundred watts. In a typical situation where ITFS frequencies are assigned to different institutions in a given area, care is taken not to assign adjacent frequencies so as to avoid interference. Interference often occurs when the transmission sites of these frequencies are different and the strength of the signals, received at a receive antenna from each transmission site, is different. In such a case, the more powerful signal will interfere with the weaker signal. Broadcasting all signals from the same antenna and at the same power eliminates this problem, allowing the assignment and operation of adjacent frequencies. Even for nonadjacent frequencies, transmission from separate towers will create problems with the positioning of the receive antenna that can only be solved by substantial increases in cost at the receive sites.

To build a wireless analog of a cable system one needs to acquire a large number of ITFS frequencies, which no single institution can do. FCC rules prohibit the allocation of more than four frequencies to any one institution. Therefore, to build such a system requires multi-institutional cooperation, both to acquire the necessary frequencies and to operate from the same transmission antenna. In nearly all other respects, creating and operating a wireless system is the same as with a cable system. The one major difference is working with the FCC instead of local governments.

Consortium Arrangement

The Detroit metropolitan area consists of many cities, towns, and townships located primarily in three counties: Macomb, Oakland, and Wayne. The Intermediate School Districts in these counties, together with Detroit Public Schools, serve approximately half of the school children in the state of Michigan. The Catholic Archdiocese of Detroit also operates a large number of schools and other service agencies in these and adjacent counties. At the same time, this metropolitan area is served by WTVS-TV, a major independent public television station. Most of Wayne State University's 34,000 students come from this area.

Seven of the organizations mentioned above came together in 1987 and formed a consortium to operate, jointly, an eighteen-channel wireless cable system under the name of Community Telecommunications Network (CTN). CTN was created primarily because each institution had submitted a competing request for the ITFS channels that were made available in the

Detroit area in 1985. The competition could have been harmful and legally costly for each institution, and it would have reduced the total number of channels that could have been made available to the Detroit community as a whole. In addition to CTN members, many other public and private institutions filed with the FCC for use of some eighteen channels made available in Detroit. A point system devised by FCC did favor the educational institutions, but was not adequate to differentiate among them. The decision by FCC to conduct a lottery among the educational institutions with the highest score led to the recognition that a coordinated assignment of these frequencies was far better than a random one. The joint filing, which was made to the FCC, allowed the CTN members individually to acquire two or three channels each, but at the same time specified joint transmission of all channels because of the interference issue described previously.

The CTN members, however, went beyond the technological requirements and decided to operate the television transmission facilities jointly. This collaboration had the additional benefits of sharing and scheduling the channels so as to maximize the effectiveness of programming for participants. A nonprofit corporation was formed in 1987 to allow the group to act as a single entity. Applications were then made to a number of public and private agencies resulting in over $1.6 million in grants. The success in grantsmanship can also be attributed, partially, to the diverse nature of the consortium. In 1989, the CTN members selected Wayne State University to be their fiscal and operating agent. The CTN board consists of superintendents of the intermediate school districts, a vice president of Wayne State University, and the executive director of the public television station. This board directs the overall development of the CTN system. All individuals working on behalf of CTN are university employees. University administrative infrastructure is used for management of the CTN facilities, operations, and programs.

Creation and maintenance of the consortium was and is not an easy task, given the diverse objectives and sources of funding of the member institutions. Member institutions are required to give up some level of independence to maximize the common benefits. At this point in the evolution of this consortium, there seems to be a high level of goodwill and resolve for the consortium to function effectively. A major challenge for the CTN is to find mechanisms to invest in programming, in advance of any arrangement for revenue generation by the program. Another challenge is keeping the goodwill of cable operators and others whose cooperation is necessary to the full operation of CTN.

The Detroit System

The CTN system's Technical Operating Center (TOC) is located next to a 1,000-foot tower approximately eight miles north of downtown Detroit. The TOC is set up to allow transmission from two antennas, located at the top of this tower, which can handle up to thirty-two channels. With transmission power of fifty watts, the signal carries fifty miles from the tower site. To minimize interference with signals in the

Canadian airspace, which is only eight miles away, antennas are designed to weaken signals in the easterly direction and use is made of a signal-polarization technique. The signal covers all of southeastern Michigan, which is home to most of Michigan's population and over 80 percent of Michigan's commerce. The TOC is fully automated and includes a robotic system for the handling of videotapes. The full programmability of this system allows a single operator to run the entire operation. Programs to be transmitted may originate from TOC-based videotapes, received by microwave relays or from the Michigan Bell fiber network that terminates at the TOC. A satellite-receive dish that allows direct reception of programs from any satellite on Ku or C bands is also integrated into the overall system. With the above arrangements, a small staff is able to receive nationally or locally generated programs from many different sources, and rebroadcast, or delay broadcast them within the CTN service area.

