DISTANT AND LOCAL ASPECTS OF EXCHANGING REAL-TIME MULTIMEDIA INFORMATION WITHIN DISTRIBUTED CLASSROOM COMMUNICATION SUBSYSTEM

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INTRODUCTION

Applications based on distributed computing and multimedia information have changed performance requirements of network technologies and communication protocols. People have thought for a long-time that computer networks could offer only asynchronous communication services so that real-time transmissions wouldn't be possible. Since 1992, experiences with audio and video conference applications across the Internet have proven that there are strategies to integrate real-time services across the network chiefly when the "real-time" is cleverly traded between what an application really needs and what the network can offer.

The explosion of a new generation of applications across computer networks is the natural consequence of finding better methods to manage information in digital format and of integrating these methods in computer environments. Distributed Computing Environments are classes of objects (e.g.: information servers, communication services, networks, graphical interfaces, media drivers) and associated methods (e.g. methods to access, to transmit or to present information). Some of these objects are instantiated to create a particular environment where users can develop a particular activity. Users must "emerge" in this environment in order to pursue their activity. Activity is mostly human. Session is a better term to express the temporary existence of a particular environment. A session might be started by users or by applications. Objects may be shared between different sessions when they have appropriate interface for each session. They belong to a session only when the session "needs" them otherwise they rest in a "potential" state. A session may associate states to objects that are involved in . A common or a distributed manager (under human control or following preconceived rules for that type of activity) may use information about these states in order to take decisions about session evolution. When session ends, all states are cleared and "active" objects returned to their "potential" existence.

The new generation of applications aims at providing users with such computer mediated environments to accomplish their activities better than in other environments. Computer Mediated Communication is a class of environments that enable transmission and reception of messages using computers as input, storage, output and routing devices¹. Such
environments may support session oriented activities that use multimedia, multi-party communication:
- synchronized distance teaching (from teaching to collaborative learning);
- cooperative work in telepresence (from tele-meeting to real-time co-design);
- multimedia information recover (from media on demand to intelligent query multimedia databases);
- tele-work in virtual reality (from data collection to local intervention in remote fabrication process);

Designing computer mediated communication environments is a complex task. This is the reason why we've started with an experimental platform for distant teaching and training. This platform is flexible enough to let us analyze different aspects of exchanging real-time multimedia information in distributed environments.

FROM COMPUTER ASSISTED TO COMPUTER MEDIATED LEARNING SYSTEMS

An efficient learning system must be a robust and flexible tool serving teachers and students on achieving high quality of taught information. Computer assisted learning systems were designed to facilitate knowledge organization and representation independently of teacher's presence or student's location. Most of them are based on built-in learning scenarios and an associated knowledge database dedicated to the set of concepts which students have to learn. Multimedia authoring tools offer a fascinating framework for new architectures of computer assisted learning applications. This new perceptual quality of learning incites students to interactivity and enforces their need of being integrated to the learning environment. The only way to fully achieve these goals is to add communication means to this environment and let users collaborate and share learning resources independently of distance. Hence we'll be able to set up distributed learning systems that offer real-time interactivity between students and a real or a virtual teacher. These systems must be reusable in various domains and must allow users to dynamically choose a learning scenario. In this context, asynchronous individual learning and synchronous real-time collaborative learning are no further antagonistic but they complement each other to finely complete education.

Recent evolution of network technology and widespread development of multimedia applications enable the transition from the classroom social space to a "cyberspace" of computer supported distributed classrooms at least for experiments. We need experiments as there is no other way to capture feedback from user behavior during a computer mediated collaborative learning session. We designed our platform to be flexible that is to allow dynamic composition of object instances within a session (like setting-up or tearing down an audio channel between a group of participants, coherent presentation of information issued from distributed servers, temporarily sharing the same work-space between distant users). The result is that students and teachers may tailor the learning environment to their specific needs on the spur of the moment. This is the consequence of multimedia integration in distributed applications and of communication subsystems ability to accommodate transmission requirements of these new applications.

GENERAL PRINCIPLES IN DESIGNING DISTRIBUTED CLASSROOMS

We define distributed classrooms environment as a "world class" with access points (multimedia terminals or workstations) spread across a wide area network. Networks make distance transparent to end users and support distributed access to information and services or applications. Teachers may teach to this class while standing in front of their friendly desktop workstation. The teaching support could be the "hypercours"² which is a