



The Value of High Performance Networking on International Distance Education Team Building, Technology Selection, and Innovative Teaching Methodology

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1 Developing New Processes - People, Technology, Methodology

Attitudes toward the role of distance education tend to polarize within institutions of higher learning. The first claims that an asynchronous learning experience will always be inferior to a live, interactive session between the student and the educator. The second group will argue that students receive a wider range of opportunities if permitted to draw upon the experiences of multiple knowledge presenters along with the vast amount of information accessible through the web. These two attitudes are by no means mutually exclusive. By crossing the boundaries of time, location, language and culture, this project will be an experiment that demonstrates a merger of the two philosophies, resulting in a semi-synchronous learning experience.



The title of this paper would lead you to believe that this is a technical document, and that the formula for a successful international distance learning experience is comprised of bandwidth, cameras, protocols, and video servers. Truly, there would not be a distance learning project without those components. Showcasing the technology was the primary objective when this project was first conceived, but it became apparent very early in the planning stages that the physical characteristics would share an equal partnership with team building and teaching methodology. Actually, it has been the mental processes of the people involved and their willingness to develop different teaching styles that have given the technology a true value.

The steps leading to the provision of a video infrastructure that would permit new and innovative teaching practices to be applied to current distance learning techniques were not accomplished easily. Even with the proliferation of organizations like Internet 2 and Renater 2, the involvement of technicians at both end sites and along the path will determine the success or failure of the quality of the demonstration. Only recently has it truly become feasible for student interaction using quality video and audio on a global scale, but not without considerable human involvement. Perhaps within three years, or less, the network will have matured to the point where high quality international video will be as simple and cost effective as using the telephone is today, but we are definitely not there yet.

In its entirety, this project has become more than a showcase for the current technology, it is unfolding as a process that motivates the interaction of three key elements: People,



Technology, and Methodology. The value of this paper, then, is the sharing of those processes whereby these elements were brought together to create an enhanced collaborative learning experience for the students and the involved faculty.

2 The People Process

The concept for this project began as a result of an existing professional and personal relationship between two people, the Chef de Department, Centre Interuniversitaire de Calcul de Grenoble in France, and an Information Technology Director at the University of Pennsylvania in the United States. These two people discussed the possibilities of how the two research and education networks, Renater 2 and Internet2 could be utilized in an innovative and technologically based teaching program. Video was selected as the technology, but it was very apparent that the pedagogical content of the program would determine the success or failure of the experiment. The technology aspect held an equal position of importance, but by itself was nothing more than videoconferencing across a private network, something that many corporations and schools are already doing today.

With this realization, the two individuals began their campaigns on their respective campuses to rally academic support. There was no established budget, no donors, no faculty, and, no students. The solicitation consisted entirely of an appeal to the creative nature of individuals, and happily, it worked. In the United States, the University of Pennsylvania has established a history of excellence in the areas of distance education, foreign languages, and business. Academics were approached about the potential of combining these three elements into a current course offering, with the semester culminating in a live videoconference. To their credit, educators and administrators from the College of General Studies, the School of Arts and Sciences, and the Wharton, Lauder Institute of Management and International Studies agreed to contribute their time and talents to partake in a demonstration of technology and teaching expertise. The only incentive was the challenge of innovation, and to their credit these people accepted that without any promises of financial or career advancement, and have contributed their time and talents on top of their very lengthy project lists. Similarly, the participants at the University of Grenoble, Pierre Mendes campus, where members of the IT support organization and the Ecole Supérieure des Affaires willingly contributed their skills and resources.

The volunteers were organized into specific teams in both countries, Educational Content, and Technical. In the United States, there was a necessary third team that dealt with the production issues surrounding the demonstration and the multi-media documentation of the processes. Motivating educators and technologists to spend the extra time necessary did not stop at the university campus level. The technical team was not complete without the involvement of administrators and technicians at Renater, STARTAP, and Internet2. These organizations would share an equal responsibility with the University technicians for the final quality of the videoconference. Previous efforts to create high quality video without the participation of the network providers were considered unsuccessful. Poor image and audio quality detracts from the learning experience, especially when the objective involves facial expressions, body language, intonation, and pronunciation. The two research networks, Renater and Internet 2, and the interface gateway, STARTAP, will provide the service guarantees necessary to make this event successful.

