Tele-teaching Scenarios over Broadband Networks

Ch. Bouras A. Gkamas V. Kapoulas Th. Tsiatsos

Abstract

In this paper we present various tele-teaching scenarios over ATM network infrastructure. In each scenario we present the standards which we use, the logical components, the demand in resources (network resources and equipment) and its special characteristics. Main result of our experiments is that broadband networks offer many capabilities for high quality tele-teaching and generally speaking high quality Telematic services.

Introduction

Today we can register a growing public interest in the Internet and especially in the World Wide Web. At the same time, the computer networks are becoming increasingly fast with the use of new technologies. Furthermore Asynchronous Transfer Mode (ATM) based networks, which offer speed up to 622 Mbps, are installed and new capabilities like Quality of Services (QoS) are available to applications. These achievements make possible the implementation of tools that offer tele-teaching capabilities over networks with QoS characteristics.

In this paper we present various tele-teaching scenarios over ATM network infrastructure. During each scenario we present the standards which we use, the logical components, the demand in resources (network resources and equipment) and the special characteristics of each scenario. In the following paragraphs we present three tele-teaching scenarios: Point-to-Point over Native ATM, Point-to-Point with the use of TCP/IP over ATM infrastructure and Multipoint with the use of TCP/IP over ATM infrastructure.

Point-to-Point Over Native ATM

In this scenario the applications use the ATM infrastructure and protocols in order to transmit data (video audio and application sharing data). In this scenario the transmission of video and audio is based on ITU H.323 version 2 standard and more particularly on the Annex C of this standard. The application sharing capability during this scenario is based on the ITU T.120 standard. In this scenario we investigate the new capabilities that the native ATM protocols offer to tele-teaching. Figure 1 displays the architecture of the point-to-point tele-teaching scenario over native ATM. During this scenario the video encoding is based on H.261 and H.263 standards and the audio encoding is based on G.711, G.722 and G.728 standards. The quality of the transmitted video is FCIF/QCIF with frame rate 30 fps. The required bandwidth for the implementation of this scenario is 768 kbps.

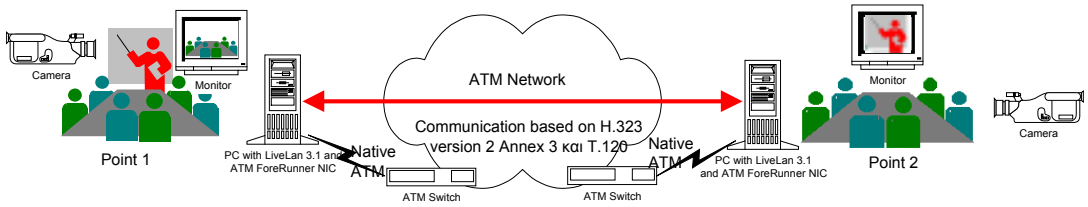

Figure 1 Point to Point Over Native ATM

For the implementation of this scenario each point must have the following equipment:

- Access to ATM network with ForeRunner ATM adapter
- PC with the PictureTel LiveLan 3.1 videoconference tool installed

During this scenario we investigate the capabilities of the native ATM to support tele-teaching.

Point-to-Point with the use of TCP/IP over ATM infrastructure

In this scenario we use tools and technologies that we use on the typical tele-teaching over TCP/IP networks. More particular we use the ITU H.323 standard for the transmission of the audio and video and the ITU T.120 standard for application and data sharing. During this scenario we investigate the capabilities and the benefits of using the ATM network infrastructure for the implementation of tele-teaching scenarios which are applied for a long time over IP networks. In addition, this scenario is easily implemented, because there is not need for special servers like MCU (Multipoint Control Unit). Figure 2 displays the point-to-point tele-teaching scenario with the use of TCP/IP over ATM infrastructure. During this scenario the video encoding is based on H.261 and H.263 standards and the audio encoding is based on G.711, G.722 and G.728 standards. The quality of the transmitted video is FCIF/QCIF with frame rate 30 fps. The required bandwidth for the implementation of this scenario is 400 kbps in each point.

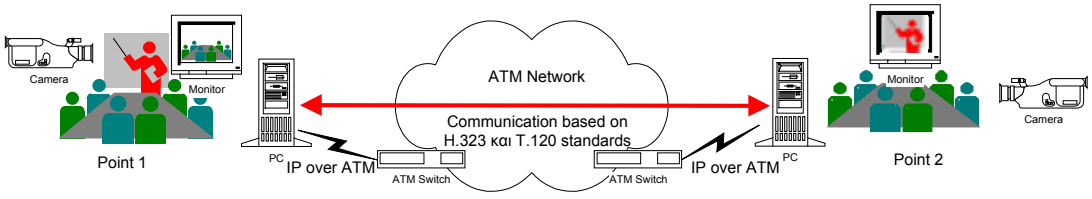

Figure 2 Point to Point with the use of TCP/IP over ATM infrastructure

During this scenario we investigate the capabilities that the ATM infrastructure offers to already implemented solution of tele-teaching over IP networks.

