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A Supplement to: systemscontractor.com
systems
contractor news

Produced for:

infoComm2002

DISTANCE EDUCATION EXPANDS AT

MIT

By Charles Conte

IT INFRASTRUCTURE AND NEW A/V TOOLS TEAM UP FOR A POWERFUL SYSTEM

In the Fall of 2000, the Massachusetts Institute of Technology (Cambridge, MA) Distance Education program went online, live from Bechtel Hall on the MIT campus, delivering learning sessions regularly from Cambridge to Singapore via a 155-MB-per-second Internet2 broadband connection.

The system concept and implementation proved so successful during the 2000–01 academic year that this fall the Singapore-MIT Alliance (SMA) — comprised of MIT, the National University of Singapore, and the Nanyang Technological University — began to beam 540 hours of instruction

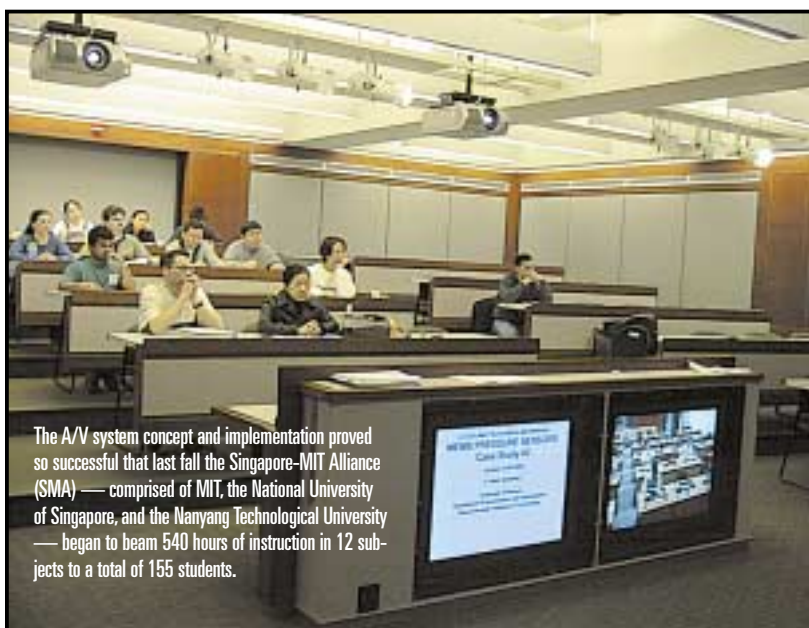
in 12 subjects to a total of 155 students. MIT president, Charles M. Vest, in his report for the academic year 2000–01, called SMA “the world’s most technologically advanced point-to-point synchronous educational program...a grand, living example of the emerging global university.”

Down on the (Codec) Farm

Scaling the initial system — essentially a codec, central router, production “pod,” and one DE classroom — to meet the increased demand for services was the task of the original system design team: A/V and acoustical consultant Scott Walker of Waveguide Consulting, Inc.; senior

systems engineer Alex Villiard of Crestron Electronics, Inc; and director, MIT video productions, Larry Gallagher.

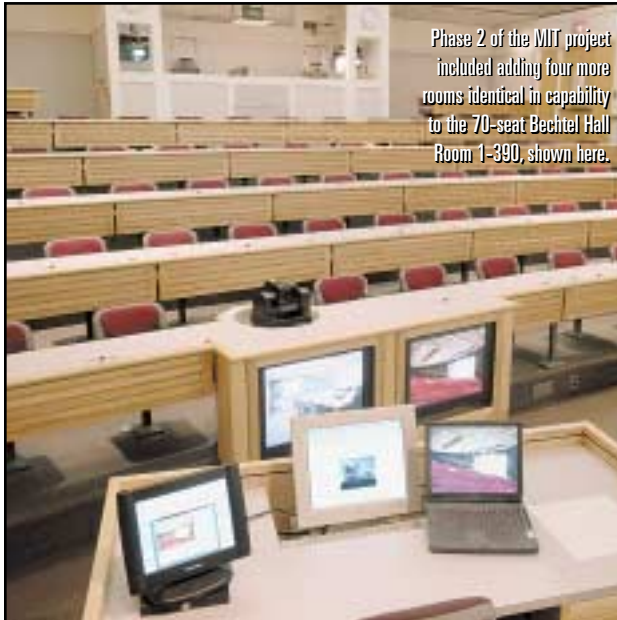
Phase 2 of the project consisted of expanding the Master Control Room from one codec/control pod to three and adding four more rooms in two buildings to the DE network. Two rooms are virtually identical in capability to the 70-seat Bechtel Hall Room 1-390 with its side-by-side video screens — the 60-seat room 3-370 in Building 3 and the 20-seat room 8-404 in Building 8. Two smaller rooms have been added: an “overflow” room, 3-270, and an eight-person video conferencing room, 8-408.



