

# BCBU+ Handbook

*A Guide to Establish  
Virtual Cross-Border Campus  
for BCBU Network*



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2011 - 2013 (BCBU+) Handbook Editorial Board

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# **BCBU+ HANDBOOK**

**A Guide to Establish Virtual Cross-Border Campus for BCBU Network**

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# 1 INTRODUCTION TO THE HANDBOOK

The purpose of the Handbook is to describe the potential technologies and tools that can be used to setup a Virtual Campus, and it also offers an actual use case scenario on the Virtual Campus developed for Kolarctic ENPI CBC BCBU+ project partner Universities. The handbook is targeted to teachers, administrative and IT support personnel in educational institutions and also for all other interested groups.

This handbook gives guidelines on developing distance education, Cross-Border Virtual Educational Collaboration, and also it contains narrative articles of experiences in distance learning, pedagogy, administrative practices and academic approaches used.

The handbook consists of five chapters;

1. Introduction
2. Selecting a Web Conferencing System
3. Selecting a Learning Management System
4. Building the BCBU+ Virtual Campus, and
5. Distance Learning Use and Experience - Selected Examples from BCBU+ Project.

Chapter one briefly describes the purpose of the handbook and the background of the BCBU+ project. Chapters two and three describe some of the Web Conferencing systems and Learning Management Systems available today, and discuss how an organization can select solutions that best suit their needs. Chapter four offers concrete examples on how the BCBU+ Virtual Campus was implemented, and finally chapter five offers articles about distance learning experiences of different project partners.

## **BACKGROUND OF THE PROJECT**

The Barents Cross Border University Development Project 2011 - 2013 (BCBU+) originated from the long term co-operation between partners of Barents Cross

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Border University Network (BCBU). The Network was founded in 2006 by Universities from Northern Finland and Northwest Russia. The co-operation has a starting point in mutual interests of the partner universities as well as in principles and aims of partnership programs and the EU Northern Dimension Policy. The BCBU+ project is a concrete action of the BCBU network to further develop the collaboration between educational institutions in the Barents region.

The BCBU+ project has 10 partner universities:

- Six universities from Northwest Russia: Northern State Medical University (NSMU), Northern (Arctic) Federal University (NArFU), Petrozavodsk State University (PetrSU), Karelian State Pedagogical Academy (KSPA), Murmansk State Technical University (MSTU) and Murmansk State Humanities University (MSHU),
- Two universities from Finland, University of Oulu (UOulu) and University of Lapland (ULapland);
- One university from Norway: Narvik University College (NUC)
- One university from Sweden: Luleå University of Technology (LTU).

The funding for the project comes from the EU Kolarctic ENPI CBC programme for the 29 months of implementation period. The project started on 18.4.2011 and it lasts until 17.9.2013. The project falls within first priority of the Kolarctic ENPI CBC programme that deals with Economic and Social development.

The project aims to improve higher education in the Barents region by developing jointly international multidisciplinary Master's programs of BCBU in the four fields; Comparative Social Work (CSW), Software, Systems and Services Development in the Global Environment (GS<sup>3</sup>D), Circumpolar Health and Wellbeing (MCH), and Environmental Engineering (BEE). The two-year study programmes are in the central fields of the EU Northern Dimension priorities and follow the principles of the Bologna process.

The overall objective of the project is to contribute to the development of the Barents region by promoting Cross-Border academic cooperation, to train highly skilled,

technologically literate workforce for the knowledge-based economies of the region. The project was planned to address this by implementing cost effective measures to further develop and integrate MSc programs to regular activities of BCBU partner universities aimed at meeting the labour markets need in the program area, by developing models of best practices for implementation and cooperation of MSc programs. In addition the project works to strengthen and institutionalise a Cross-Border Campus for implementing the MSc and later the PhD degree education.

One of the key goals of BCBU+ project was to give educational institutions opportunities to strengthen cross border relations and strengthen the existing network by establishing a common E-Learning and Web Conferencing platform, developing the Virtual Campus.

The first step was to equip each Russian partner university, one room with sufficient infrastructure for multipoint online meetings, web conferences and teaching activities. The partner institutions were linked together with common web conferencing and learning managements systems to start and enhance cooperation virtually over Internet.

The experiences from the testing, evaluation and training process while building the BCBU+ Virtual Campus resulted in the writing of this handbook.

### **THE HANDBOOK EDITORIAL BOARD**

The outline of the handbook was discussed in Rovaniemi at the first BCBU+ steering and working group meeting in June 2011. Since then, partners have worked together with the structure for the content of the handbook and have shared the responsibility for writing.

Later in October 2012, the project established the Handbook Editorial Board to keep the handbook writing and editing process up to date. The board consists of teaching and administrative personnel from the partner Universities.

