A Collaborative Model for Lifelong Learning and the Arts Using Broadband Multicasting

Leonard Steinbach [*]

[*] Cleveland Museum of Art, Cleveland (Ohio), USA
E-mail: lsteinbach@clevelandart.org

ABSTRACT
The Cleveland Museum of Art has embarked on an innovative program which delivers lifelong learning opportunities through cultural programming to isolated and impaired older persons by providing high quality live interactive video and video on demand. This is distributed using broadband multicasting over a fundamentally public infrastructure. The purpose of the program is two-fold: First, this project demonstrates that this type of programming can be profoundly beneficial to the recipients who are otherwise isolated from traditional cultural, social, and intellectual engagement. Second, this project emulates how the internet will deliver far higher quality of media content as broadband multicasting becomes more widely feasible, thereby enabling this type of program delivery. In addition to program and technical descriptions of the project, emphasis is placed on the process that generated the concept and then brought community organizations, technology companies, and diverse cultural organizations together in order to make the project a success.

KEYWORDS: Lifelong learning, IP/TV, broadband, multicast, video on demand, older persons.

INTRODUCTION
Can art make life better, more meaningful? Can technology make it happen? This paper describes a project that has targeted an isolated and impaired segment of our community, and, using advanced telecommunications technology to bring to them the resources of diverse cultural organizations is trying to demonstrate that art can make life measureably better and the innovative use of technology can help. The story is a work in progress of great technological, social, and educational aspirations converging with community partnerships, corporate interests and government funding. The facts and the process are laid out with our hopes unveiled, so that others may scrutinize, replicate and improve upon our product and process.

This paper presents an innovative approach for using broadband multicast technology over the public infrastructure to deliver high quality video-on-demand and live interactive cultural programming, complemented by web-based resources, to older persons in assisted-living residence facilities, community-based centers, and disabled persons in their homes. We are using this transport to change peoples' lives through continuing lifelong

learning experiences with, and exposure to, the arts. We intend to stimulate their intellect, increase their interaction with each other, and reduce their sense of isolation in ways that will have both subtle and substantial life improving impact. We are indeed striving for no less than arousal of the spirit, though we will define our goals a bit less spiritedly later on.

The technology we have chosen comprises the best tools we could find at the time (March 2000) which would let us emulate one scenario of not-to-distant future internet-based interactive telecommunications and content distribution. If the technology described forms the skeleton of the program's structure, then the community partnerships of cultural, technological, and community organizations form the heart. This paper hopes to place the value of these community collaborations on par with the facilitating technology. No doubt the technological means for this type of project are continually changing and expanding, but we hope that the process and program model we are presenting will survive, evolve and prove useful to others.

BACKGROUND

To understand the impetus for this project it is important to understand its host's core values and experience. The Cleveland Museum of Art, established in 1916 in the Midwest city of Cleveland, Ohio, is one of the finest encyclopedic art museums in the United States and is an integral part of Cleveland's cultural and civic identity. As an institution established "for the benefit of all the people forever," the Museum welcomes close to 600,000 visitors each year. The Museum also has a long history of extensive public programming in film, music, and dance as well as art-related classes, lectures and family programs. In addition, the Museum has strong relationships with the community and community groups through a range of outreach programs and community festivals as well its teacher, school services, and adult continuing education programs. In 1998, the Museum became a content provider and source site for a regional live interactive distance learning program for students from elementary school through high school throughout the region. This helps fulfill a long established strategic goal of the Museum to create "rich and diverse educational and public programs that serve and engage many different audiences and communities in an innovative and dynamic fashion."

More recently, the Museum's Board of Trustees also recognized the importance of technology within all areas of the Museum and established another strategic goal, "to become a national leader in the use of new and emerging technologies to enhance the value to society of the museum's collections, intellectual initiatives, and other activities." To accelerate progress in this area, in 1999 the Museum established a new Information Technology Division, headed by a Chief Information Officer (CIO) on peer level with other senior management and reporting to the Museum director. The new CIO (the author) immediately established a guiding doctrine for technological leadership and adventurism: "The core competency of a museum is not the mastery of diverse, complex technologies... it is the creative use of them." There is no contradiction here. It is quite possible

for a Museum to achieve its technology-based dreams without insisting that it find all the financial capital and human resources necessary to become a competent authority on complex technologies and their management. Expertise should be gathered and focused. This principal will be echoed throughout the project plan.