The A/V system concept and implementation proved so successful that last fall the Singapore-MIT Alliance (SMA) — comprised of MIT, the National University of Singapore, and the Nanyang Technological University — began to beam 540 hours of instruction in 12 subjects to a total of 155 students.

Bechtel Hall (Building 1, room 1-390) was the first lecture facility (of a projected nine) on the MIT campus linked to an expandable Master Control hub in Building 9, over a third of a mile away from Bechtel. Room 1-390 and the Master Control hub were intended as both the prototype and core of a campus-wide, high-bandwidth network with links to the outside world. Crestron e-Control—an Internet/browser-based control technology that allows connection with and control of most any A/V or environmental device via a LAN/WAN/Internet connection — was and is at the conceptual center of the infrastructure.

Master Control's "one-pig" codec farm (from Phase 1) is now a three-pig farm with the addition of two more production control modules. The two Crestron Isys TPS-6000 touch panels in Master Control grew to four, and the single Isys TPS-5000 in Bechtel 390 expanded to



TPS-5000s in four classrooms. Each high-end, DE room now has its own dedicated Tandberg Codec 6000 and control pod.

All of the cables connecting the classrooms to the Master Control Room are single mode, fiber optic cables installed by MIT's Information Services department. IT cabling is the transport medium for these intense A/V systems.

That Time Frame, Again

The time frame for Phase 2 implementation was three months this past summer — the same three-month time frame allotted to Phase 1. In academia, June–August is the work window.

In Phase 1, Bechtel 1-390 underwent almost no architectural renovation. In Phase 2, two architectural firms — DIAQ (Somerville, MA) and Ganister Fields Architects (Hamilton, MA) — were tasked with complete renovations of rooms in two different buildings, on two separate time-tracks. The contractor awarded the project — Electronic Engineers (Montgomery, AL) — was chosen in part because they were able to dedicate a single person (project manager, Steve McMurtry) to live, quite literally, with the project.

"The schedule for Phase 1 was extremely challenging," says Waveguide's Walker, "but the time frame for Phase 2, even though it was technically an expansion of the original network structure, was even more intense."

The Name of the Game is "Control Options"

By Alex Villiard, Senior Systems Engineer, Crestron

The integration of control to both the LAN and RS-232, with specific reference to the new Sharp projectors, was the most challenging piece of Phase 2 of the MIT project. Building in network control is something new to projector manufacturers, but it is the natural evolution of the concept of Crestron e-Control.

Partly driven by industry forces led by IT departments such as MIT's, Crestron has taken this idea of a local- and wide-area control and bridged them internally with the introduction of the Crestron 2-Series processor and the Dual Ethernet card. This Dual Ethernet card with its Network Address Translator (NAT) is useful at MIT, and many other campuses, in that now the RS-232 link is not necessary; it has become an IP link instead.

At the inception of the MIT project some three years ago, Crestron could not tie into the building/campus IP network while maintaining a local/room control IP network. The Ethernet/e-control capabilities of the TPS-5000 and TPS-6000 touch panels could access the rooms over the LAN, as they do right now, but, in Phase 2 and future expansion, the distance and location of the Sharp projectors is not limited to the RS-232, but extends over the WAN.

The Crestron 2-Series can easily replace/upgrade the current hardware at MIT (and other educational settings) to give MIT this added IT expandability. Options are the name of the game, and because Crestron and



manufacturers like Tandberg learned from the MIT project, we now have a variety of products that crosses the IT and A/V boundaries.

The Tandberg 6000 units were the

most seamless integration of the project. The TCP/IP (Telnet) connection, with its Command Line Interface (CLI), is the first of many products that have a background steeped in IT and yet the traditional audio/video and RS-232 controls are there for A/V. Crestron and Tandberg's deep commitment to the I2P partnership resulted in most of the control and functionality lacking in the codec inherited in Phase 1 instantly realizable with the Tandberg. Add in control via the CLI (both in TCP/IP and RS-232), and the abilities to stream audio and video across the IP Wide Area Network (WAN) and host several IP or traditional dial-up sites, and the Tandberg product is miles away from its predecessor in the system.

Like MIT, the Wharton School uses a high bandwidth I2 connection. There, the IT department is so A/V-savvy that they are the A/V department as well. The whole Wharton system, and others on commercial and university campuses — with Gigabit backbones for streaming A/V over IP — is an extension of the ideas started three years ago at MIT.