The Board members are from five partner universities:

- LTU: Svante Edzen, Lars Furberg and Heidi Hartikainen;
- NUC: Knut Collin and Arild Steen;

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- ULapland: Mohammed Dawued Mohammed and Tarja Orjasniemi;
- UOulu: Kari Pankkonen
- NArFU: Evgeny Khaymin.

The board has worked together with project members by using the online meeting facilities established by the project. Weekly status updates and biweekly editorial board meetings were hosted in Adobe Connect virtual room, and one editorial board workshop was held in Luleå to work on the Handbook text development.

On behalf of the project, the board would like to express gratitude to EU Kolarctic ENPI CBC governing body Joint Managing Authority Rovaniemi Branch for their support throughout the project. The Editorial board is grateful for the Russian partners who submitted their articles for chapter five, LTU for hosting handbook Luleå workshop and ULapland for giving support in the process.

The Editorial board believes this Handbook will be useful for all those who are interested in distance learning, to implement Web-Conferencing system and other related Cross-Border Virtual collaboration.

**Dear Reader, Welcome!**



## 2 SELECTING A WEB CONFERENCING SYSTEM

*This chapter briefly discusses the difference between Video Conferencing and Web Conferencing, and their suitability for distance education. The chapter also offers examples and user experiences from different Web commercial and non-commercial Web Conferencing options available today, more detailed information about technical requirements, pricing, and problematic issues are included in Appendix I.*

*Further, it also discusses how different organizations can find a Web Conferencing system that fits their needs by comparing functionalities, pricing, and technical requirements together with experts in each area from their own organization.*

### 2.1 Video Conferencing vs. Web Conferencing

In a video conference cameras are used to enable participants in a Virtual conference to see the presenter and maybe also other participants. Because there are requirements for dedicated camera, audio and networking equipment, it is usual to have rooms set up only for Video Conferencing [9].

Video Conferencing requires high bandwidth, and the equipment and bandwidth required to hold near broadcast quality video conferences still places barriers to entry quite high. Recently low cost services aimed at small business have become popular. Based on webcams as opposed to more sophisticated and expensive cameras the picture quality and size are limited but adequate to see who you are talking to. The audio can be carried over phone lines or VoIP can be used [9].

Web Conferencing is a set up where a presenter delivers a presentation over the internet to participants scattered all over the world. In the most basic form, the presentation is not interactive; meaning that participants can see what is going on in their screens but can only follow up the presentation. The advanced systems allow

the presenters to share different applications or their computer desktop with other participants [9].

Web Conferencing systems vary quite much in cost, complexity and functionality. At one extreme, some systems can cost thousands per month, require large software packages to be installed and rely upon having specific firewall configurations and high bandwidth internet. On the other extreme there are also many free services available but they tend to only support a limited number of participants and lack in features. They are also often unsupported and not suitable for business use [9].

While Video Conferencing is usually carried out via dedicated Conferencing rooms and is popular with business clients - Web Conferencing options are more suitable for distance education as they enable the participants to connect to the lecture from where ever they please, simply through their browser or by installing client software into their computers. All what is needed for the participants is that they have a computer, a headset with a microphone and internet access – no expensive equipment needs to be purchased.

## 2.2 Examples of Web Conferencing Systems

This section briefly introduces some of the Web Conferencing tools available in 2011-2013, their basic user features and some user experiences. For a more detailed summary of each technology including hardware and system requirements, problematic issues and pricing see Appendix I. The Web Conferencing tools included in this chapter are Skype, iLinc, Adobe Connect, Vidy Personal Telepresence, Microsoft Lync and Sonicfoundry Mediasite.

### 2.2.1 Skype

Skype is VoiP (Voice over internet Protocol) software that allows users to make voice and video calls over the Internet. Skype is a Peer-to-Peer P2P system meaning that it makes use of background processing on computers running their software. To use Skype, the user only needs a computer with an Internet connection, a headset, and a webcam [8].

