



# THE COMPUTERWORLD HONORS PROGRAM

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## CASE STUDY

**LOCATION:**  
*Pittsburgh, Pennsylvania,  
United States*

**YEAR:**  
*2006*

**STATUS:**  
*Laureate*

**CATEGORY:**  
*Media, Arts and  
Entertainment*

**NOMINATING COMPANY:**  
*Microsoft*

### ORGANIZATION:

University of Pittsburgh

### PROJECT NAME:

Video on the Network

### Summary

Demand for transporting video over the network at the University of Pittsburgh is steadily increasing. The service can be used in a variety of ways including distance learning; webcasting; streaming video content to classrooms, public relations, promotions and athletic events; and in content delivery and integration with cable, satellite and licensed services. The University's network (PittNet) supports the delivery of certain types of digital video on an ad-hoc basis between producers and viewers within the University community. Computing Services and Systems Development (CSSD), the University's central IT unit, has built a solid network foundation to address the three most critical issues related to digital video: bandwidth, network efficiency, and managing access to the network.

CSSD is developing technology to support centralized storage and access to digital content, integrating technology for "video on demand," and utilizing its Web portal capabilities to manage and simplify access to content. Cable services, other licensed content, and video conference bridging (ISDN-to-IP) functionality will also be incorporated.

Video on Demand allows users to access digital content that is available through a "program guide" similar to digital cable television. Continuous streaming and selections of archived digital media and cable programming will be made available. University content providers can upload Web clips, live video streams, and create video libraries for access by viewers using computers connected to PittNet.

### Introductory Overview

Historically, the University has had limited capability for the network transport of video content. Efforts began more than 20 years ago with the implementation of a pre-production commercial video switch which met the requirements of its day. This device has not kept pace with technology and has far exceeded its useful life span. This equipment requires a point-to-point connection over multimode network fiber, an inefficient utilization of network resources. This requirement also inherently limits the capability and flexibility of the system because live video connections can be made only between conference rooms with point-to-point connections



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established. Subsequent efforts to upgrade the underlying technology met with limited success.

Over the past several years, CSSD has completed substantial upgrades to its network infrastructure. By 2004, a Gigabit Ethernet backbone was in place and 100 Mbps service was made available to all 24,000 network ports. These upgrade efforts also included the implementation of a one device per network port policy across the University.

Additional upgrades were put in place in 2004 to support multicasting across the Pittsburgh campus. Potential bottlenecks were eliminated in large closets by optimizing the configuration of stacked network switches. In early 2005 the University's network backbone was upgraded to 10 GB capacity in central network hub sites. This project will continue with the upgrade of the remainder of the network over the next several years.

CSSD worked with focus groups to assess the demand for video and to determine the types of applications that would be required for video delivery. As a result, the project was charged with the following goals:

- Deliver live and stored video across PittNet. Video will be delivered over the network using multicast for prescheduled distribution and unicast for on-demand broadcasts.
- ;Provide a mobile, easy-to-use video delivery service for applications that do not require broadcast-quality video transmission.
- Provide video-on-demand (VoD) services to permit replay of stored video broadcasts from any point on PittNet.
- Deliver high quality videoconferencing services.

The University implemented an enterprise Web portal to deliver enterprise applications and services to students, faculty, and staff in 2003. The portal is the ideal medium to deliver video services to the University community including links to live broadcasts and a catalog of stored video titles. The specific advantage of the portal is that the catalog can be tailored to specific target communities, which already exist within the portal and are under continuing development for other groups. Video broadcasts from the Chancellor, for example, can be made available to everyone while broadcasts from an academic dean can be made available only to the students, faculty, and staff of the dean's specific school.

### Benefits

Video on Demand provides an easy-to-use interface to view digital video over the University network. The service allows users to browse a program guide and select stored video, streaming webcasts, and other licensed content available on the system. The program guide is integrated with the Web portal to support user-based authentication and provide access that is similar to enterprise applications. The service allows the "uploading" of video content to centralized video servers and categorizing for playback.