A Sign of the Times: Controllability

The MIT Distance Education program is technologically hinged entirely on the concept of a networked control system, namely, Crestron's IP-based e-Control and its ability to access any A/V device anywhere on the net-



work. As a sign of the times, and of how firmly intertwined IT and A/V have become, Walker cites the selection of new video projectors for Phase 2 of the project.

"Reliability and control problems with the original, owner-recommended projectors caused us to look for other solutions," he says. "We selected the Sharp XG-V10WU video projector as a replacement, not for its brightness — though, at 4700 ANSI lumens, it is bright — but for its ability to be accessed and controlled over an IP connection via Sharp's SAPS software, while at the same time being controlled via RS-232 from the Crestron control system.

"This resolved two issues," says Walker. "Two separate groups, in completely separate locations on campus, need access to the five projectors on the network: the Distance Education folks in Building 9 Master Control, who operate the system during distance learning sessions, and the A/V group responsible for local A/V classes and projector maintenance. Master Control accesses the projectors via Crestron's e-Control and passes commands via RS-232. A/V accesses them

over IP via the SAPS software, monitoring the projectors for critical parameters and operating status. Both groups have the access they need through a simple software interface."

The second issue involved picture-in-picture capability, i.e., a high-res background with a video image in the foreground. The Sharp projector spec'd in Phase 2 provides picture-in-picture capability right out of the box. Through its Internet2 pipeline, MIT has the bandwidth to do screen-sharing/application-sharing, which is a part of every session with Singapore, while maintaining instructor/student video contact on both ends. "In Phase 1, this was handled through expensive, third-party video hardware," says Walker. "In Phase 2, we were able to achieve the same results and saved approximately \$20,000 in equipment costs.

"The name of the game has changed," Walker summarizes. "It's control."

Day-to-Day with SMA

Distance education coordinator Elaine Mello has as much experience as any user with the DE program on a day-to-day basis, coming to MIT at the end of the 1-390 build period for fall of 2000. For her, a standout feature of the system is its, "ease of adaptability," and that is in great part

due to Crestron control. "I can assign the beta cam deck to a particular pod, for instance," she says, "without having to run to the other end of Master Control and physically hit the buttons on the deck."

Standard working procedures are to have one technician for each class, plus a supervisor (Mello or distance education technology administrator David Scannell). "Starting in fall 2001, we were running four simultaneous classes in the morning, all running over IP to Singapore," says Mello. "This semester, we've been doing a call to Singapore at 7:30 to 9:00 a.m., then dropping it and, using a video bridge we recently installed, going straight to another class, with just enough time to change the tape in the deck." This arrangement, and other similar back-to-back bookings, was actually tested out in 1-390.

"One of the ways in which this program is unique is that we do two different types of recording," says Mello. "One is a program feed, consisting of all classroom cameras, far-end video, and the computer, which is scan-converted. This feed goes via fiber optic to Streaming

Media Compression Services here in Building 9 at the same time, and within 12 hours a student can go to the SMA Web site and review the entire class. In addition, we do a record video of the professors', students', and document cameras, which is the same feed that's going through to the codec — i.e., what they see in Singapore.



Within 24–36 hours, students in Singapore are able to stream a synchronized two-screen recording of the lecture, with video in one window and native resolution graphics in the other.” [For a 10-minute streaming video introduction to program operations, as well as program goals and achievements, see the MIT-SMA Web site: web.mit.edu/sma/About/SpecialEvents/Symposium/Videos.html.]

Because the MIT DE program is very much a work-in-progress, Mello stresses how important it has been that the systems designer and programmer have been so willing to consult the system users at every step. In addition, she says, “Crestron and Waveguide have been great about allowing us to implement changes in the system to accommodate the way we actually work.”

And helpful changes can be implemented rapidly. “Alex Villiard can get into the system remotely make changes and tweaks, then call us to see how those changes work for us,” says Mello. “Getting him on-site to make changes would be tedious and impractical. It’s just not necessary.”

Tear it Up, One More Time

Phase 3 looms.... Exactly what will comprise Phase 3 is not yet decided, but it will most likely involve adding a larger router to classrooms in the newest structure on the MIT campus, architect Frank O. Gehry’s visionary 430,000-square-foot academic complex, the Stata Center.

“When it comes to Phase 3, we have two options,” says Walker. “One that we built into the design is that we can simply increase the size of our central router and leave everything in tact and effectively double the capacity of Master Control. However, this option is predicated on the number of simultaneous classes MIT expects to deliver to Singapore or other partners in that general time-zone.” Since Singapore is essentially MIT’s main partner, separated by 12 hours, only a few hours of the day are available in which to provide interactive, synchronous classes.

“We also designed in a fully automated mode that requires no production pod or technician, so a skilled faculty member can manage a class by him or herself.