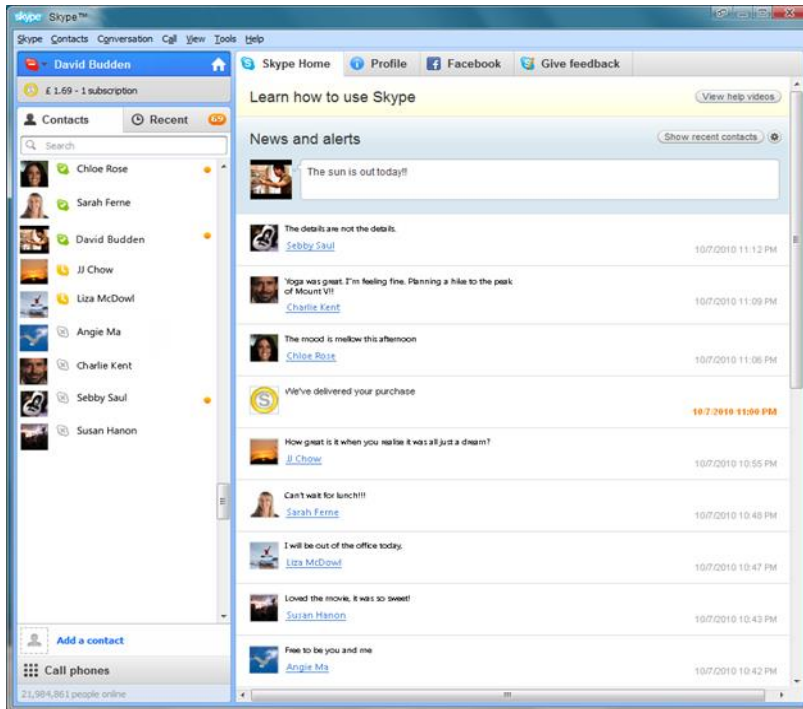


Fig 2.1 Skype home tab [12]

The P2P system that supports Skype communications is able to route calls through the most effective path possible. Skype keeps multiple connection paths open and chooses the one best suited at the time. This has effect of reducing latency and increasing call quality throughout the network [10]. Skype calls are encrypted, to protect customer privacy. The same is true for shared files, chats, and video. For more detailed information, see the Skype security centre [11].

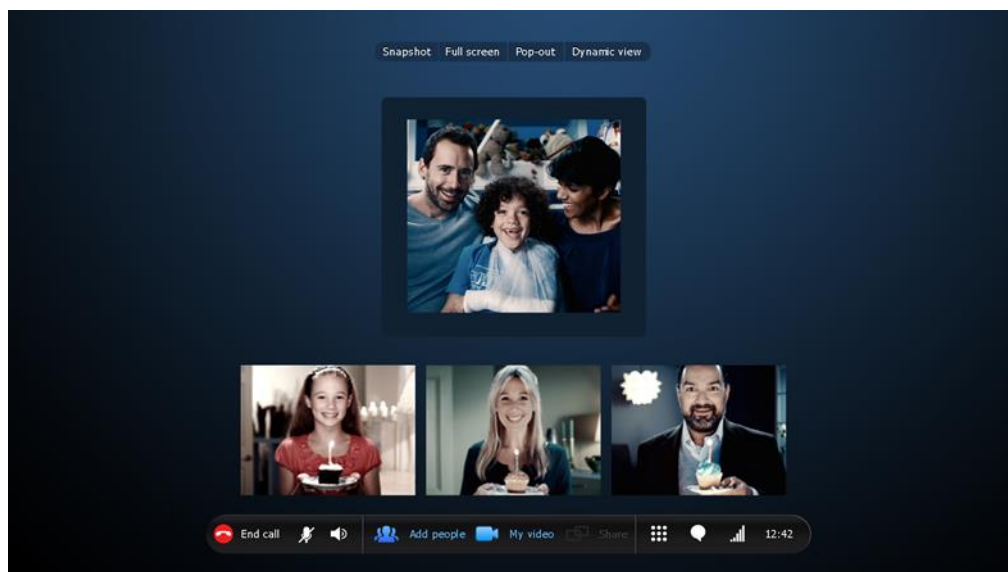


Fig 2.2 Skype 5.0 Group video calling full screen [14]

Skype has recently launched a new online platform that specifically caters to the education sector [19]. Skype in the classroom brings together a community of people and information to save teachers time and help them make the most of Skype and the international teaching community [12]. It seems however that this platform is mostly targeted at teachers in the comprehensive schools, for example language teachers connecting students with native language speakers.

### 2.2.1.1 Features

The following list of features was obtained from the Skype website [13]

Table 2.1 Features of Skype

<b>Audio</b>	Skype to Skype calls, conference calls, online numbers, Skype to go number (credit or subscription), call forwarding, call transfer, voicemail, caller ID
<b>Video</b>	Skype to Skype video calls, group video calling, screen sharing
<b>Messaging</b>	Send instant messages, send files, send SMS, Facebook integration
<b>Managing</b>	Skype Manager allows you to manage Skype in your business; create accounts, allocate credit and assign features.
<b>Integration</b>	Skype connect allows you to integrate Skype with your existing phone system. Currently the service is available only in US.