This background is key to the development and success of the project. Without a history of community involvement, strong educational programs, and a dedication to the use of new and evolving technologies, it is unlikely that the Museum would have ever conceived of this project nor received the funding and other support needed to make it happen. *Our experience suggests the importance of making sure that a project's goals are congruent with the institution's core mission and priorities.*

FUNDING OPPORTUNITY AS CATALYST

In the fall of 1999, the Museum became aware of the availability of United States Government "Technology Opportunity Program" funds for projects which would demonstrate the benefits of an advanced national information infrastructure to communities throughout the United States [17]. This funding opportunity also identified "Lifelong Learning and the Arts" as an area of interest, particularly "training and instruction to lifelong learners in non-traditional settings such as homes (and) community centers." With this scope defined, we proceeded to explore whether there was a qualifying program the Museum would want to develop which would further its goals. However, we would not contort our goals in order to obtain funds.

As should be expected, there was significant discussion within the Museum among staff and leaders from Information Technology, Development, Education, Curatorial, and Community Outreach areas, regarding the possibilities. We had many questions, answers and ideas, but finally realized that the truth lay not in ourselves but in our stars... our friends and colleagues in the community, without whose participation and insight from the beginning, no program could be a success. We held a technology/program brainstorming "party". Colleagues from our distance learning participating schools and from nearby cultural organizations converged. Representatives of community groups aggregated. Technology companies whose help might be needed in specification and installation were there to keep our lofty aspirations planted firmly in reality. Curious curators convened. Staff from the public (as compared with commercial) TV station were "tuned in" and got "turned on". After two hours of guided and passionate discussion, a general consensus seemed to evolve. We would focus on isolated older persons in assisted-living facilities or those who frequented community centers, and, if possible, disabled persons who primarily spend their time at home. We would provide both programming on demand and live interactive programs where they live or congregate. It felt right and meshed with Museum goals.

It is noteworthy that this meeting, borne of prior excellent relationships within the community, resulted in more than

"an idea". Our guests informed our thought process, and we made it clear that if we went forward, we would be committed to this together. *Our experience confirmed the importance of garnering feedback, insight and support at an early stage of project development from those whose support of the program will be vital and who know the target population best.*

ASKING KEY QUESTIONS

Although we had embraced a conceptual framework for a project, it was important to articulate and then answer several critical questions:

1. What did we hope to achieve?
2. Was there technology available which would make the project feasible at an acceptable cost?
3. Would residential facilities and community-based organizations commit the time required to participate successfully in this program?
4. Who would provide the cultural content, both live and archived, for this project?

How could the Museum establish and support this level of technology without diverting resources from other projects, or violating the precept of creatively using technologies without investing an inappropriate amount of time and effort in them

The answers to these questions are explored later. *More importantly, we found it vital to openly ask critical questions about project feasibility, value, and comparative priority very early in the planning process; by actively trying to find questions whose answers might change our course, we confirmed or adjusted our thinking and direction and instilled confidence among museum staff who would be collaborators.*

VALIDATING OUR PRESUMPTIONS

Intuitively, it seemed reasonable to expect that older and impaired persons might benefit from interaction with cultural activities, but we needed to confirm our hunch. With the assistance of Malvin Schechter, a noted journalist, gerontologist, and consultant on issues of population and aging, important research findings were brought to our attention. Gerontological research contended that programs in the arts stimulate cognitive functions, enhance daily life experience, and trigger memories and creativity in older Americans. Research confirmed that being part of a social network and diminishing isolation and loneliness has a significant impact on health and longevity [14,8]. One study concluded that "interactive computing technology opens up access to levels of communication and personal control that impact directly on the quality of life for 'confined' individuals. Indeed, the term 'confined' loses much of its meaning when the world is at one's fingertips."

The Museum also already had its own experience in this area. For example, the museum has worked with the County Board of Mental Retardation, a government agency which "assists individuals with mental retardation and developmental disabilities... achieve a life of increasing capabilities" and their clients for close to three years in a studio art program. Work with this population had already resulted in dramatic changes in their lives. The simple artistic freedoms like choice of colors or how to position the paper has increased confidence in participants who have attempted other personal

achievements. One individual learned to climb stairs for the first time at the museum, while another spoke his name for the first time in his life. *A combination of our own direct experience along with supporting evidence from independent research proved instrumental in giving us the confidence to continue with our program plans.*

ESTABLISHING PROGRAM GOALS

Based on the published research and our own experience, we knew we were on the right track. We refined our "over-arching" program goal as follows:

> "To enrich the lives of seniors and disabled adults through excellent arts programming delivered to them where they live and congregate via interactive broadband technology. Arts-related programs will be delivered to participants at three types of sites: assisted living residence facilities, community-based centers, and private homes. Older as well as physically and emotionally disabled adults will benefit from relevant and rewarding exchanges with cultural institutions through the new technologies proposed herein. This will be achieved by making it possible for them, for the first time, to participate in a broad range of excellent programs from which they have been historically isolated".

