



## THE UNED ICT ARCHITECTURE FOR “VIRTUAL ATTENDANCE”

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### Summary

*eLearning has become a key part of the way in which higher education is undertaken. Online courses, consisting of essentially textual materials, discussion forums, limited (auto)evaluation, etc., have represented the state of the art in this area for some time. While the UNED has used such “virtual courses” since 2000, in recent years traditional universities in Spain have started to complement their existing educational offer with them. While these universities can be argued to be becoming ever more “virtual” in their educational model, recent technological innovation in the UNED has enabled us to go beyond “virtual courses” to give rise to “virtual attendance”, whereby the transactional distance present in eLearning is greatly reduced by application of specialized ICT which permits the same types of interaction in distance learning context that are possible in traditional face-to-face learning scenarios. This is achieved by the integration of synchronous communication and learning resource generation and management capabilities into our open source educational platform aLF/dotLRN. In this article, the ICT architecture underling virtual attendance, namely the relation of the AVIP tool to aLF, is described together with the way that such virtual attendance can be used to train student competences.*

### Introduction

The UNED is the largest public distance education university in Spain (in existence for more than 30 years) with over 200,000 students, 1400 lecturers and 2000 administrative staff. There are currently over 70 of these study centres distributed throughout Spain and Europe. As well as the lecturers the university also has 6900 tutors work in these study centres. While the UNED has used “virtual courses” as part of its blended learning methodology since 2000, the combination of a drop in student numbers (in Spain in general) together with the intrinsic benefits that eLearning offers, have caused the majority (if not all) of the traditional universities in Spain to complement their existing educational offer with such online courses. While these universities can be argued to be becoming ever more “virtual” in their educational model, recent technological innovation in the UNED has enabled us to go beyond the concept of “virtual courses” (implicit in eLearning) to give rise to a new term: “virtual attendance” (Read, 2008), whereby the transactional distance (Moore, 1973) present in eLearning is greatly reduced by application of specialized ICT which permits the same types of interaction in distance learning context that are possible in traditional face-to-face

learning scenarios. This is achieved by the integration of synchronous communication and learning resource generation and management capabilities into our open source educational platform aLF/dotLRN. In this article, the ICT architecture underling virtual attendance, namely the relation of the AVIP (Audio Video over IP) tool (explained below) to aLF, is described together with the way that such virtual attendance can be used to train student competences (both oral and written) within the European Higher Education Space.

### **Towards Virtual Attendance**

Before undertaking an analysis of the composition of the computational architecture necessary to give life to the concept of virtual attendance, it is necessary to consider why it is indeed essential for online learning. In essence, the answer comes from the way in which people work and learn as members of social groups. This is reflected in learning theories such as Social Constructivism (Vygotsky, 1978), Situated Learning (Lave and Wenger, 1991) and Activity Theory (Bedny and Meister, 1997; Bertelsen and Bodker, 2003). It can be argued that if we are to provide online learning tools then they have to extend what is currently possible in eLearning platforms, essentially asynchronous learning activities. Virtual attendance requires the integration of synchronous and asynchronous tools in an eLearning platform, to enable the appropriate types of communication to be undertaken including the relevant kinds of educational resources, at the right time, in the same way as in face to face education. Furthermore, the notion of the “granularity” of resource manipulation needs to be considered. The mere provision of a simple way (from a desktop PC or portable connected to Internet) to record video and audio, or the presentation of educational material and its inclusion as resources for online learning, is not a sufficiently rich mechanism to warrant the use of the term virtual attendance. This is argued to be the case, since the granularity of integration is too coarse, there is not enough flexibility present in the way in which the different communicative resources can be combined and used. For any effective degree of virtual attendance to be achieved, a fine grained operational granularity is required, where the tools are perfectly integrated, overcoming the standard interoperability problems (Read, et al., 2003).

