

## Innovation by Using a Virtual College™

Ole E. M. Borch, Peter Sjøby Nielsen<sup>1</sup>,  
Department of Control Engineering, Aalborg University, Denmark,  
L.M.Ericsson A/S, Denmark<sup>1</sup>  
[borch@control.auc.dk](mailto:borch@control.auc.dk), [peter.s.Nielsen@ericsson.dk](mailto:peter.s.Nielsen@ericsson.dk)

### Abstract

*The rapidly growing demand for flexible competence development is forcing educational institutions to expand in remote teaching and learning in terms of technology and pedagogic. Flexibility in time and space means distribution of material and facilities, but at the same time optimise nearness. This article presents how simple equipment was used and how the pedagogical model is implemented in the innovation process. The way slides, sound, video and whiteboard were used in a virtual college as well as performing the exam is described. The methods were used in the course: "Object Oriented Programming with Java" and the course method had a very fine evaluation. The activity also discovered many things to be improved.*

### 1. Introduction

Flexible learning in time and space is an increasing demand from employed people, who are deeply involved in projects in the firm and where time slots in the time manager has priority over personal competence development time slots. However firms have an increasing focus on constantly knowledge development for their personnel, but are also concerned in building up competences in general in the surrounding society to have a greater possibility for recruiting people able faster to match the demands for competent people.

To meet the demands, universities and other educational institutions must spend more time and effort in developing methods for teaching in face2interface situations. Asynchronous and synchronous multimedia teaching technology and pedagogy has to be adapted by teachers since the face2face teaching methods is less applicable in remote teaching and the teacher's freedom in the pedagogical methods is less accepted.

### 2. The basic idea

It is a demand, that the participant is able to use the daily work computer platform to take courses both on-line and off-line. It should also be possible to mirror the environment to home computer for self studying and

training. By using the desktop computer in the workbench rather than going to a special conference room is important in the learning session. If some topics in the running on-line multimedia course is of no interest, the participant can simply work in another window frame on the computer and return to the course when interesting topics turns up in the headset. The participant should be able to join the course session when relevant and pick up topics when needed. Sometimes the participant is not able to join a course session, and therefore every session should be recorded for later replay from the web or a CD. A session recording is a real-time logging of what happened in the virtual space when the course was given. That is slides, teacher words, whiteboard, comments from the participants etc.

The course itself must be planned very carefully in terms of goal and contents. Also it must be modularised to support topic driven attendance based on the users background and interests, and the modules could be organized as learning objects in a database from where other courses could benefit. This is very useful in another situation, namely 'competence on demand' where an employed has the possibility to fetch a learning object 'right here' when needed in a working situation.

Multimedia aspects such as sound are the most important instance, since it is a great improvement in nearness in distance teaching and learning. Often echo and delay is a great problem. Echo and delay are NOT acceptable, since simultaneously talk is important during course session and the greater the delay the less the conservation. Pictures of participants are not that important in live version, but a still picture on the screen when conservation is taken place is a social advantage. An automatic picture highlight or similarities would be preferable when the person speaks up. Performing the exam must be possible on individual basis and there should be no need for gathering the participants physically on seminars, however, it is an advantage if the participants in one way or another has obtained some sort of social relations from the group before joining the first course session.

### 3. Virtuality

### 3.1. The College

The software virtual framework was originally designed and implemented by the Delta[3] firm in an EU project. The College is a number of rooms in space where the participants can go to at any time.

Every person can see where the other participants are located. This is useful for the teacher for calling people before a classroom session continues.



Figure 1. Virtual College navigation map [3]

The *hall*-info-board [Figure 1] is where course information and schedules are broadcasted. The *classroom* is where the teaching takes place: interactive talking, drawing on the whiteboard and turning slides. The *grouproom* is where problems are going to be solved in groups or on individual basis. Problems are available on tables. The *study* is meant for asynchronous study. A student can come here and look at session slides, play the scene recorded from previous classroom sessions, visit links to on-line references, information about literature etc. The *tearoom* is for fun and relaxing like playing games. The *office* is for person-to-person communication like performing exams.

### 3.2. Sound, picture and recording

Sound is the most important facility in multimedia remote education. To listen and talk is a great improvement in nearness and turn-around time compared with the written version called chat, which requires a great deal of planning and discipline before more than 2 persons can start chatting.