The service will be of considerable value to departments with extensive libraries of existing content stored on videotape. By providing video appliances for the quick and easy encoding and uploading to a digital format, CSSD will enable instructors, instructional designers, and other content developers to quickly and easily prepare video content for delivery at any time.

The video bridge will enable users to schedule their own IP-to-IP and ISDN-to-IP video confer-



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ence sessions. Additionally, the centralized service will greatly reduce the amount of servers and hardware needed to provide these services. All members of the University will be able to utilize the service through the network. Live video production and broadcast will be provided as a special service through the appropriate University unit.

This project will enhance the University's leading efforts in distance education and collaborative research involving institutions worldwide. In addition to teaching and research efforts, this system provides a platform from which the University can increase its exposure throughout the local, regional, and global communities.

### The Importance of Technology

The significant increase in virtual classrooms and distributed audiences has resulted in a shift in paradigms from the traditional classroom model. The ability of instructors in one location to communicate with students in another, or many other, locations requires the implementation of technology that can carry real-time communication over the network and the Internet. In addition to real-time content delivery, there is increasing demand for access to recorded presentations that must be accommodated in an effective manner.

From the time that video services were first implemented at the University, the technology has evolved significantly. Video server, encoder, and bridge technology has matured. With a state-of-the-art data network, CSSD can employ these technologies to meet the rising demand for video over the network services. Videoconferencing equipment has been implemented that allows for conference room to conference room (multipoint) or desktop to conference room (point to multipoint) communication. In addition to providing distance education solutions, the system can be utilized for multi-site administrative conferences, meetings involving research groups, and a variety of other purposes.

CSSD has developed an extensive infrastructure to support enterprise applications including a network operations center (NOC) that provides around-the-clock monitoring, troubleshooting, and problem resolution services for the network and all enterprise applications and services. The University Web portal is able to focus content on specific groups of individuals using the capabilities of the Central Directory Service, which is the central authoritative source of identity and roles for every individual affiliated with the University of Pittsburgh. The Central Directory Service permits the creation of communities with common interests and provides the ability to focus content to these specific groups of users.

Video on demand servers are based on Microsoft Windows technology and allow for smooth integration into the NOC data center. Windows integration with the LDAP compatible Central Directory Service and Microsoft Active Directory allows for consistent application and granular control over user rights and authentication.

### Originality

The most exceptional aspect of the project is that the University has developed the state of the art network infrastructure over which bandwidth intensive applications such as network based video can be offered with the highest quality and reliability available. The video platform provides a central solution for delivery of the very best quality video services.



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The originality of the University's approach was in making the strategic decision to implement an enterprise video delivery and videoconferencing service. CSSD has provided and maintains the underlying equipment, applications, and integration with the enterprise portal. In addition, CSSD provides the network infrastructure to provide high performance functionality. The University academic and administrative community determines how best to utilize the system. Video content development is accomplished by staff with appropriate expertise.

Other institutions have deployed these types of services, but frequently use a decentralized approach in which the specific content providers determine the equipment and methods of delivery. The University's approach is truly unique in that the underlying technology is centralized, but the decisions on how to best utilize these services are left at the discretion of those best positioned within the University to do so.

### Success

When fully implemented, this project will be rapidly adopted due to the already very high demand for high end network video services. This demand exists within academic, research, and administrative areas.

### Difficulty

The most significant challenge to implementing this service was preparing the University network to support high bandwidth video content without significant bottlenecks or performance issues that would affect the quality of the presentations. The Ethernet upgrade projects addressed this issue to a degree, but the chief difficulty involved the analysis of traffic patterns throughout the entire network to determine the equipment configurations that would provide optimum performance.

The second challenge involved the design of a method of presenting content options to the appropriate groups of users. CSSD has the capability of presenting content to specific groups. This project required a significant development effort involving the Central Directory Service and the enterprise Web portal to ensure that once the content providers selected an audience, the specific content is made available appropriately. The solution involved the development of an online catalog whose contents vary depending upon the affiliation or academic interest of the user.

There was no difficulty obtaining either approval or funding for this project.