To this point, however, MIT has preferred to have a technician at a production pod for each class so that the technician can make intelligent decisions about what source to send at any given moment. If MIT determines that they need more pods, then we’ll need to physically double or triple the size of the Master Control room when Stata and other buildings come online,” says Walker. If this happens, it will have to take place (that’s right) over a summer vacation.

Pedagogy and technology have become so intertwined in the MIT DE programs, and fairly rapidly, too, that the institution must now face its own immense potential as an exporter of high-quality education, branded with its name. “Learning — not technology —

is the goal of SMA,” president Vest has said. “We are extending our learning community by teaching outward from our campus in both synchronous and asynchronous modes — carrying MIT to the world.”

Making Contact

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Thursday Afternoon

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3. Understand the Architectural Design Process.

Educate yourself on the phases of a typical building design process (programming, schematic design, design development, and contract documents) and learn where to place your attention and focus throughout these phases. Once the project moves beyond the design development phase, making major changes such as raising ceiling heights to accommodate larger projection screens or changing from front projection to rear projection may be impractical and too costly to consider. You should work with your A/V design professional early in the project to develop the appropriate facility infrastructure systems that will support the specific A/V and IT technologies to be integrated within the facility.

4. Finish the Job. A/V installations fail for a number of reasons, but probably the number one reason is the "Last 5 Percent" problem. All too often, A/V installations are left in an unstable state of quasi-functionality because the installation is never fully completed. Owners many times blame the technology, but the real blame often belongs to the humans who designed or installed these systems. Ensure that your contracts are structured to protect you from being left with an incomplete installation. Hold back money if necessary and make sure that electronic copies of system documentation (both hardware and software programming) are required as part of the contract so that, if you do have to get another team to finish the job, they can pick up where the other team left off. If you do not have the internal expertise to evaluate the quality and completeness of the installation, you should consider using an independent consultant to act as your technical representative throughout the process through contract closeout.

5. Make the Time to Learn A/V. Lastly (or perhaps firstly), IT managers should take advantage of the many opportunities available to learn about A/V technologies. Tradeshows like InfoComm can pro-

vide a wealth of learning opportunities from the vast tradeshow floor to the numerous technical seminars available to end-users. In addition, ICIA (the A/V trade association that puts on the InfoComm tradeshows around the world) offers year-round online and on-site training courses through its CTS certification programs, as well as opportunities to network with your peers through ICIA's various member councils. Nothing will prepare you better for managing your A/V facilities than dedicating the time to learn the about the intricacies of the A/V landscape, networking with your peers, and obtaining industry-certified training.

Avoiding the "Thursday Afternoon Bombshell" should be the goal of every IT/AV department. The ever-evolving and blurring worlds of IT and A/V technologies hold much promise for today's end-users, but also represent complex challenges and great opportunities for disappointment. Partnering with qualified A/V professionals and educating yourself on the demands of A/V systems will provide you with the tools to manage this technology convergence and, perhaps, make it home for supper more often than not.

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Making the IT/AV Connection

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meters. This is a delivery rate not feasible on 100BaseT networks. For this reason, wideband analog distribution systems located behind the scenes couple with network control and display systems to deliver the video bandwidth required. Analog routers and distribution components easily deliver 300 MHz or more video bandwidth over a hundred feet or more to support presentation-quality graphics where they are really needed. Control of these wideband systems is easily handled via serial control interfaces or, in some instances, via direct Ethernet connection. The marriage of high-performance

analog distribution and routing equipment with network-enabled control systems is the foreseeable formula for IT/AV integration until low-cost multi-gigabit per second networks are commonplace.

For corporate boardrooms, classrooms, and presentation venues, a centrally located analog matrix router can supply the necessary wideband graphics to a sizeable group of rooms. Each room may have independent control via the network or dedicated control interface for its share of content resources. For example, a modest 12x8 RGBHV router can readily supply 1024x768 quality graphics (or higher) over more than 100 feet from the main distribution point to a cluster of eight separate rooms with each presenter receiving his/her choice of up to 12 graphics sources. For applications where there is only network cabling available, solutions exist that allow analog transmission of wideband video over CAT 5-type data cable. These video "networks" are independent of the data network, but provide a means to realize high-performance graphics delivery at reasonable cost over existing wires. A special format converter translates standard RGBHV computer information to a transmission level more suited to the CAT 5-style cabling design. A companion receiver recovers the signal and restores it to normal video drive levels for the display. These video distribution solutions can be readily applied to the interconnection of multiple boardroom and classroom locations where the relay of graphics may be made to include other network clusters.

Working alongside the Ethernet LAN, wideband analog video distribution systems are the best solution for high-performance image delivery.

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