### 2.2.1.2 User Experiences

*I have had Skype installed on both my personal computer and work computer since it was launched, and I find it a handy tool both when keeping in touch with friends and colleagues. Especially when working on different projects with multiple universities involved it is a great way to make calls point-to-point or with a few participants.*

*I have also used Skype in teaching to tutor students that need one-on one attention, but I would not recommend it for holding actual classes – as it was noted in the features section, the program does not have an inbuilt white boarding or call recording functions, and you can only see video if there are very*

*few participants – I think that these are the functionalities that really hinder its usefulness in classroom situations.*

- Heidi Hartikainen

*Due to the availability and price Skype has been my number one choice for the last five years. I have used Skype for personal and educational purposes. The main reason is that it is free to download, quite simple to install, adjusting the audio and video setting is relatively easier than other tools I encountered. In addition, the interface is easier to understand for new users. Calling by phone to friends and relatives living in other countries is costly, but Skype has been a zero-cost communication for people who have computer and internet connection.*

*Other than normal chatting, audio and video services, at times I have also used the screen sharing functionality of Skype to discuss educational and work issues with my friends and colleagues. This service makes one-to-one discussion very interactive.*

- Mohammed Dawued Mohammed

*Skype is widely used at UOulu in point to point contacts, interviews and meetings for teaching and research personal. More often it is good alternative for phone calls. It works well enough on even relatively low bandwidth in Internet access.*

- Kari Pankkonen

### 2.2.2 iLinc for Learning

iLinc for learning is a Virtual learning environment that enables real-time teaching and learning through the internet [2]. The student can participate in the seminar from their own home computer through a Web browser after they have installed a client program into their computer. The iLinc —Virtual Classroom” lets students participate in a multi-point audio conference with the teacher and other students and the teacher can hand out files to the group [2].

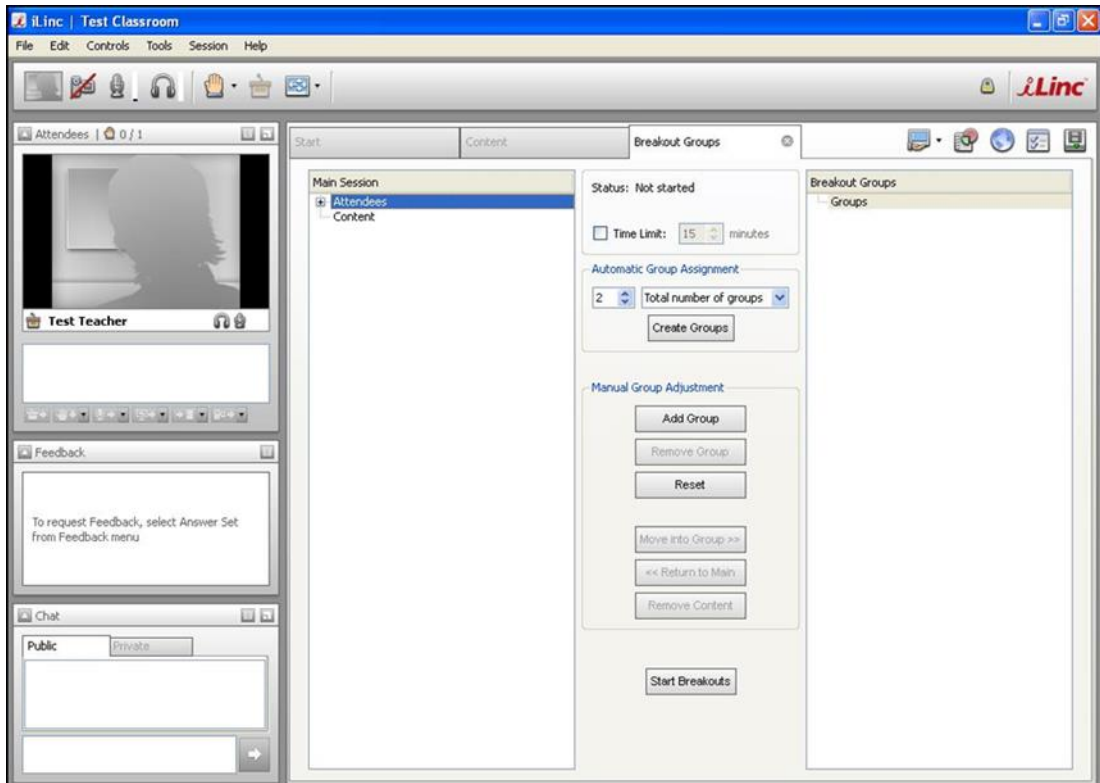


Fig 2.3 iLinc breakout groups

iLinc also provides such interactive tools as shared Web browsing, shared applications, PowerPoint slide viewing, shared whiteboards, and live text chat. The seminars can also be recorded so that the students can listen to them later on [3].

