

Requirements to Design a Virtual University

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Abstract - This paper presents the requirements and the elements to design a Virtual University. The Virtual University consists in offers the knowledge and capabilities to people incapable of assist the place where is given a certain class through virtual classrooms localized in remote places, with the capacities of allowing to the audience interactive and communicate with the instructor and other students in real time.

Introduction

The ATM net is the capable resource to manage information to high speeds. The necessity of controlling multiple video flow with images of high resolution is interpreted with the requirement of a high bandwidth. An ATM net provides bandwidth about 155Mbps to 2.4Gbps sufficiently to distributing dozens of image of Megabytes in real time. In addition, ATM has the advantage of controlling voice, images, and data simultaneously, independently of protocol used.

We describe the connection of the system talking about of protocols, algorithms, standards and basic devices to use on a net ATM. With the intention of show the importance of the Virtual University, the content of this topic is in a Web Page which permit that any person interested in its development may consult it. The document presents a synthesis of the characteristics of the system and its implementation on ATM net.

Virtual University is an ambitious project that hopes to give teaching and training to distance for students with the use of new technologies. This experience of learning must provide multiple ways that include audio, video, images of high resolution, access to electronic libraries with multimedia information from remote sites and eventually access laboratories and tools. The increasing use of video for distance learning is stimulate by:

- Advances in comprehension of images and voice that reduce the requirements of the bandwidth for a determined quality in audio and video.

- The increasing disposability of B-ISDN (Broadband Integrated Services Digital Network), using technologies of digital telecommunications in switches, access circuits and nets.
- The appearance of standards in service of video / audio that allow the enterprises to develop standards interpretable products.
- The waited efficiency of using video as part of a multimedia conference.

The key of distance education is interactive learning in two ways. Through of distance learning someone can achieve degrees from his home or office. Distance Learning eliminates some of the costs associated with teaching. For example a course could be given in one campus and transmitted to other campus. In the future, the system could be fit in a way that it can reach homes' through cable TV and telephone system. Where fore if it's equipped with a camera and other accessories of transmission, the student can send its image to the instructor.

The medium of distance education can be considered in four basic categories:

- It sends simultaneous audio and video.
- It sends audio.
- Communications based in computers.
- Material distribution [23]

In Virtual University all these categories are essential and later it will be described in detail.

Before entering full to the Virtual University characteristics, is important to know some technical aspects about videoconferences and the popularity that it is gaining each day in educational and Intranet aspects. This way of communication is slowly gaining acceptance inside education field and about the entire corporate field. The interactive videoconferences have a great variety of advantages as applications and archives compartments, document conferences, white board, virtual space of collaborations, so on. That allows a good integration of its participants and share resources. The videoconferences are classified in three types:

- Interactive videoconference point by point.
- Multiple Interactive videoconference.
- Bi-directional video by Internet.

In the first two distant points establish communication with transmission capacities and audio reception and video in bi-directional form, which allows the professor and students of all places see each other and establish an interactive, simultaneous and symmetric communication. This communication to distance represents a closer model to the optimize communication from a classroom due to its flexibility and it does not require expensive productions.

In the second one, in case that connecting various sites simultaneously distant is necessary to have the equipment that can join and separate the signals to the emission will. This equipment is known as bridges or multiple point units and can communicate until 20 points. The communication between different distant sites, to choose the point of origin of the image that it is projected on all the sites can be accomplished by different ways: by level of sound automatically programmed, controlled by the teacher, etc.

Finally in what bi-directional video by Internet is refereed, exist systems for multiple point conferences in real time based on the protocol TCP/IP. To make use of its capacities, communication must make itself in to a reflector site.

Characteristics and Requirements of the System

The goal of the distance education can be defined as: ***"Bind interactively students, instructors and educational content separated by distance or time"***

The instructor is capable of supplying material in the same way that in a traditional classroom. This material consists of images in video, transparencies, acetates, handmade diagrams, etc.

In conclusion: is required that it has the capacity to provide high definition images (1280X1024X24 bits color) to remote scenarios. The communication must allow communication between both sides for instructor parts and assistants. As follows, we show the requirements for the systems and the characteristics that satisfy to this in the table.

The system consist of a session and remotes classroom, these are connected by optic fiber between of ATM Switch. The session classrooms, where the lessons are

given, the students "can" get the presentation of instructor like audio and video of theirs "partners" by distance. The place have an extra room for the control and the conduction of the classes, there are equipment for the net and support for the instructor. The net of work terminals controls the digitalis images.