For several years digital whiteboards and high-quality videoconferencing systems have been used within the UNED. Specifically, in the study centre at Ponferrada, they have been used to enable students at smaller associated centres (in smaller villages nearby) to participate in tutorials being given at the centre without the need to actually attend the centre. In 2006 a new plan was started by the UNED to update the technological infrastructure of its study centres. One of the key projects in this plan was the development of system that would integrate the higher end videoconferencing systems with lower end Web-based conferencing software, making use of digital repositories to provide more flexible access to the materials and sessions recorded by lecturers and tutors. The resulting system, developed by the group INTECCA1 under the direction of CINDETEC, and the Vice-Rectorship of technology for the regional study centres, was called AVIP (Audio / Video over Internet Protocol). This tool has been developed to work at three different functional levels, as described below.

Firstly, the level 1 service: special classrooms are equipped with high-quality videoconferencing systems, large colour plasma televisions (to see/hear the other participants in a video-conference), together with digital whiteboards. These classrooms are interconnected by the use of MCUs (multi channel units). The interactive digital whiteboard (which is connected to a computer) is a very powerful tool because it enables the speaker to combine the functions of a standard whiteboard with those that computer-based multimedia technology can provide, for example, interactive presentations, hypermedia, and any desktop computer program. Since each manufacturer of these digital whiteboards uses different interconnection standards, it is easy to interconnect whiteboards from the same

manufacturer, but difficult to interconnect different whiteboards. Hence, a digital whiteboard server software had to be developed as part of AVIP to enable interoperability between different whiteboards to be possible.

Since its development, AVIP level 1 has been used in many trial teaching scenarios and has been successful in that it enables students to participate in lectures or tutorial sessions without having to attend the regional study centre where the lecture is being given. All that is required, is that the students go to a local associated study centre (for example, in a nearby village) where an AVIP level 1 classroom is available (the AVIP2+ enables students to connect to a level 1 session, from any networked computer, and is described below). The only inconvenient with this system is the cost of installing these classrooms, since video conferencing systems, the colour televisions, and the digital whiteboards are far from cheap. However, a less expensive version of the tool (AVIP level 1+) has been subsequently developed using a professional Web-cam and microphone, and a simpler wall-based whiteboard (instead of the standalone digital whiteboard), and is being systematically installed in other regional study centres.

Secondly, the AVIP level 2 service: consists of recording sessions produced by the AVIP level 1 or 1+ in a digital repository. These recordings increase the flexibility of the tool since students can access them online at any time, and therefore, students who were not able to connect to an initial AVIP session (because they were working, had other classes, etc.), are able to view them at their leisure (as video on demand). It is also possible to export the audio from a recording so that the students can download it (as MP3) onto their computers or onto their handheld devices. While the students who view the recordings are able to learn from what was taught at the time, obviously there is no interactivity, so any questions that arise cannot be dealt with at that moment.

Thirdly and finally, the AVIP level 2+: consists of a web-based conferencing tool built around Flash technology (called Conference online), which enables users to connect together (and to a AVIP level 1/1+ service) from a standard web browser, sharing a simulated desktop environment where presentations can be used as a backdrop for an interactive video class (enabling the speaker to annotate the presentation or add any other details). Since this technology does not require a large bandwidth it is possible to have more than 100 users connected to the system at the same time. Obviously control is required for user participation (the same phenomena is present in face-to-face classroom teaching), to prevent everyone from speaking at the same time. Someone, typically a lecturer or tutor, is defined as the moderator and can talk, control the presentation, and let other members of the group speak. In a similar way to the AVIP level 1 and 1+, the sessions can be recorded for future use. As well as its application for standard distance education taught classes, the AVIP level 2+ is also very useful for a lecturer (or tutor) to record small video fragments illustrating some concept related to a course s/he teaches (where no other users are present in session), which can be recorded and left for student use. For example, lecturers on language courses, where students need to learn how to speak in a foreign language, can record fragments of them speaking in that language, illustrating the concepts the students are currently learning. Another example would be to control or use desktop computer software often included as part of practical work that students have to undertake. Even though the instructions for the use of this kind of software can be included in documents, or given over the phone, a simple recording of the AVIP level 2+, where the lecture actually shows how to start up the software and use it, can be of far greater use to the students. Now that the AVIP system has been presented it is necessary to consider how it has been integrated into the UNED eLearning platform aLF, so that the way in which the recordings of the sessions can be recuperated from within aLF.