The **RAT** (Robust Audio Tool) [Figure 2-right] used is an audio program from University College London,

Computer Science Department based on multicasting, which is very powerful and user-friendly and requires only a sound interface PC card and a cheap headset. When a participant is starting the RAT application the name is shown for all the other users of a RAT application associated with the same IP-address and port, and when one is talking the name is highlighting. It is important to tune the technical system not to have echoes and only minimum of delay. The mute facility is enabled when participants are not using the microphone, and the RAT also has a threshold to filter background noise.



Figure 2. To the right: 15 participants have started the RAT application on the same IP multicast address and the same port. Left: A zoom-in VIC image of the teacher.

The **VIC** (Video Conference Tool) [Figure 3] used is a video program also from University College London, Computer Science Department, also used in a multicasting environment.

A web cam is connected to the computer, and the application is started on a defined multicast IP and port number. The picture frame is showing all other users who have started a VIC application. VIC may take a lot of bandwidth so the benefit of using VIC must be considered carefully in relation to picture quality.

The teacher sound and cameras are real-time recorded on a special purpose recorder. After a teaching session the recording is merged with the session slides and stored on the web server and on a CD. Course participants who could not join that specific session are therefore able to play the session before the next live session. The zoom facility [Figure 2-left] is used when a conversation takes place or the teacher is using the whiteboard.



**Figure 3.** 9 participants and the teacher have started the VIC application on the same IP multicast address and the same port.

#### 4. Session method

Course description and tools requirement and installation are submitted to the assigned participants. Short minutes before a session they start the RAT and VIC, and the teacher welcome each student when they show up on the RAT and thereby tune the sound. The VIC is mainly used to signal that the group is collected and participants are joining the session. When the teacher finds that most of the group is in the classroom, a start message is given in the microphone, and the first slide is presented. Consequently the multicast slide turns up on the participant's screen. Every slide turn is accompanied with a message in the headset because that message is recorded and is an indication to the player of the recorder to turn the slide.

When the whiteboard is needed, the teacher clearly express that before using it, because the participants must change focus to the image of the whiteboard on the VIC and perhaps make a zoom of the image. Returning to the 'slide show' is also announced because of the recording system, so the user playing the system has the possibility to synchronize the slide turning.

When a topic has been taught, the teacher tells the participants to go to the group room for solving problems. Before sending them off, an introduction to a problem is presented on the whiteboard. In the group room the participants finds the problem text and hints on the table. Sometimes a solution is also stored in the group room, so participants who don't want to solve the problem at least can have a look and learn in that way. The time reserved for solving problems is announced, and when expired, the

teacher asks the participants to return to the group room, and the slideshow is continued.

During the session interactive sound is used, both in the classroom and during problem solving. A camera is showing the teacher all the time and another is showing the whiteboard.

At session end a 'good-by' is broadcasted accompanied with request on reflection on the present session.

#### 5. Examination

In the normal sessions, the teacher is multicasting sound, whiteboard drawings and slides. When it comes to exam, a method is to be found to secure a reasonable and reliable way not to cheat the teacher. The level of security depends very much of the target group. If it is an examine getting a grade and even a degree, a high level of control must be used. In the case of competence development for people in a firm it is not that important. Passed or not is often sufficient. On the other hand it should be rather difficult to cheat since the participant should feel that the test is real.

Before the exam, a problem to be solved was presented to the participant for individual solving. All solutions were submitted by email to the teacher. The solutions were stored on the web but not visible. A timescale for the examination was made, and published. At the exam-session the person was called by phone and a point-to-point sound channel was established and the web solution for that person was opened. Based on that web material, questions were put out stressing for answer. That means, that if an answer was not immediate given, the next question was put out. The result is given after the last answer, and the web and multimedia channel is closed. It is recommended, that a live image of the participant be used during the exam, feeling closer contact. A point-to-point image is not needed, so the VIC multicast image environment is kept unchanged.

Exam-questions must reflect crucial topics from the course, since the participants are on the course for learning and not to be caught by the teacher!

#### 6. Results

##### 6.1. Sessions

The **whiteboard** used was a traditional one, where the teacher made drawings and two cameras where focused on teacher and whiteboard. This is a pedagogical advantage since it brings life into the environment and focus on the participant screen is changing.

As the **image** of the participants was not very much used but a social factor, so to save bandwidth, the

frame/sec (fps) was set to round one. On the other hand, a low-resolution live image was a fine attendance indicator. The image of the whiteboard was set to 15 fps, highest quality and 2000 kbps. The second camera on the teacher when turning the slides had the same settings as for the whiteboard camera.