All the conference is cached by microphones and cameras and distributed in all places. The control software for videoconferences allows close-up, in focus and combinations with images in one monitor for the users.

The next lists show the recommended equipment of every place. The equipment can change according to the available resource.

Session Classroom

- 2 video Screen NTSC 32"
- Digital monitors 27" or LCD projector
- 2 workstations with high capacity in hard disc and RAM
- Mobil camcorder
- Ambient microphone and echo eliminator
- Speakers system

Control Section

- Acetate projector with video interface
- Scanner for image digitalization
- Laser disc reproducer
- Classrooms session monitors and remotes
- Video Control Panel
- Server
- Network equipment
- (Adaptations, codecs, routers, interfaces, etc)

Remotes Classrooms

- Camcorder
- Video monitor of 32" NTSC
- 2 Workstations of high develop and capacity
- Speakers System

Performance ATM Network

The multimedia conference has traffic, a performance and unique requirements. This include the transference of audio, video and other dates in real time with guaranteed efficiency such as communications point to point, point to multipoint, multipoint to point and multipoint to multipoint. The existent networks of transportation like

packets switching and circuits switching do not guaranteed the satisfaction of all multimedia conference requirements. The ATM network has the potential to transport both synchronous traffic like video and voice, and asynchronous traffic like information.

The ATM net use transmission facilities of very high quality like optic fiber and present superior characteristic in one bit error. The LAN can provide:

- Bandwidth higher; much more than FDDI (*Fiber Distributed Data Interface*)
- Low latent state
- Mayor disposability
- Mayor operational limit in a number of stations that can be connected for a simple LAN

The figure shows the ATM configuration for multimedia conference.

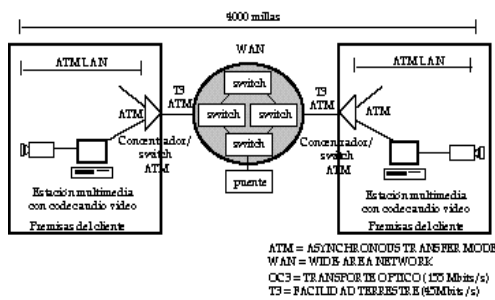


Figure No.1 ATM Configuration

ATM Technology

The Asynchronous Transfer Mode is a technology of communication that uses small cells of fixed size. The ATM is Asynchronous because the cells are transmitted through the net without having to use specific time fragments in package like T1 frame.

These cells are small (53 bytes) comparative to the LAN package of variable length. All kind of information are segmented in field of small blocks of 48 bytes, the rest five bytes correspond to a header used by the net for moving the cells. ATM is a connection-oriented technology in contrast with LAN base protocols, which are connection-oriented less. Connection oriented means the connection to be established between two points with a signaling protocol before any data transfer. Once the connection has been established the ATM cells are self-routed because each cell contains fields that identify the connection of the cell to which they belong.



Figure No. 2 ATM Cell

ATM replaces the medium share with a central switch that dedicates a connection for each user. This topology is analogous to PBX (*Private Branch Exchange*) used for internal called. The transmission of different kind, including video, voice, and data can be mixed in ATM transmission with ranges of 155Mbps a 2.5Gbps.

Exist two interfaces in ATM networks, the UNI (*User-Network Interfaces*) and the NNI (*Network-Network Interface*). The UNI binds the device user to a public or private switch, and the NNI describe the connection between two switches (Figure 3). There are two public interfaces UNI, the firs work to 45Mbps and the another works to 155Mbps.

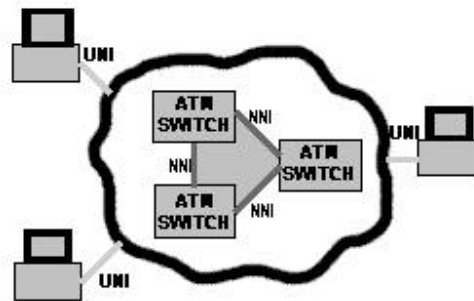


Figure No.3 ATM Network and Interfaces

The using of cells for transmission of data do not means that protocols today do not be used. ATM is totally transparent to the protocol. The switch to "read less binary level" passes the charge of each cell. The net by self, do not check the charge of data for mistakes, and it is leave alone the terminal devised end. (On the fact the only check up mistakes in cells is in the header, were fore the integrity of VCI/VPI are safe).