### 2.2.2.1 Features

The following list of features obtained from the iLinc website [4]

Table 2.2 Features of iLinc

<b>No of attendees</b>	per Named User (default): 50
<b>Audio</b>	Internet Audio (VoIP), Integrated Audio with Free & Toll Free Conferencing,
<b>Video</b>	Video for Floor Holder, Video for Participants (Unlimited Multi-Person)
<b>Messaging</b>	Public Chat, Private Chat, Closed Captioning
<b>User features (moderator and attendee)</b>	Upload Photographs, Desktop, Application & Region Sharing, Interactive Whiteboard, breakout groups, Session Recording & Editing Tools, Leader-Synchronized Web Browsing, Transfer Files to and from Participants, Auto-Reconnect Users with Poor Bandwidth, Gather Feedback via Instant Answer Sets, Real-Time,

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	Customizable Polling, Streaming Audio/Video (YouTube, Flash, etc.), In-Session Survey Tool, Live Streaming Video, Test Tool (In-Session or Stand-Alone), Use "Glimpse" to Peek at Students' Desktop, Breakout Groups etc.
<b>Setup functions</b>	Custom Site & Unique URL, Site Brand with Logo & Select Colors, Session Start Page Branding (logo), Event Registration Page Branding, iLinc for Meetings
<b>Administrative functions</b>	Personal Reporting, 128-bit AES Encryption over SSL, Robust Administrator-Level Reporting, Fully Customizable Session Settings, Content Management Capabilities, Public-Facing Activity Launch Portal, Customizable Invitation/Reminder E-Mails, Web Event Registration Tools, Online Course Catalogue
<b>Integrations</b>	Integration with Microsoft Outlook, Option to Add iLinc for Salesforce Integration, Option to Add iLinc LMS Integrations

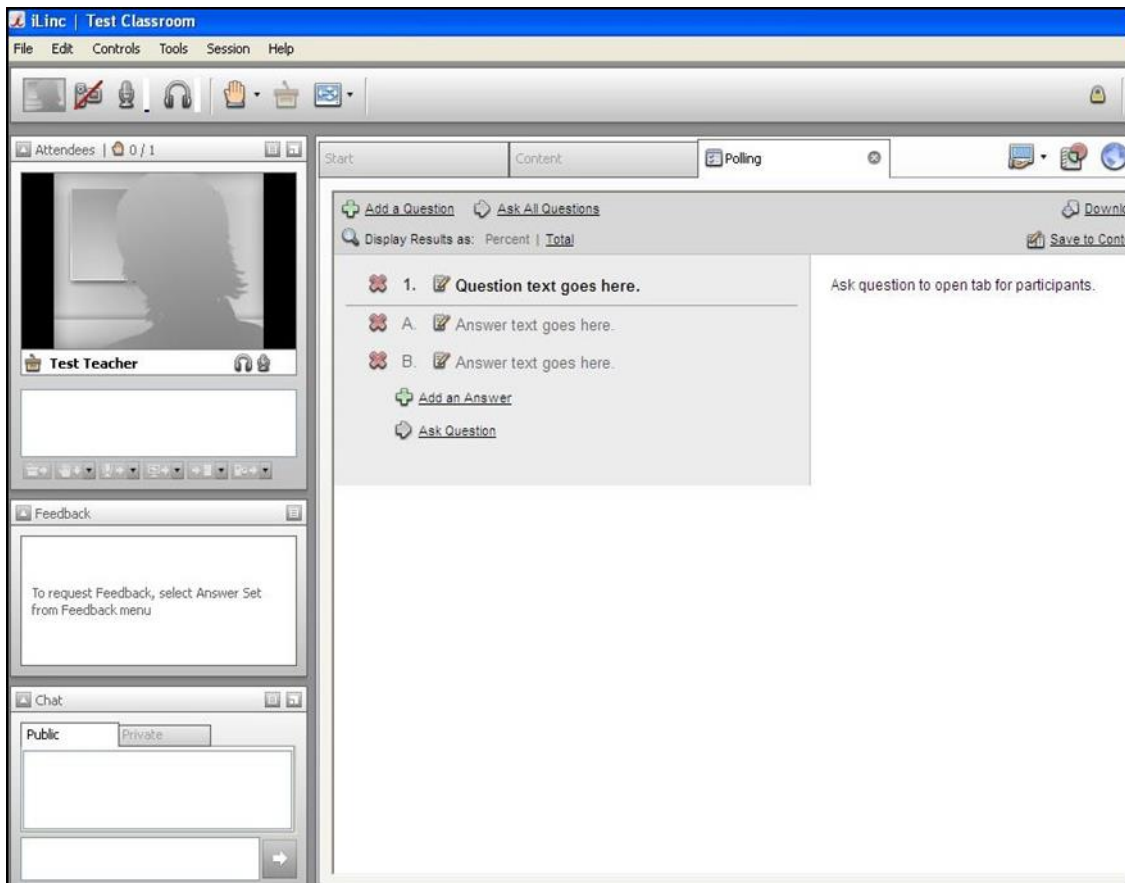


Fig 2.4 iLinc Polling feature

### 2.2.2.2 User Experiences

*I have only come into contact with iLinc during the testing phase of this project, when we were kindly offered a testing room from Kemi-Tornio University of Applied Sciences to test out the functionality of the program. I was very pleasantly surprised at how handy a tool it was – All of the functionalities for the teacher were easily found and easy to use and the content easy to manage. I would definitely recommend this as one option to consider when thinking about applying a Virtual learning environment.*

- Heidi Hartikainen

### 2.2.3 Adobe Connect

Adobe Connect is a Web Conferencing platform used for meetings, E-Learning and webinars. The meeting participants connect through their Web browser and the product is Adobe Flash based. All individual meeting rooms are organized into 'pods'; with each pod performing a specific role, interactive tools include for example like shared Web browsing, shared applications, PowerPoint slide viewing, shared whiteboards, and live text chat. The seminars can also be recorded so that the students can listen to them later on.