To understand the full impact of the intricacies of the team building process, **figure 1** shows the United States and French team members and their supporting organizations. The formation of three distinct teams allowed each function to work within its own discipline and communicate in its own jargon. Educators are generally uncomfortable when the subject focuses on camera angles and optimal lighting. Conversely, the production people start to yawn when the technology folks get wildly excited

about packet prioritization on an IP network. Separate team meetings did not detract from the general

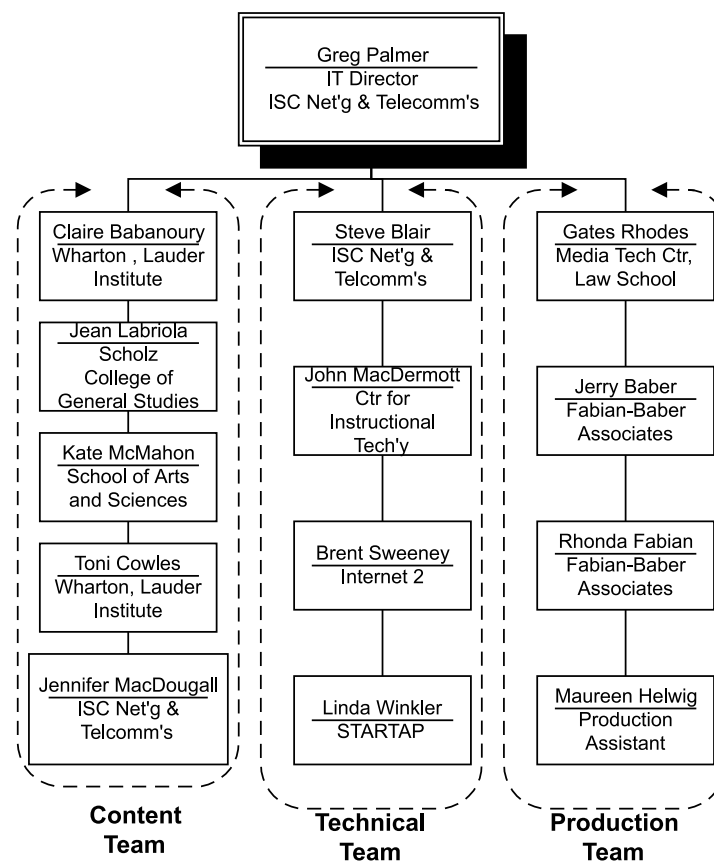


Figure 1 - Project Organizational Structure, University of Pennsylvania

enthusiasm everyone felt in working towards the common objectives, but permitted them to focus on their own specific tasks. The evolution of the dynamics between the individual teams and their international counterparts has been an excellent example of collaboration. Certainly language, personal schedules, and the 6-hour time difference created difficulties

in communicating and problem resolution. A significant amount of time was consumed simply trying to schedule dates for the pre-conferences and final demonstration. It was very common to experience a 2-day response delay to questions posed via email. As deadlines approached, this produced a certain amount of stress since it was a factor that could not be controlled. Cultural differences certainly played a part as well.

The teams at the Universit e de Grenoble were similarly constructed. **Figure 2** shows the key individuals that have been instrumental in this collaboration. At both locations, there were many more people who contributed to the project, bringing the total to nearly 30. Without their involvement, the experience would have been far less meaningful. The roles that each team member played in constructing the class content, the technical infrastructure, and the pedagogical approach to delivering the content were equally important in the creation of this demonstration. A more definitive explanation of their contributions is presented in the next two sections.

Content team :	Jacques Trahand, Vice-President, Universit�e Pierre Mendès-France Didier Retour, Director, Ecole Sup�erieure des Affaires James Corbett, Professor, Ecole Sup�erieure des Affaires
Technical team :	Jacques Prevost, Renater, Paris Claudine Chassagne, IT Director, Universit�e Pierre Mend�es-France Marc Chavot, IT Department, Universit�e Pierre Mend�es-France
Coordination (Grenoble several projects with Penn):	Jean-Francois Desnos, Department head, CIG Eric Jullien, Networks research engineer, CIG

Figure 2 - Project Organizational Structure, University of Grenoble

3 The Technological Process

The technological candidates were MPG-2 streaming media and H.323 videoconferencing, or some combination of the two. Both of these are associated with distance learning, but given the short timeframe for completion and the complexities of streaming media, it was decided that H.323 video had the least amount of technical risk and was best suited to demonstrate the capabilities of the two networks Internet2 and Renater. Cost was another issue. Having a very small budget, streaming media servers and expensive room equipment were out of the question. Both sites would have to make do with existing video systems. The result was a near zero cost for video equipment.