The aLF platform is the result of research and development undertaken in the School of Computer Science of the UNED. It has been built over the enterprise information system

dotLRN. As such, it is robust and scalable, and is actively used by more than 90,000 people. Over the last couple of years it has been modified and extended to be prepared for use in the EHEA. As part of this work, the AVIP tool has been integrated into it, in two ways, as will be seen here. Firstly, the AVIP level 2+ tool can be accessed from within a course in aLF (for synchronous communication), should a lecturer or tutor wish to have a virtual meeting with the students, or to prepare a small video fragments (where no other uses are present in the session). Only a lecturer or tutor is able to do this (no students are currently able to reserve sessions). The interface used to reserve a session with the AVIP level 2+ from within aLF, can be seen in figure 1 below. As can be seen in the figure, the basic information needed to define a session is just the name to be given to it, and the students who should be included in the session. While it is possible to assign a password to control access to the session, this is generally unnecessary, since access to a course in aLF, or any other part of the UNED's virtual campus is controlled by a single sign-on authentication process.

Añadir reserva de conferencia ON-LINE

Nombre de la sala <small>(obligatorio)</small>	<input type="text"/>
Descripción de la sala <small>(obligatorio)</small>	<input type="text"/>
Fecha <small>(obligatorio)</small>	Hoy <input type="button" value="v"/> <small>(i) Fecha de la reserva</small>
Hora <small>(obligatorio)</small>	0:00 <input type="button" value="v"/> <small>(i) La duración sera de 120 minutos</small>
Contraseña	<input type="text"/> <small>(i) Dejar en blanco si no se quiere requerir contraseña</small>
Confirmación de contraseña	<input type="text"/>
<input type="button" value="Marcar todos"/> <input type="button" value="Desmarcar todos"/>	
Invitados <small>(obligatorio)</small>	<input checked="" type="checkbox"/> Timothy Martin Read . <input checked="" type="checkbox"/> Rafael Pastor Vargas <small>(i) Máximo 60 invitados</small>
<input type="button" value="OK"/>	

Figure 1. aLF Interface for reserving an AVIP 2+ session

Once a session has been defined, when the day and time arrives, the participants can access the AVIP level 2+ tool, accesing the interface shown in figure 2 below. Here a presentation can be loaded into the tool and the speaker can give a class. If the moderator so decides, the session can be recorded (including the uploaded presentation, the interaction and markup that the speaker makes with regard to it, etc.) and stored in the digital repository for future use. The repository used for this purpose is Fedora, since it enables different physical repositories to be federated together for search and retrieval purposes. The meta data used in the storage process is obtained from the educational context within aLF, i.e., the course information, lecturer, date, etc.

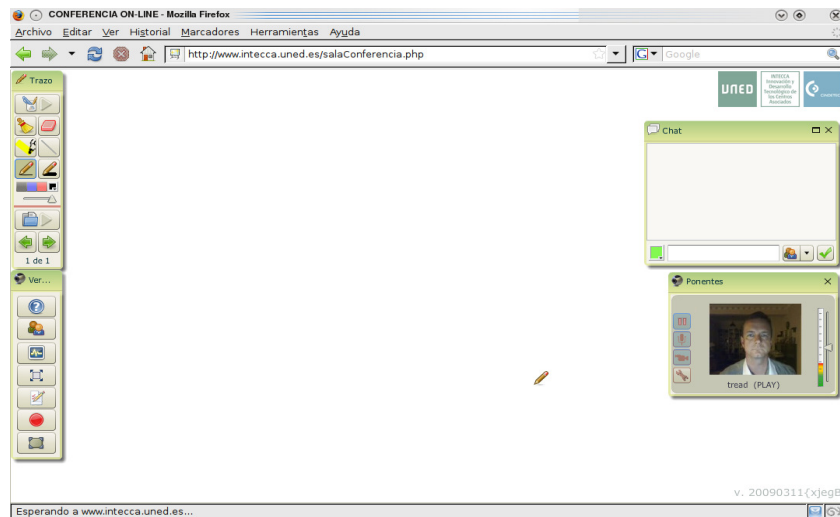


Figure 2. AVIP 2+ (Conferencia Online)

In order for a lecturer or tutor to retrieve and use a recording of an AVIP level 2+ session from within aLF, the following steps must be undertaken: firstly, the Fedora search interface must be used to locate the recording, as can be seen in figure 3 below. Secondly, a link to the recording is included in the document section of aLF (where all uploaded files are kept for a user in the platform).