The university also operates a powerful data network in southeastern Michigan. This network already provides many services to other institutions in the area and allows access to all university computers without the need for long-distance communication charges. Electronic mail, bulletin boards, computer conferences, specialized databases, library catalogs, and many other services are available on this network. The CTN television broadcast facility, in conjunction with this data network and two-way voice communication, provides a powerful system to support many applications in distance learning, teleconferences, and information services. The following examples, involving K–12 courses, university and college courses, university/industry training, and small business support, illustrate the versatility and power of the combined systems.

Oakland Schools. One of the CTN partners, Oakland Schools, is originating programs from its main facilities in a Detroit northern suburb. These programs are carried by means of a fiber-optic cable to the TOC, broadcast live, and automatically recorded for rebroadcast. The programs can be received at all equipped schools throughout Oakland County.

Wayne State University's College of Engineering. This college originates courses specially designed for the Ford Motor Company from its main building on campus. The programs are carried on fiber to the TOC and broadcast to several Ford Motor Company sites. Over a hundred Ford Motor Company employees receive instruction in conference rooms and their own offices on video-capable personal computers. The computer network is used for questions and answers. In addition, a computer conference can be set up to allow all participants to engage in discussion of the course topics. This minimizes the need for office hours for the faculty to meet with students. Any student can raise questions at a time convenient for her or him, and instructors can answer questions at a time convenient for them. Provision of the courses to Ford employees is a first step in the automation of much of a master's degree program that the university has been providing to Ford in Detroit, England, and Germany since 1983.

Foreign-language news programs. The CTN system provides current foreign-language news programs to the university's many foreign-language instructional programs. The programs are received live via satellite and rebroadcast to the language laboratories and classrooms.

Services to small business. Through a Small Business Administration grant from the Michigan Small Business Development Center, which is also operated by the university, the services of CTN will be provided to Michigan's small businesses in southeastern Michigan. In effect, those small businesses can enjoy the same sophisticated technological support that is available to the Ford Motor Company, the world's third largest manufacturing enterprise.

The Detroit System. The Detroit System allows CTN partners to send a limited number of programs for themselves, and for members of SEMTEC, over the existing cable systems to over 1.1 million homes. The entire range of wireless cable system channels can be received at most properly equipped Michigan businesses and educational institutions. CTN programs can also be supported by existing voice and data networks, making for a comprehensive, flexible, and cost-effective means for distance learning and other informational services. Current programming includes programs for K–12, college courses for sixteen colleges and universities in the area, pastoral programming, and several information services. Future planning includes major expansion of these services and programs to support public safety, health care, foreign language instruction, human resource development, and community redevelopment.

Conclusion

The willingness of Wayne State University and its partners to cooperate and share resources has resulted in many advantages:

- It has allowed an increase in the number of available channels in the Detroit area.
- Unhealthy competition for access to cable systems and airwaves has been eliminated.
- Operational costs are shared, dramatically reducing the cost to the participants.
- Major flexibility for programming and scheduling is achieved.
- The potential for gifts and grant awards is increased.

It is too early to measure the effectiveness of the CTN and its programming. In 1985, the forerunner of the CTN system served fifteen hundred students enrolled in eleven different higher education institutions. A survey conducted in 1987 by SEMTEC and sent to the administrators of seven public universities, two private colleges, and eighteen community colleges, indicated that television students in all but one institution performed the same as, or better than, other students in taking examinations or completing assignments. A survey of students taking the television courses indicated that television made it possible for 51 percent of them to take college courses and made it possible for an additional 21 percent to take extra courses.

A major potential that may be realized, as we gain more experience with the system, is to begin working together on joint educational and informational programs. Another major potential is to duplicate this experience in other high-cost technological or service areas, such as computing and telecommunications.

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Suggested Readings

Garay, Ronald. *Cable Television: A Reference Guide to Information.* New York: Greenwood Press, 1988.

Engelman, Ralph. *The Origins of Public Access Cable Television, 1966–1972.* Columbia, SC: Association for Education in Journalism and Mass Communication, 1990.

Cable in the Classroom is a monthly publication that covers innovative educational use of cable television, reports on the cable industry, and provides a schedule of cable programs of educational value. It can be obtained from Cable in the Classroom, 1900 N. Beauregard Street, Suite 108, Alexandria, VA 22311.