Specifically, we would:

- Develop an art program that provides a mechanism for intellectually stimulating older adult learners;
- Develop an interactive, art-based program that facilitates social engagement among older adult learners;
- Develop a delivery medium which can reduce the social isolation often associated with living in senior care facilities; and
- Develop a replicable model that can be used by other cultural organization seeking to deliver comparable content to similar populations via interactive broadband technologies.

Most important, our program would explore and demonstrate how such learning and engagement improves the lives of older or disabled persons for whom a visit to conventional museums and cultural institutions and activities would be difficult, inconvenient or impossible. We would hope to learn how these extramural programs might stimulate such audiences to inquire and learn in satisfying ways. Additionally, we would develop a model and experience base that, by the nature of content and technology, is replicable throughout the country, especially as this technology becomes increasingly available.

Once articulated, these goals served as conceptual boundaries. In this way neither spontaneous afterthoughts from staff nor community self-interests could inadvertently divert us from the fundamental premise of the plan.

DEVELOPING THE TECHNOLOGY PLAN

The technology plan for the project had to complement our programmatic and content-oriented goals as well as the goals of the prospective funding agency. Our vision was to establish a multi-point "distance learning-like" environment with some level of interactivity, which would allow free

access to archived video and other material, additional web-like content, and the web itself. The technology would have to be more open, less complex and less expensive than traditional video teleconferencing. After all, this is the way Internet is going: more, richer content and greater interactivity through affordable access to a high-speed (broadband) public infrastructure. Even if the right infrastructure was not there yet, our charge from the prospective funder was to be innovative in our use of broadband technology, and demonstrate what the future may be.

This presented three technical challenges: how to capture, digitize, and compress video; how to develop and manage an online video-on-demand archive as well as prvide for the "broadcast" of live programming; and, how to achieve an infrastructure for getting the content from the source to the client. A special work group was established to find the answers. This small group initially included Museum Information Technology staff and a consultant from Keane, Inc., a major national I.T. consulting firm that was engaged in another Museum project, who agreed to contribute his assistance without charge.

Some prospects were easy to rule out. Although we considered cobbling a variety of products and technologies together to accomplish our goal, we knew this would conflict with our "core competency doctrine" and hobble our chance for success. The best likelihood for Museum-wide support and a successful implementation would be with as close to a turnkey solution as possible. Environments such as those available from Real Networks or Microsoft NetMeeting and others were immediately ruled out. The nature of both our content and clients would demand close to full screen video of near television quality. We wanted our clients to have warm, seemingly familiar experiences with both our technology and our content. After all, the program was not targeted toward highly self-motivated Internet users who would put up with quarter-screen jitters.

Content and outcomes would be the reason for client participation, ease of use was paramount, and our technology should not be so complex that it gets in the way.

The Planning Process

The technology planning process lasted from January through March, 2000. Although the following process and selection reflects the technology available at that time, the considerations still remain relevant. We knew that we would require high-speed (broadband) connections to our clients. We also realized that we were looking for an IP multicast solution for our live broadcasts in order to use our bandwidth efficiently. We decided that the increasing availability of DSL, with its emphasis on downstream speed, would make it a viable means of network connectivity (Craioveanu, 2000). We did not consider Internet access through cable-TV providers, because this was not available in our area at the time.

The State of Broadband Multicast

IP multicasting is defined as an "efficient means of transmitting of a single large stream of data to a group of selected users at the same time on a TCP/IP network such as the internet"

[6]. It is also fundamental to the evolution of the Internet as demand increases for better quality transmission of video and audio, and as transmissions become targeted toward groups rather than broadcast to all. IP multicast protocols have been under development since the early 1990's. Thus far they had been used primarily in corporate and academic environments where network traffic can be carefully engineered and monitored. We were aware of some public initiatives in this area, such as Mbone, since 1996 a cooperative and voluntary experimental virtual network within the Internet. This has been succeeded by other "bones," including 6bone and Qbone, and other protocols, as the Internet itself continues to evolve. But, there was (and is) no current standard [8].