The **sound** was hard to install and tune due to delay problems. The delay was round half a second and reasonable. Fortunately the participants could hear the delay, and therefore waited to give a listener the chance for sending a reply.

The **'slideshow'** was well functioning by using point2point connections to spread the slides –pseudo-multicast.

The **recording** system was very useful, but only the sound, slides and the two teacher cameras were recorded. The next is to improve the recorder so recording from the backbone is possible, so everything from the session can be stored including conversation, slides and images from all participants.

The IT initiative group at Aalborg University (ITI) gave some pedagogical advisory and made session observations.

## 6.2. The Exam

The exam was carried out according to the description earlier in this paper, and the participants were very pleased with the organisation and contents. The nearness between the teacher and the participant was close and the feeling of 'just us' was recognized during the exam point2point communication. Also the introduction social talk before the exam was useful.

## 7. Conclusion

The system described was successfully used in a course "Object Oriented Programming with Java" given to 17 employed persons at two sites at Ericsson Denmark from Aalborg University Denmark. Next step is to improve the system so every node on the network can be either a student or a teacher specialisation. This means, that demands to the equipment must be low price and easy to handle. A teacher should be able to take any node anywhere and start a course. Headset, web-cam, slides and associate software is no problem since it is cheap and common used on daily PC's, but using whiteboard and electronic whiteboard is a problem to be solved in the sense of dynamic teacher node. A software whiteboard is available and can be used, but using the 'real' whiteboard with a camera focusing on both the whiteboard and the teacher is of major pedagogical quality. A compromise for the use of whiteboard is to be found since the

electronic whiteboard has a better reading performance and is capable to be a shared media.

The recording system is not simple and is not cheap, so letting every node being a potential recorder facility is not realistic but instead it could be localized in one site and managed via a web interface. The present recorder for the moment must be located at the teacher node, since cameras and microphone is physical connection to the recorder.

The overall target for improvement of the system is shown in the following prioritised list:

1. Remove delay in the sound system
2. A backbone recording facility of all activities in a session should be possible, and the recorder should have a web interface
3. Improvement in the college navigation system
4. Consider the use of low cost whiteboard on any node
5. Only participants in one room can hear and see each other and not people outside the room. The teacher must have a 'call all' facility. The RAT and VIC applications should be integrated in the virtual college not being standalone applications.

The philosophy in the Delta [3]system is fine, but should be improved on the following important areas:

1. Animated slides and mouse should be possible to export to participants
2. A web interface for the teacher to insert course material and manage the virtual College must exist to attract teachers not familiar with file systems and teaching tools.
3. The file structure should be changed clearly to manage infinite number of courses.
4. The window sizing problem must be solved

The delta system is a very fine platform programmed in java language and using applet technology.

The participants were very satisfied and pleased with the way the course was performed.

### 7.1. 3G – third generation market perspectives

Mobility will add a considerable dimension to Ericsson Virtual College™. A reasonable bandwidth for the network is needed to use video as an attractive facility. With a 3G mobile access, the concept will be much more powerful in terms of complete independency of location.

Ericsson Virtual College™ has the opportunities to be a major driver for 3G services – a killer application in M-learning!

## 8. Acknowledgement

Please bring your signed copyright release form that will be available on the Submission of Full Paper, the following homepage, to the conference site.

Thanks to Anette Lorentzen, Mia Bæk and Helle Bækkelund Jensen in the ITI[5] group for advises and support on the pedagogical side. Also thanks to Brian Kirkegaard at ITI for technical assistance setting up equipment and connections. Many thanks to personnel at Ericsson in Aalborg, Denmark, for being patient when blocking a meeting room for course studio, and asking for 'this and that'. Great thanks to the participants for not just joining the course, but also acting as test persons in technology and pedagogic as well as spending their time in public relation activity.

## 9. Links and References

- [1] AalborgUniversity,ControlsDepartment,MMTL group  
<http://www.control.auc.dk/MMTL/>
- [2] L.M.Ericsson,Denmark  
[www.ericsson.dk](http://www.ericsson.dk)
- [3] DELTA: software for the virtual class room  
[www.delta.dk](http://www.delta.dk)
- [4] Mbone Conferencing Applications: VIC and RAT  
<http://www-mice.cs.ucl.ac.uk/multimedia/software/>
- [5] ITI: pedagogical advices (In Danish)  
[www.iti.auc.dk](http://www.iti.auc.dk)
- [6] Evaluation report (In Danish not public)
- [7] TM is Trade Mark by Ericsson