Design of Virtual University

The WWW is a very powerful tool for distance education. Due to the facility in the change of information with a relative interactivity, the documents are the essential medium for any educative or corporation Intranet. The distribution of this data is very flexible and

very pleasant thanks of the inclusion of graphics in the text and more recently the sound and video.

In spite of the utility of this device, the characteristic of this Virtual University system show on the sheet with the educative propose using different kinds of service for give a very interactively to this site.

The System Connectivity

The system of distance education on ATM consists in different elements. The architecture and the device change little among prototype, but generally the next components are basically used.

- **ATM Switch.** Guide the data flux between sites.
- **Encoder / Decoder.** Digitalis the signal (audio/video)
- **Adaptation Cell.** It transforming the digital signal to transmit on the ATM
- **Multiplexed.** Mixed the different signals in an only wire
- **Control Software.** Used for establish connection and to control sessions.
- **Wiring.** Provide connectivity. Optic fiber and coaxial wire. P

The most important element is the *switch*, the heard of the system. Provide an intelligent connection between different sites. The switches are the principal block in the construction of an ATM net. They work as hubs in which devices and others switches are connected, and are command of direct the information cell to the destine right. As follow is describing how is handled each kind of signal and the function of each device.

Audio and Video

The video images capture by cameras and microphone provide similar signal that most converted into a digital by the encoder/decoder. The codec is connected by an interface DS3 to the adaptor cell for transform the signal to an ATM cell formats.

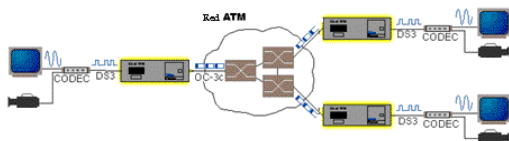


Figure No. 4 ATM net

Other two elements very important in the system are the cell adaptor and multiplex. There exist devices that make up two components or well can be fixed. Before sending any information to the switch is need be changed into a cell of 53 bytes.

The audio and video for being a source of a CBR (constant bite-rate) generating a continuos traffic, they become into cells using the adaptation layer ATM1 (AAL1).



Figure No. 5 Codec

Data

The length variable packets created by formats FDDI (Fiber Distributed Data Interface), Ethernet and others LANs (Local Area Networks) are changed to cells using the layer adaptation ATM5 (AAL5). La AAL5 is very efficiently for the traffic of LAN because of the explosive nature of this traffic that normally is not continuos.



Figure No.6 Data packets

This can be implemented the same way in a network Ethernet if the images and data do not demand a big bandwidth. Finally is required software to control the sessions. Through the software the instructor or the operator established the connection with the others classroom that will participate in the conference. The same software is used to control the video images as it is mentioned in the system description.

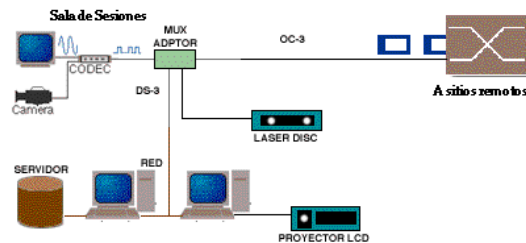


Figure No.7 Full System

Conclusion

In this job the characteristics of the Virtual University were seen using HTML for study the technologies and the algorithm used in the development of a distance education system. There were introduced a group of conditions that must to group the infrastructure that handles the information traffic that involves a multimedia system of conferences.

The emphasis that is made of an Internet in this job pretends to confirm the importance of that the World Wide Web has in the distance education. This can be said that this element is the first one to be in as a part of the Virtual University development. The academic nets are very important to the adductive development. The students have access a huge mount of information because of the "Globalization" made by the net of nets.

The web page realized is an example of how can these ways can be used to supply complementary learning and parallel to the one offered by one discussion forum and multimedia elements each time easier to access any way.

The analysis of the different architectures and connectivity ways to Virtual University seen in this job, led us to the conclusion that a distance education system with base ATM must meet the following characteristics: scalability, multiscaning capacity of the ATM net used, handle of permanents virtual circuits and switched, infrastructure of optic fiber and a complete interaction among students, instructors and didactic material.

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