Figure 3. AVIP 2+ recordings search / recuperation interface in aLF

Thirdly and finally, this link, or reference to the recording session, can be included in any other part of the platform for practical use. For example, within the planning tool shown in figure 4, within a forum, within an activity, within a questionnaire.

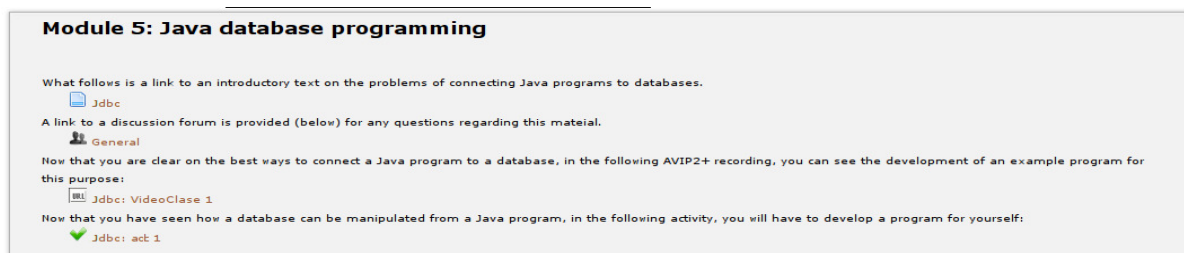


Figure 4. Example use of an AVIP2+ recording from aLF

An example application of these technologies to give rise to what is defined as virtual attendance, could be the recording of an initial AVIP 2+ session to introduce to the students some important concept. Subsequently, it could be referenced from within the planning tool (as per figure 4) to initiate a debate, thereby leading to a collaborative activity, where small groups of students use the AVIP 2+ to make a recording of a collective recitation. Subsequent student evaluation on the part of the lecturer or a tutor can be based upon recordings of the AVIP 2+, participation in foreign, as well as any written form of evaluation.

## Conclusion



Añadir seleccionados al área de documentos				
<input type="checkbox"/>	Título	Autor	Descripción	Objeto
<input type="checkbox"/>	1 Sistemas distribuidos: VideoClase 1	Timothy Martin Read .	Grabación de Conferencia ONLINE: SD__VideoClase1	
<input type="checkbox"/>	2 Tim Demo 1	Timothy Martin Read .	Grabación de Conferencia ONLINE: Demo1	
<input type="checkbox"/>	3 Demo	Timothy Martin Read .	Grabación de Conferencia ONLINE: DemoTT	

Añadir seleccionados al área de documentos

This article has presented the technological infrastructure underlying the concept of Virtual Attendance, highlighting the way in which a fine level of functional granularity can be obtained by blurring the limits between synchronous and asynchronous communication and material manipulation, to provide distance students in the UNED with a “didactic experience” similar, if not superior, to that on offer in traditional universities.

Future work that will be undertaken in this area is oriented toward increasing the flexibility present in the way in which these tools can be used. Firstly, the individual access to the AVIP level 2+ tool by students needs to be improved, so that they may access it without having been previously invited to participate in a session by a lecturer or tutor. This will be particularly useful for the generation of student recordings and it is envisaged that the Web 2.0 philosophy will apply here, giving rise to a large number of recordings. While many will be irrelevant to teaching activities, some (for examples, summaries given by students of their own lecturing notes, language students practicing their oral production, etc.) will provide very useful education resources. Secondly, the way in which digital rights management of these recordings is undertaken needs to be improved. Currently, unless otherwise stated by the moderating lecturer or tutor, all recordings are only available to the lecturer or tutor for use within courses.

Thirdly, as the number of AVIP sessions within the Fedora repository increases, it becomes increasingly harder for users to access them with simple search techniques. Hence, automatic semantic indexing techniques are being applied to provide a more flexible way to access the recordings. Fourthly and finally, work is being undertaken to explore the way in which the recordings can be packaged together with other materials, enabling them to be used in different courses and different eLearning platforms.

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