The second technical issue was the selection of the two end-points. There were many volunteers, but the primary reason for selecting the University of Pennsylvania and the University of Grenoble was based on a very practical need for readily available bandwidth. Both institutions are currently nodes on their respective national research backbones, thereby eliminating a costly and time-consuming build-out of infrastructure. The architecture was pre-existing, and incurred no additional cost for this project. Bandwidth capacity of up to 155 Mbps was available from Philadelphia in the U.S. to Grenoble, France via the

STARTAP international gateway. The infrastructure cost was absorbed by the existing fee structures imposed by the research networks, Renater and Internet2. The result was a zero cost for network access and utilization to this project.

The next decision involved the method of prioritization. The preferred format was 802.1P packet prioritization. Unfortunately, there were no guarantees that this was supported through each leg of the journey from Philadelphia to France, so the less complex method of IP Precedence was selected. This was common at each router hop and on both campuses. Even this aspect was made difficult by the problems of language and time zones. But without the guarantee that the video packets would be delivered across the network in a uniform, consistent manner, the risk of being unable to provide good audio and video to the students would have been far too great.

Resolving the on-campus connectivity issues was not an insignificant task. Establishing appropriate data routes from the Ecole Superieure des Affaires videoconferencing center to the Renater network did not exist at the beginning of this project. Nor did Renater recognize the IP address of our initial test equipment as something that could be sent to the United States. In the first test, packets from France traversed the Renater network only as far as Paris and then rode the Internet to the U.S. where they were delivered on the University of Pennsylvania's standard connection. Needless to say the quality left something to be desired.

On the U.S. side, the room selected for the class demonstration was located in a facility belonging to the School of Engineering. Three router hops were necessary before the data was even presented to Internet2. The collaboration of the central IT Networking Department and the SEAS IT group provided the necessary prioritization for the successful transport of packets across the campus. This problem was further compounded by the amount of bandwidth available to the entire facility where the conference was to be held. Despite an aggressive program to upgrade buildings from shared 10 Mbps aggregate links to 100 Mbps connections, this building had not yet been migrated. It was feared that the video traffic in conjunction with existing data streams would be insufficient. That issue was resolved by the central IT Networking group.

At the time of this writing, the final test between the two endpoints is being planned. When that happens, technicians from all the networks being used will monitor the video traffic to determine whether the correct paths are being followed, and what bottlenecks may be in place. Figure 3 shows the network routes that will most likely be used for this project.

4 The Academic Methodology

The Content Teams were challenged to determine the best teaching application that would lend itself to the situation. Developing objectives that would meet the criteria of each institution was also taken into consideration. To ensure that the educators involved in this project were in complete agreement about the content and structure, a combined faculty meeting was held using the same video technology that will be used for the final demonstration. The agreed upon subject was business oriented and video became the essential media since the interpretations of facial expressions and body language are vital to the

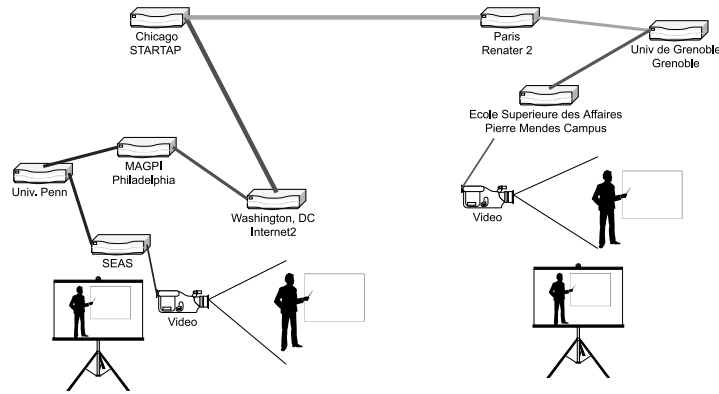


Figure 3 - Network Pathway

business communication process. The academic objectives were stated as being: proficiency in the foreign language; understanding of the business and national cultures; negotiation skills and business acuity.

This collaborative project has been conducted with students at the advanced/superior level in language proficiency. We are finding that the above-mentioned objectives can be best achieved by using a project-based teaching methodology which is in essence interdisciplinary and which encompasses several constituting elements of knowledge building such as general language, business language, business content and business culture around a relevant real life project. To take full advantage of the videoconferencing tool and to enable true communication, the project has to be sound and ring true. The business case is an ideal example of material for project-based teaching and as an authentic learning tool, it maximizes the use of time and resources. An equally valuable tool is the global simulation. Both models lend themselves well to the use of videoconferencing during the critical negotiation phases as it enhances the whole experience in ways yet difficult to measure by creating a truly powerful learning moment.