In addition to the protocol issues, IP multicast also requires a telecommunications infrastructure which is "multicast enabled." That would be a network comprised of routers and cabling which can handle the traffic generated by rich media and which can also filter signals so that allow clients can selectively receive (subscribe to) transmissions with a quality of service that would make the product palatable. (This is somewhat simplified, but sufficient for this purpose.)

The current acceleration of commercial interest is IP multicast is clearly evidenced by the IP Multicast Initiative, "a world-wide, multi-vendor forum accelerating the adoption of IP Multicast, stimulating demand of IP Multicast products and related services" and significant source for articles, white papers, and conference information [9]. More than fifty companies now participate in this forum, including Cisco Systems, Real Networks, Yahoo Broadcast, and Lucent Technologies. There are even a number of national conferences each year focusing on public broadband distribution as well as the related area of content distribution networks (CDN). CDN's are networks especially designed to enable content providers to distribute rich, scalable, accelerated, Web-based content, including TV-quality streaming media to end-users by replicating contents to the "edge" of the network, minimizing the distance from the point (and thereby the number of hops) between the physical server and the end user [5]. In any event, even though there may have been some complex and costly workarounds, the public infrastructure was not ready yet for broadband IP multicast, even though we were.

Although the focus of this paper is the program that was implemented rather than a current technology assessment, it should be noted that the broadband landscape (or wireless-scape) has become even more turbulent during the year and a half we have been working on this project. In the United States, accelerated demand for DSL service collided with providers' exaggerated promises, mis-assessed infrastructure capacity, lack of qualified staff, a lack of available capital, and cut-throat competition to send more than a dozen providers into bankruptcy and disconnect hundreds of thousands of network users from the grand internet cloud. [15]. Cable TV providers are also struggling to meet demand although it claims more than twice as many users as DSL, and more than 90% of all cable TV companies offer highspeed internet access [2]. It is also reported that

"roughtly 9% of U.S. households curently use broadband internet access today, and that these subscriptions will increase 77% by 2004 [1]. (I believe this is a gross underestimate.) Meanwhile, broadband fixed wireless seems to be emerging rapidly as a consumer alternative [16]. And with 3Gwireless almost here, depending on where here is, plans for 4Gmobile's promised 2Mbps – 20Mbps "seamless services provisioning across a multitude of wireless systems and networks" has found its niche as a focal point on the technological horizon [10].

Meanwhile, back on earth in the present, although multicasting is much more efficient than simultaneous unicasting, there has been a lag in adoption. Most routers across the public Internet are not multicast enabled and there is the perception that multicast routing is extremely difficult to configure properly and debug. In fact, the technical innovation of this project is the *way* in which we circumvented this obstacle to presage the multicast-enabled world. But even this problem is likely to be alleviated sooner than expected. Without delving into technical detail, a new "Source-Specific Multicast" protocol, expected to become a ratified Internet Engineering Task Force specification later this year, promises to eliminate many router configuration issues, although success will now depend on local computer operating system and media player support. Most router vendors (e.g. Cisco, Juniper), are supporting this protocol, as are the media players from Microsoft and Real Networks. Windows XP will support source-specific multicast upon release later this year [13]. A final context, perhaps a driving force, of all this is the growth and technical sophistication of Content Distribution Networks [11]. *It was an important part of our process to review projected developments in the technology we were about to use, so that our application would look as close as possible to what the future seemed to have in store.*

CHOOSING A SYSTEM

Our product review brought us to Cisco Systems, Inc.'s IP/TV system [4]. Cisco's IP/TV was chosen over other prospective solutions because it provides a more comprehensive set of features, in an end-to-end turnkey solution, than any other solution we could find. It comprises video capture with a choice of compression techniques, real-time broadcasting capability, video archiving, an internet-based interface, and full router support at all points. As a tool designed for education and training applications within an academic or corporate environment, other features, including an interactive question manager and usage monitoring tools would also add value. A true broadband multicast solution, IP/TV provides very high quality full- or near full-screen video, which we had identified as a requirement. We also decided that the implementation of a turnkey solution by a single well-known vendor had the added advantage of one-stop training and support. If our program proved successful, new and more feature-rich products could simply replace the elements we had chosen. Finally, because we would use Cisco routers, they could be held responsible for the system's performance end-to-end.