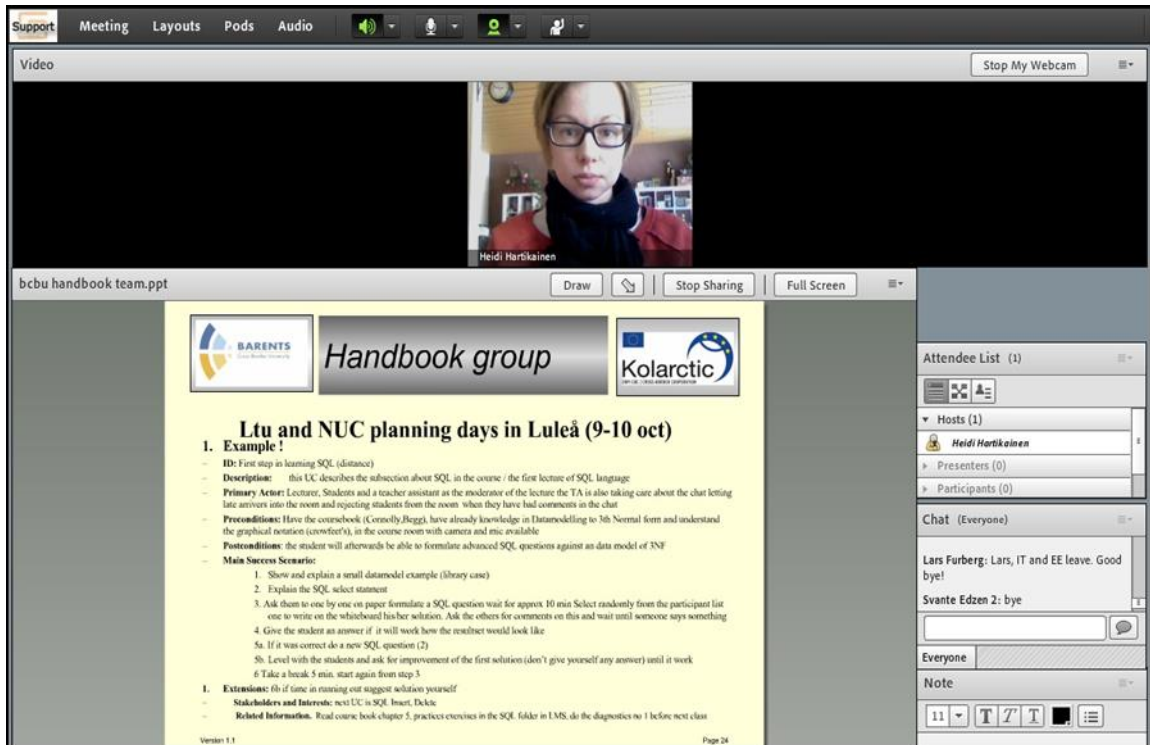


Fig 2.5 Adobe Connect document sharing

## 2.2.3.1 Features

The following list of features was obtained from the Adobe website [1]

Table 2.3 Features of Adobe Connect

<b>Audio</b>	Participant audio and host audio.
<b>Video</b>	Participant video and host video.
<b>Messaging</b>	Public and private chat between participants and host
<b>User functions (host and attendee)</b>	File sharing, screen sharing, whiteboard, Web links, polling, Q&A, meeting recordings, breakout rooms, notes, sharing audio, video, PowerPoint etc.
<b>Setup functions</b>	<ul style="list-style-type: none"> <li>- Single-click URL access through Web browser.</li> <li>- User defined URLs for meeting rooms. Any number of individual meeting rooms, work-in-process can be stored.</li> <li>- Write to more than 100 APIs to add functionality to Adobe Connect</li> </ul>
<b>Administrative functions</b>	<ul style="list-style-type: none"> <li>- Manage course or curriculum setup using enrolment management capabilities.</li> <li>- Manage enrolment with automated email notifications, set approval and prerequisite processes for self-registering learners to enter courses.</li> <li>- Enable learners to view their training and track their progress through learning paths.</li> </ul>

