

## Arts & Humanities Initiative

[www.internet2.edu/arts](http://www.internet2.edu/arts)

Just as laboratory and health clinic are evolving into global, distributed facilities, arts and humanities venues like the stage, museum and lecture hall are expanding into virtual, worldwide networks of collaborating artists, scholars, educators, students and fans. Internet2's **Arts and Humanities Initiative** is helping its community present rich arts and humanities content to a new, eager, international audience and, in the process, redefining how artists and presenters create, perform, teach and connect with their audiences.

The USC Shoah Foundation Institute's Visual History Archive, currently available via the Internet2 Network. Photo by S. Peter Lopez, courtesy of the Institute. ▼



### FOR MORE INFORMATION

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### Digital content collections on demand

Among the important content collections made available through the Internet2 Network are the C-SPAN Video Library and Archive, with 80,000 hours of programming; the Research Channel, with 2800-plus programs available on demand; and the University of Southern California (USC) Shoah Foundation Institute's Visual History Archive, with 105,000 hours (135 terabytes) of video testimonies of Holocaust survivors and other witnesses. The Institute's video archive is available via the Internet2 Network to scholars, professors and students on three continents.

### Performance collaborations across multiple sites



▲ Bradley University's multi-site performance of Elmer Rice's classic play, *The Adding Machine*. Photo courtesy Eric Behrens, Peoria Journal Star.

Bradley University piloted the use of advanced networks to create a live multi-site performance of Elmer Rice's classic 1923 play, *The Adding Machine*, with participants integrated from Bradley's campus in Illinois, the University of Waterloo in Canada and the University of Central Florida, before a backdrop of high-definition, panoramic video images. According to one reviewer, the result was "not technology for technology's sake, but a vital re-imagining of a theater classic."

### The global stage

Performers no longer need to be in the same room with peers, students or audiences to communicate their message. The Philadelphia Orchestra, through their Global Concert Series, became the first major orchestra to transmit live concerts to multiple large-screen venues. Series concerts were captured by high-definition cameras, processed with a Tandberg E5782 encoder and streamed live to national and international campuses with an HD MPEG-2 20 Mbps multicast stream delivered over Internet2 and partner networks.

## Producing successful network arts events

Internet2 and the New World Symphony (NWS) join forces each year to present **Performing Arts Production Workshops**, hosted on the NWS campus, to teach Internet2 members how to produce successful interactive performing arts education, multi-site performance and high-quality netcast media events. Based on participants' enthusiastic responses, a series of annual *international* Performing Arts Production Workshops was inaugurated in July of 2009, with the first workshop presented by Internet2, the Trans-European Research and Education Networking Association (TERENA) and Consortium GARR at the Music Conservatory of Trieste, Italy.

## Research brings art up close and personal

Science and engineering applications aren't the only ones pushing the frontiers of advanced networking. Some music applications, like simultaneous remote performance, have their own set of extreme network requirements—in this case, extremely low latency. As audio connections and processing introduce signal delays, music gets more and more out of sync. To solve this persistent problem, a team at the Conservatorio G. Tartini has developed **LOLA**, a low-latency audiovisual communication tool. The codec latency of this software is a stunning 5 milliseconds, resulting in a full audio and video coding and decoding round-trip latency of about 21 milliseconds. In a recent test, two pianists—separated by the equivalent of the distance from Trieste to Venice, about 100 miles—played selections from the Bach Brandenburg Concertos together with a round-trip latency of only 22 milliseconds.

Another perennial challenge in live performance videoconferencing is audio feedback—where sound from the remote site feeds back into the originating site's microphones, creating an annoying loop—which can make effective communication nearly impossible. Available echo-canceling microphones cancel out too many important frequencies to be acceptable for musicians. Enter **EchoDamp**, created by Dr. Brian K. Shepard, Assistant Professor of Pedagogical Technology at USC. Created with support from USC's Thornton School of Music—who releases the software for free to educational institutions—and technical and testing assistance from Internet2, NWS and others, ECHOdamp listens for the *directionality* of a sound's source, using that information to prevent echo from entering the audio chain in the first place, rather than using phase cancellation and frequency filtering. If echo does enter the signal, it is gracefully damped in a manner that is both unobtrusive and



▲ (Left) Thomas Hampson, one of America's leading baritones, conducts a master class at Manhattan School of Music with the Curtis Institute of Music via Internet2. Photo by Andrew Lepley. (Upper right) At Discovery World's Digital Theater, Milwaukee residents heard the Philadelphia Orchestra in all its high-definition glory while watching a spectacular, 27-foot wide, 2048x1920 resolution image—complete with subtitles and live interviews. Photo by Don Kasprzak. (Lower right) New World Symphony's Catherine Miller and Conservatorio Tartini's Maria Fiore Mazzarini work with each other remotely at the first international Internet2 co-produced Performing Arts Production Workshop in Trieste, Italy. Photo by Justin Hourigan.

musical. As a result, participants can experience the full audio frequency spectrum without echo.

Another research success story is Internet2 Industry Partner Polycom's **Music Mode**. Every year, some 1,700 students engage in Manhattan School of Music (MSM) master classes, workshops, clinics and private lessons. MSM's remote audio requirements led music technologists to consult with Polycom engineers, developing settings that optimize the audio quality of Polycom's videoconference systems. Their efforts resulted in Music Mode, a now-standard feature on some Polycom systems that transmits audio using a configuration that reproduces live music more faithfully—for example, disabling noise suppression and automatic gain control.

All around the world, Internet2's Arts and Humanities Initiative is helping its community join a global cast of distinguished artists and educators, showing them how they can use advanced network innovation to enrich the lives of students, art lovers and audiences everywhere.