Multipoint with the use of TCP/IP over ATM infrastructure

Figure 3 displays the architecture of the multipoint tele-teaching scenario with the use of TCP/IP over ATM infrastructure. This scenario uses the same standards with the above-described scenario (ITU H.323

and ITU T.120). This scenario differs from the point-to-point scenario because this scenario needs special equipment, a MCU (Multipoint Control Unit) which acts like a reflector. The MCU collects the video and audio of all the participants and transmits to the participants only one video at a time, mostly the video of the professor during tele-teaching. During this scenario the video encoding is based on H.261 and H.263 standards and the audio encoding is based on G.711, G.722 and G.728 standards. The quality of the transmitted video is FCIF/QCIF with frame rate 30 fps. The required bandwidth for the implementation of this scenario is 400 kbps in each point. During this scenario, we have to pay special attention to bandwidth requirements in to MCU connection due to the fact that the required bandwidth to the MCU connection is n*400 kbps, where n the number of the participants to the multipoint lecture. In this scenario we investigate the advantages of using ATM infrastructure for multipoint tele-teaching, where the demand for high bandwidth is crucial (especially to the MCU network connection).

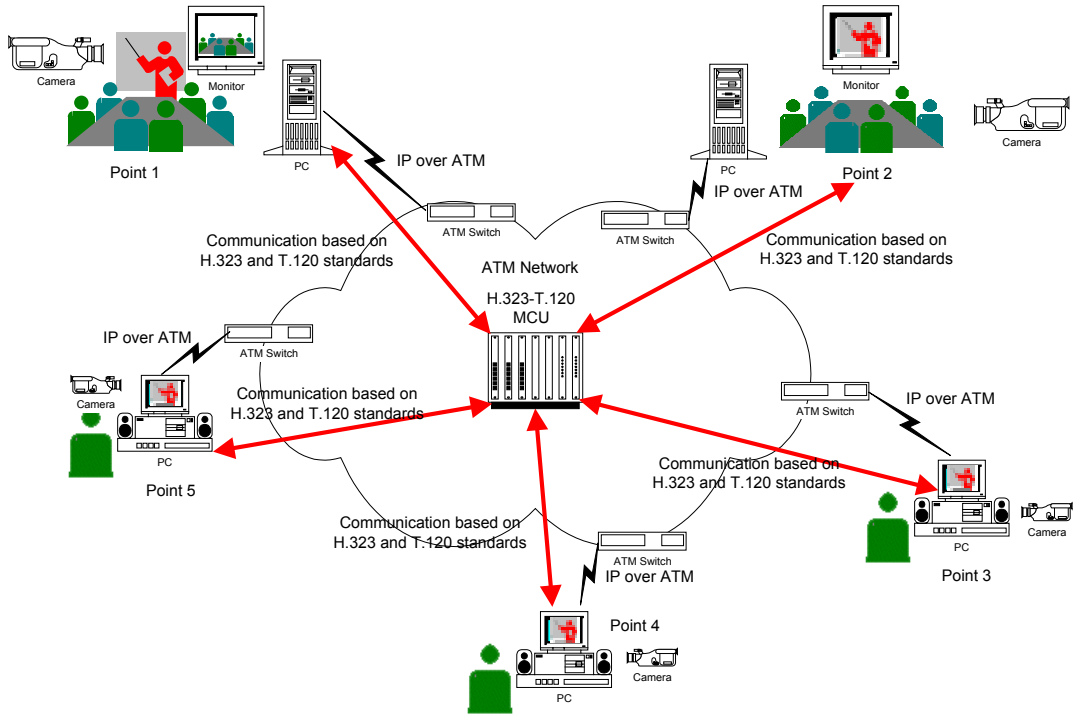

Figure 3 Multipoint with the use of TCP/IP over ATM infrastructure

Conclusion

During each of the above scenarios the appropriate network resources are allocated with the implementation of ATM Virtual Path or Virtual Circuits. During the scenarios we have made various performance measurements and we have drawn conclusions about the use of ATM on tele-teaching. Main conclusion of our experiments is that broadband networks offer many capabilities for high quality tele-teaching and generally speaking high quality Telematic services.

This work is done during the ATMNet project of the Greek "General Secretariat for Research and Technology". The goal of this project is the internetworking of local ATM networks of Greek Universities with the public ATM network and the demonstration of Advance Telematic Services over this network.

Address

Contact Person:	Assistant Professor Ch. Bouras
Contact Address:	CTI, PO BOX 1122, GR 26221 Patras, GREECE (c/o Dr. C. Bouras) - 61 Riga Ferraiou Str. - GR-262 21 Patras, Greece
E-mail:	bouras@cti.gr
Fax:	+30-61-996314
Telephone:	+30-61-960375