This initial assessment was followed by a product demonstration and tutorial for our technology team at Cisco's office, and additional telephone conferences with Cisco's IP/TV specialists. The agreement that our local Cisco sales and

technical reps would join our technology team as needed, and that the regional office would provide training and technical assistance to help assure project success clinched the decision. The decision was later bolstered by an informative case description of an IP/TV project at the Virginia Community College System [3]. *We determined that having a very good system with the best possible external support let us focus on program effectiveness. This was more important than having a few more "sophisticated" features that would add disproportionately to the project's technical complexity and risk.*

System Configuraton

The planned configuration of the Cisco IP/TV system included:

- *IP/TV 3411 Control Server* which centrally manages the entire IP/TV system.
- *IP/TV 3422/3423 Broadcast Servers* capture and digitize, store, and transmit programs according to directions received from the IP/TV 3411 Control Server.
- *IP/TV 3431 Archive Server* provides large-volume storage capacity for Video on Demand (VoD). It enables the appropriate stored video programs to be delivered at the right time, to the right audience, whether streaming prerecorded video on a scheduled basis or responding to a singular request.
- *IP/TV Viewer* is the IP/TV system client-side software, which communicates with the IP/TV 3411 Control Server to get information about all available programs and display a program listing. It allows participants to select and display programs, ask to receive a scheduled program or choose to display a program on demand.

The configuration of the equipment is described later and portrayed in Figure 1.

Supplemental Cisco software which will prove effective for providing, managing, and monitoring content development and delivery includes: *Web Presenter,* which allows the opening of a video window and web-based slides concurrently; *Web Plug-in*, which allows a participant watch an IP/TV program embedded directly in a Web page; *Question Manager,* which provides a participant interactivity by letting participants type in questions on line (a moderator or instructor either answers the questions in real time or archives them for follow up); *Web Info*, which allows participants, while watching a program, to click a button and travel to a predefined URL location, typically a Web page, containing additional program information; *SlideCast,* which permits participants to simultaneously see the presenter's PC-generated presentation materials in one window and the presenter in the other, as if they were in the same room; and, *StreamWatch*, which gathers participant demographics such as number of participating stations, identities, and viewing times for pre scheduled programs, and for on-demand programs logs information about which programs participants are watching and when.

INFRASTRUCTURE DESIGN

Having tentatively selected the product

suite that should meet the video capture, storage, management and distribution requirements of the project, the network infrastructure on which this would ride had to be identified. As noted earlier, the public Internet is anything but ready for broadband multicast prime time. We enlisted the assistance of a local major Internet Service Provider (ISP) who recognized the benefits of early involvement with broadcast multiband. Their assistance was also encouraged by their ongoing relationship with the local Cisco office, not to mention the prestige and good will associated with assisting the Museum. The expanded technology team now comprised representatives of Keane, Inc. (consulting), APKnet (local ISP), Cisco Systems, Inc., and Museum technical staff, along with any additional ad hoc experts we could think of to call or e-mail. The network infrastructure would work as follows:

1. As a DSL reseller, the ISP would create private virtual circuits between itself and our clients.

2. The DSL client lines could be then be connected to a single high speed, broadband, multiprotocol, multimedia router (Cisco 7206VXR) with a highly secure, specially configured gateway connecting it to the public internet.

3. The IP/TV Control and Archive servers would be co-located at the ISP and connected directly to the high speed hub to assure the fastest and most direct service delivery. Demanded video would travel directly from the ISP to the client via the virtual private circuit. The servers could be operated remotely from any site with an authorized IP connection, yet benefit from the power management and physical security inherent in a ISP facility.

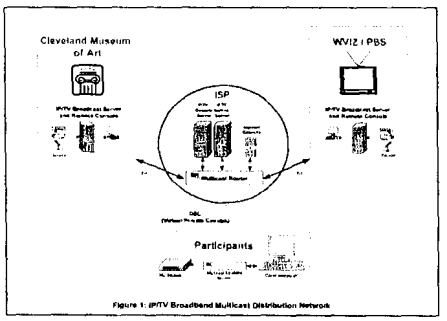
4. Live broadcasts would be compressed and fed by Broadcast servers at program origination points to the Control servers at the ISP via dedicated T-1's terminated at the high speed router; similarly, video-on-demand archival material could be loaded onto the archive/media servers at the ISP using the same Broadcast servers via the same T-1's.

5. Client locations would require multicast enabled routers in addition to the DSL modems specified by the provider of the DSL loop.

This configuration establishes a fundamentally closed system. The ISP, which acts as the hub, maintains end-to-end control of all emanating lines. Filtering at the gateway prevents our high bandwidth content from spilling into and degrading service on the ISP's Internet backbone.