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	<ul style="list-style-type: none"><li>- Curriculum managers and administrators can use prerequisites and test-outs to guide access and content selection.</li><li>- Assess course effectiveness with reports that provide an overview of student progress.</li><li>- Leverage security for secure content delivery and confidential result tracking</li></ul>
<b>Integrations</b>	<ul style="list-style-type: none"><li>- Access from mobile devices.</li><li>- Optional Desktop Adobe AIR client.</li><li>-Integrate with eLearning applications and SCORM- and AICC-compliant LMSs.</li><li>- Use Universal Voice to integrate with virtually any audio provider or teleconferencing platform.</li><li>- integrating with existing video telephony devices supporting SIP/H.264.</li><li>- Schedule, start, and join meetings from Microsoft Outlook or IBM Lotus notes. Integrated address books, availability lookup, and recurrence features.</li><li>- See a list of invitees and their presence on Microsoft Live Communications Server and Microsoft Office Communications Server. Initiate chat conversations with LCS or OCS instant message users directly from within Adobe Connect.</li></ul>

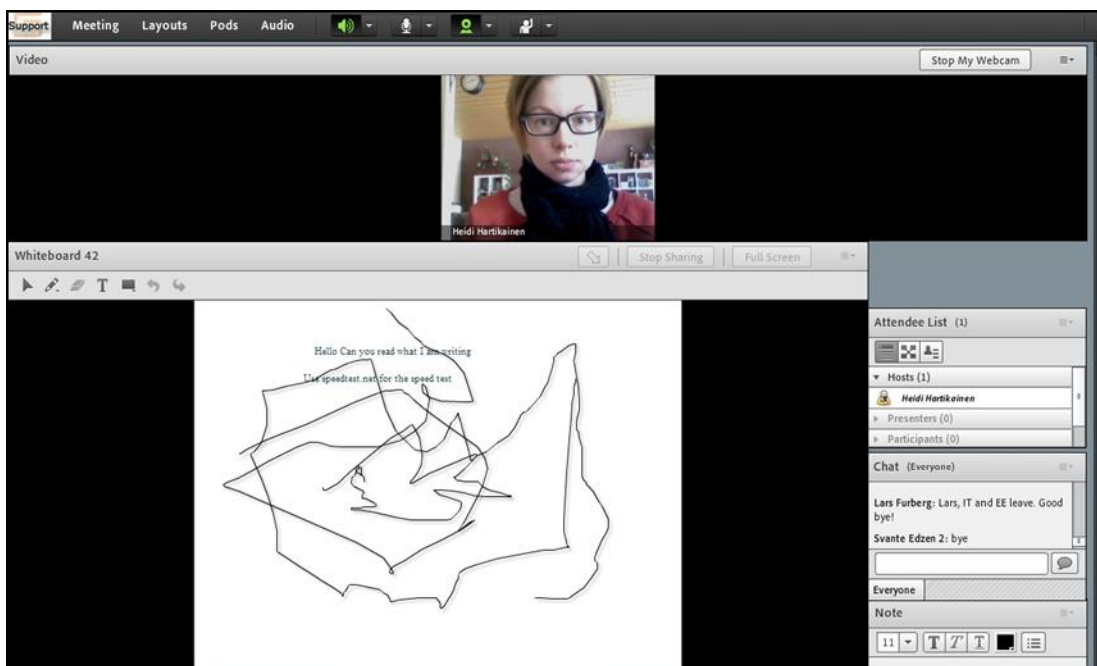


Fig 2.6 Adobe Connect whiteboard

### 2.2.3.2 User Experiences

*Adobe Connect is the main tool for holding E-Learning classes at LTU, and I have been using it for years both as a teacher and as a student. The experiences that I have on both roles are only positive, and out of all the different E-Learning platforms this is definitely my favourite one. There is no need to install anything on your own computer so the access is very easy, and all of the functionalities are extremely easy to find and use – The User Interface is well designed. As a teacher I appreciate that you can create custom rooms for the needs of each class with different layouts and functionalities.*

- Heidi Hartikainen

*I was introduced to Adobe Connect for the first time by my work colleague about a year ago. She gave me a Web-link of a recorded Adobe Connect meeting. All the tools you need for online meeting is practically used in that recorded meeting. The participants are watching the document shared, some are chatting, almost everyone is seeing each other with live streaming video, and simply it created a very interactive and collaborative meeting environment.*

*Since then I started using Adobe Connect for meeting purposes. It is quite handy if you want to invite participants who are not interested in creating user accounts, we all are fed up of these procedures. Any user can enter to a live meeting room as a guest just if he/she has the link. There is no installation needed other than Adobe Flash player, which is not much of a deal.*

- Mohammed Dawued Mohammed

*Adobe Connect is the main tool for conducting Virtual meetings and webinars at UOulu. It is widely used by teachers and students. More often also research projects and university administration uses it in meetings and information sessions. Out of all the different Web Conferencing tools this is very recommended one. The system runs on Universities servers where departments, courses, project and in some cases individual user can establish their own Virtual rooms. The user interface is running on different Web browsers (IE, Mozilla, Google Chrome etc.). There is no need to install any client on your own laptop or*