This does, however, present new challenges for the educator. That person must first be willing to share the classroom environment with other educators and other students. In an interactive environment such as this, outcomes are not predictable, which adds a new skill to the educator's list, that of moderator. As Jean Labriola Scholz described it, teachers must, "move from the sage on the stage to the guide on the side."

This style of teaching is not a one-way lecture, nor is it the free-for-all chat room discussion of many on-line courses. This is a video field trip. It uses the knowledge gained during the regular classroom activity and applies it to a group activity that includes sight and sound from a remote source.

Being able to share information and knowledge between multiple sites, to negotiate face to face, to solve a problem collaboratively in a real time fashion will truly empower all constituents (students, clients, faculty) and take them to new levels of cognitive and conceptual ability. For such projects, which are discussion catalysts around business issues,

videoconferencing promotes peer interactions and appears to be an optimal medium. In addition, it offers an environment conducive to successful negotiation, where knowledge and understanding of cultural differences are essential. If an individual or a firm wishes to be successful in international business, individual cultures must be recognized, learned, and appreciated. Foreign business practices and perceptions are different everywhere. Videoconferencing appears to be the best way to expose non-verbal communication, which is sometimes essential to understand those perceptions: facial expressions, body language and gestures will be clues to decipher cultural traits and understand more of the foreign culture in general and its business culture in particular.

The educator must have the insight to foresee where the discussion is headed and re-direct conversation, if necessary, in order to achieve the desired objectives. Class preparation is very different for this type of course compared to the delivery of a lecture. The curriculum needs to be collaborative with the remote site, involving combined schedules and objectives. Not that "Team Teaching" is anything new, but this is simultaneous teaching, where one or several international sites may have different goals. As an example, in this case both France and the United States wished to hold the conference in the other country's language so that their own students would be motivated to show proficiency. Obviously, this brings benefit to only one of the participants. The solution called for students in France to speak English, and the Americans to speak French. This provides an equal opportunity to show a working knowledge of both languages.

The students, senior level undergraduates, appear to be highly motivated with regard to the process. Some of them will continue in their studies by entering "immersion" programs where they will live in a foreign country for a period of time with little or no opportunity to speak their native language. This class will help to prepare them for that step by allowing them to experience the language and culture in its own environment prior to visiting. For the students involved in this project, emails and digital photographs have been shared throughout the term, and a pre-conference has been held to further the individual familiarization process with their international counterparts and the video process in general. The only surprises should be the method of resolving the business question set

One additional benefit to be realized from this activity is the documentation and publicizing of the experience. This type of teaching represents a low cost and effective way of enhancing the traditional classroom experience. With the continued growth of research and educational networks and the decreasing complexity and cost of technological tools, teachers of every discipline and age group will creatively modify this program to meet their own criteria. They will be defining new roles for future instructors as well, using the combined energies of technology and pedagogical prowess with no regard for geographical separation.

5 Conclusion

The most gratifying aspect of this endeavor has been the manner in which individuals from two countries, multiple academic disciplines, and the world of technology have banded together to create a meaningful learning experience. Certainly not without complications,

but the complexity will diminish with each new attempt, resulting in a plethora of international adventures for students of all ages and fields of study. Advances in video technology and the supporting infrastructure will sooner permit faculty and young people from any geographic area to gain exposure to, and interact with, cultures and languages that are currently only silent pictures in a book. The "Distance" piece of distance learning will be inconsequential.

As with all new information and communication technology, the use of videoconferencing in education and more specifically in language learning at the advanced professional level must be the result of a reasoned process involving objectives, tasks, activities and planned results. Videoconferencing offers an opportunity to rethink the principles, the methods and the objectives of language teaching for special purposes. It opens the way to a more autonomous learning process on the part of the students and to increased empowerment at several levels : language development, cultural and cross-cultural knowledge, negotiating skills, business acuity.

The large-scale finances necessary to provide the infrastructure are already motivated and in place in many parts of the world. Networks such as Internet2 and Renater, and organizations like EUNIS and Educause are providing the intellectual resources whereby a project like this can happen. Governments, private groups, and corporations are funding similar experiments around the world. But the successful international learning experience will still rely on the three key elements outlined in this paper:

- People - The combined efforts of individuals committed to education
- Technology - To find better methods of mining, transporting, and delivering knowledge
- Teaching Methods - Innovative ways to stimulate the knowledge seeker

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