Overall, thanks to an ISP with end-to-end connection control who was willing to provide multicast broadband support for a small population, we are successfully emulating the Internet of the future.

We also found that the creation of a technology team which included professionals of diverse expertise who also had particular interest in specific aspects of the project allowed us to walk through many technical and process scenarios, and pre-empt a number of potential problems.



Content Capture, Transmission and Display

While the fundamental infrastructure and core components of this project have been described, there are key ancillary devices and technologies worth noting. Live transmission we use MPEG-4 video compression with its high ratio of full-motion video quality to bandwidth and other features [12]. For archival storage and video-on-demand we will use Cisco's RTP format, which is essentially encapsulated MPEG-4 requiring IP/TVViewer client software at the workstation.

Other equipment associated with content production, distribution, and storage include video cameras, microphones, mixers, video editing system with special effects, video recorders, document cameras, slide-to-still the question of where the mastery of this complex technology should reside. The answer is, with those whose core competency *is* technology. Similarly, although the Museum has extensive experience in educational programming within the scope of its expertise, there is more to Lifelong Learning and the Arts than any single institution can provide. Finally, one must identify and enlist community

video projectors, video "pointers" and others. Some of these were already available through our existing distance learning programs while others were acquired for this purpose.

Work stations at participant sites are standard PC's with at least the equivalent of a PIII/700Mhz processor; the IP/TV Viewer uses the processor to decode MPEG-4 and RTP media. 128 MB RAM will be provided. At this time we have not identified any specific video or audio requirements beyond the minimum generally provided with current model workstations. Where a personal residence is the location of participation, standard small speakers and a 17" monitor will be provided. For group facilities, a 35" or 31" RGB/video monitor, appropriate speakers, and wireless keyboard and mouse is provided, along with any special cart or cabinet needed.

PARTNERSHIPS KEY TO PROGRAM SUCCESS

The technology plan described, although at the core of the project, is merely a facilitator of the program. The program needs content to distribute and participants to participate. If one concedes that the Museum has designed a program that qualifies as "creative use" of technology on behalf of the Museum's strategic goals, then there is

facilities and residents who would be willing to join our experiment and work toward its success.

To achieve this level of distributed responsibility, participation and interest, three spheres of "Partners" have been convened: *Content Partners, Community Partners, and Technology Partners.* (See Figure 2.)

Figure 2. Three Partnerships each have its own sphere of responsibility but rely on functional interaction and ongoing communication to assure program success.

Content Partners

Content Partners is a consortium comprised of the Museum and additional arts and cultural institutions, including the Cleveland Orchestra, one of the finest in the world; the Crawford Auto-Aviation Museum/Western Reserve Historical Society, a repository for artifacts and archives related to the these organizations is providing a broad and varied menu of programs in the areas of local history, visual arts, jazz and classical music, theater and the applied arts, as well as a range of thematic programs about general artistic, cultural and literary issues. We are projecting a minimum archive of 300 programs by the end of year two, in addition to a minimum of 12 live broadcasts offered monthly. These organizations receive no payment for their contribution. [The government grant fund could not be used to history of Ohio; the Cleveland Botanical Garden; WVIZ/PBS, the area's public television station and producer of educational television programming, and two local dance companies. The number of content partners is growing as the program matures. The combined resources of

"produce information content," although it would support some "creation or conversion of content (in order) to utilize information infrastructure technologies to address real-world problems."] The Museum's Education and Public Programs Division manages the Content Partners.

Community Partners

Community Partners are responsible for bringing, and being responsible for, a diverse participating user population to the program, including minorities and

seniors, and those with varying levels of physical and mental abilities. Organizations include several assisted living community residential facilities; a training center for the developmentally impaired; a college-based special educational program for persons age 50 and over; and, a home care agency serving an elderly population. As the program matures, participation may change. The personal commitment of community partner staff is crucial to the success of the program. Community partners have committed the time and talents of their on-site staff to facilitate the use of the technology, to integrate the project into their ongoing program activities and to create follow-up activities so that their clients can achieve the maximum benefit of this experiment. They have also agreed to encourage use of the system for group and individual video-on-demand and access to complementary web resources. The partners also take part in evaluations and surveys and send a representative to meet at least quarterly to discuss the program progress and recommend improvements. These organizations receive no payment for their contribution. The Museum's Education and Public Programs Division manages the Community Partners.

Technology Partners

Technology Partners comprises organizations whose core technical competencies are congruent with their projected roles. For example, the major regional ISP which serves as the hub, provides end-to-end network management and connectivity services to our clients and content origination and management points. The ISP also co-locates the Archive and Control servers on their premises. The television station will remotely manage the Archive and Control servers, including video-on-demand sources and broadcast scheduling. With an IP/TV Broadcast server on their premises, we will also use their studio as a live broadcast site and a source for downloaded content to the archive. Cisco Systems, Inc.'s Cleveland office has committed to a special technical support effort and has contributed training to assure that the project works. Keane, Inc. will help monitor and evaluate the implementation. Museum Information Technology staff manage the implementation process, and will perform all remote site equipment set-up (except network connectivity devices), provide help desk support for the project, and develop a friendlier end-user interface than is provided with the IP/TV package. The Information Technology Division manages the Technology Partners.

Making meaning from the partnerships

In order to assure program success and dynamically react to problems and opportunities as they arise, two areas of frequent communication are vital. First, it is important that partners within each group communicate frequently with each other. Second, it is critical that these full partnerships communicate with each other on a regular basis. Therefore, a formal aspect of the project is regular meetings of each partnership and less frequent, but formal, meeting with all of the partners of each sphere together. This assures, for example that the Content Partners can here first hand what programs the Community partners feel are most and least successful, and why. Technology Partners can learn

how their systems can become more user friendly. Community Partners can share their successes and failures in making the program meaningful to their clientele. In addition to the pragmatic aspects of this kind of sharing, all parties become more sympathetic with the concerns confronting the others. In a face-to-face setting, these humans are also more likely to extend themselves on behalf of the others. These meetings also rotate among different partner's facilities to foster greater familiarity and empathy. All partners are also encouraged to see the program in use by participants. Listservs have also been established for each Partnership as well as all of them combined, and e-mail accounts were provided for any key partner staff who didn't already have one.

In addition to the Partner activities described, we also held a one-day seminar with gerontologist Mal Schechter, who had provided the original research, and others. This would energize the group and instill confidence that although we were breaking new ground, and "feeling our way around," the success we might achieve might truly prove profound.

We learned early on that these partnerships would be key to program success, but just establishing the groups would not be enough. They would have to be supported and nurtured throughout the project so that a sense of enthusiasm, exploration and accomplishment would not wane. We are still very early on in the process, but so far, so good.

PROJECT EVALUATION

An ongoing evaluation process is vital to any experimental project and is required of any federally funded project. The evaluation plan is both ongoing, in order to provide feedback to which we can respond, and summative, in that a final report will analyze project process and outcome. We have divided this evaluation into two distinct components, *technology implementation* and *program effectiveness*, reflecting the special, different skills, required to assess each of these areas. In both cases the evaluators have been involved with the project since it commenced. This assures that prospective outcomes are agreed upon, that baseline data are collected where appropriate, that measurement and data collections techniques and instruments are in place.

Technology Evaluation

In order to assess our technology implementation, Keane, Inc. is collecting and summarizing anecdotal information about technical implementation, training and support issues, problems and resolutions. Interim feedback to one or more Technology Partner is provided where useful. This will result in an important source document for any organizations that would like to replicate in whole or part the technical program we are modeling.

Program Evaluation

In order to assess program effectiveness, we were fortunate to have enlisted the Institute for Innovative Learning, Inc., which specializes in "free choice" learning and arts-related programs. Their formative and summative evaluations, based on integrated evaluation planning with all program partners, will encompass direct

observations by evaluators, focussed and open-ended interviews, questionnaires for care givers, and case studies as appropriate. Baseline data has already been collected about the Community Partner participants, and feedback from this process has already resulted in some program adjustments.

For example, some Community Partners were targeting participants who had strong prior involvement with the arts, as opposed to clients who might otherwise benefit from the program's intervention. This led to discussions through which this preference would be integrated into the plan. We would use this population to help assess the quality of our programs – they would be in the better position to judge. Then, later, after a period of comfort with the technology and programming was established, a more "needy" population would be integrated into the program. This appears be a more thoughtful, success-assuring approach than had originally been planned. However, had it not been for this early, independent, assessment, we might have had an early program confrontation or stumble.
Interim and final reports will assess the efficacy of our approach and promote the sharing of our experience.

The value of integrating an evaluation plan, and involving program evaluators early on can not be understated. With early involvement one avoids backtracking through program history, compensating for lost baseline data, risking that a final analysis will be deemed flawed, and depriving one's self of the benefit of early signals of program weakness.

BUDGET AND STAFFING

The formal budget for this program is $1.2 million over a two-year period. Of this, $545,000 represents the federal financial award. The remainder is matched through the value of contributed support by our Content, Technology, and Community Partners, and the Museum's contribution of time of existing management and staff, and direct expenses for some equipment and supplies. The federal contribution is primarily used for hardware, software, initial network configuration and monthly telecommunications charges. Approximately 10% is applied to evaluation.

Federal dollars also directly fund 1.5 full-time equivalent positions at the Museum: a full-time Project Coordinator acts as a liaison between Program and Content providers and the Museum's project managers, evaluators and others, performing a variety of functions to assure that the program runs smoothly and effectively. A half-time Education Assistant works with all content and community partners, including Museum staff, to modify or enhance prospective content to better meet the needs of older or impaired participants. A variety of staff from both the Information Technology and Education and Public Program Divisions contribute significant time and attention to the project as needed. The Museum's Information Technology Division's Help Desk also serves as the project's help desk and the Museum's Network Manager works closely with the ISP and Community regarding technical and equipment issues. The Director of Education and Public Programs is responsible for program content and working relationships with

our community partners. The Chief Information Officer is responsible for all aspects of technical implementation, and as Project Director, all budget management, reporting requirements, and program evaluation.

It should be noted that the Museum has successfully "absorbed" this program with a minimum of additional staff. One reason is that we already had in place strong education and public programs, But more importantly, everyone who is involved in the program also participated in its planning, and knew their prospective roles before the application for funding was even submitted. Of course, some roles evolved from their original definition, and time commitments always exceed what is planned. But the earliest fostering of personal commttment to the goals of the project has metamorphosized into a dedicated team.

CURRENT PROJECT STATUS

The grant award was announced on October 1, 2000. As this paper is prepared in June, 2001 all of the IP/TV has been installed and tested. Technical staffs at the Museum, television station and ISP have been trained in the equipment's use. Remarkably, all of the equipment works as planned. The project encountered a major setback when, at the cusp of initial broadcasting, the DSL provider went bankrupt and lines went dead. This resultant delay saw us starting broadcasting in June instead of March.in almost three months delay before alternative connections could be made.

Content partners have been meeting to develop our program schedule, and the wealth of ideas is breathtaking. A special live marimba and organ concert. Our Art of the World art appreciation course for adults, videotaped and parsed into small morsels and archived for demand, complemented by a live follow-up conversation from the museum. An historian showing neighborhoods of yesterday and today to stir memories, emotions, and intellect. We have also decided to do live studio art classes, with lists of materials and other information posted in advance on our IP/TV site. But these are ideas and plans, and fodder for another paper. One challenge will be to develop the synergy of this program with the existing programs of the Content Partner institutions. Because funding rules stipulate that funds may not be used for content development, it becomes all the more important to sense what existing programs may be most amenable to re-purposing for this program audience and technology. Another challenge will be to choose programs selectively and carefully, learning from those that have proven most and least effective and popular.

We hope we have embedded into this project an ethos of "try something, see what happens, learn from it." Rather than treat this as another, formal "plan and do" program of the museum, we remind ourselves that this is grand chance to experiment, and in a good experiment even failure is a success. A few failures among some fine successes still makes for an impressive portfolio. If there are no failures, someone's not striving for the edge.

CONCLUSION

This paper has tried to present the evolution of a notion as it became an

innovation and before it becomes an institution. This paper has tried to relate the importance of an institution's persona to the achievement of an almost far-fetched goal. It tries to make the case for well-informed development and affirmation of innovative ideas. It tries to make a case for using sound inter-organizational relationships as a means of achieving projects that would otherwise be out of reach. But it also means respecting and nurturing each organization's values and special interests. It points out the critical role of evaluation and evaluators, from the beginning of project. And of course we are trying draw a picture of the future to demonstrate how advanced telecommunications, interactive broadband multicast particular, may bring cultural organizations closer, and with more profound impact, into many more lives, in the not too distant future.

If the process described seem too well thought out, perhaps I smoothed over some rough edges. If this paper seems somehow unsatisfying because it does not truly answer *the* important question, "can a technologist helpn make art meaningful?", that is because it is just too early to tell.

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ABOUT THE AUTHOR

Leonard Steinbach is Chief Information Officer for the Cleveland Museum of Art (www.clevelandart.org) and President-elect of the Museum Computing Network *(www.mcn.edu)*. He was formerly Chief Technology Officer for the Solomon R. Guggenheim Museum.
E-mail: *lsteinbach@clevelandart.org*