*PC so the access is very easy. All of the functionalities are easy to find and use – The user interface is well designed. An added value is that user can create custom rooms for the needs of each class with different layouts and functionalities. In general it is important that the Adobe Connect users have the similar software tools installed, especially that the Web browser and it's add in components are compatible with the Adobe Connect software.*

- Kari Pankkonen

### 2.2.4 Vidyo Personal Telepresence

The VidyoCampus Program is used by colleges and universities to deploy high-definition (HD) VidyoConferencing to every desktop in their community. A single site license includes a bundle of VidyoRouter appliances and concurrent use software licenses, the VidyoPortal appliance, and VidyoDesktop client licenses for desktop and mobile devices. Site licenses are tiered based on the total number of enrolled students and affordably priced for any school's budget [16].

1. VidyoRouter is a machine that performs the packet-switching function
2. VidyoPortal is a Web-based environment used to access and manage the VidyoConferencing system
3. VidyoDesktop is a software-based endpoint, managed via VidyoPortal, and is able to support HD quality video

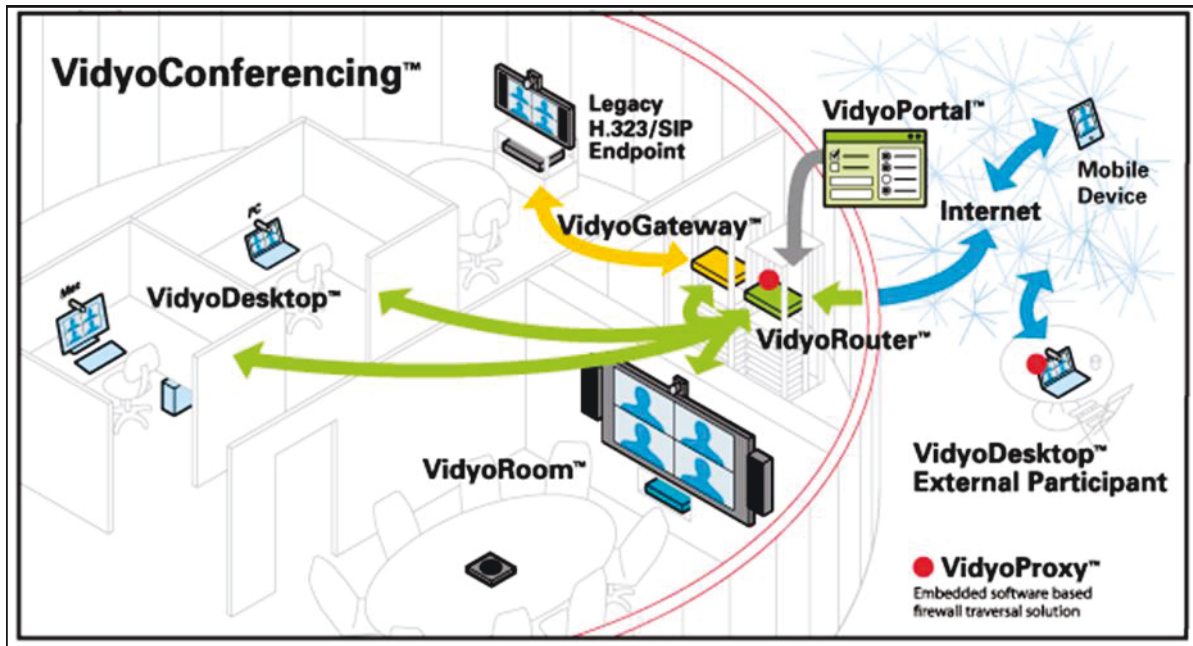


Fig 2.7 Vidyo Conferencing diagram [18]

### 2.2.4.1 Features

List obtained from Vidyo website [17]

Table 2.4 Features of Vidyo

<b>Audio</b>	Participant audio and host audio. SPEEX Wideband Audio, up to 32 KHz sampling rate Automatic Echo Cancellation
<b>Video</b>	Participant video and host video. 8 participants displayed simultaneously + plus self-view. H.264 Scalable Video Coding Video Encoding Up to 720p30 Video Decoding Up to 1080p/30
<b>Messaging</b>	Public and private chat between participants
<b>User functions (host and attendee)</b>	Share Application or Desktop, View Shared Content, Participant name display option
<b>Administrative functions</b>	User accounts established at the VidyoPortal Global Directory, personal speed-dial list Presence indication in directory On-screen call statistics by participant Call detail records Client software download From Web or VidyoPortal
<b>Integrations</b>	Can be integrated to work with Adobe Connect and with Microsoft applications including Outlook, Office Communicator and Active Directory

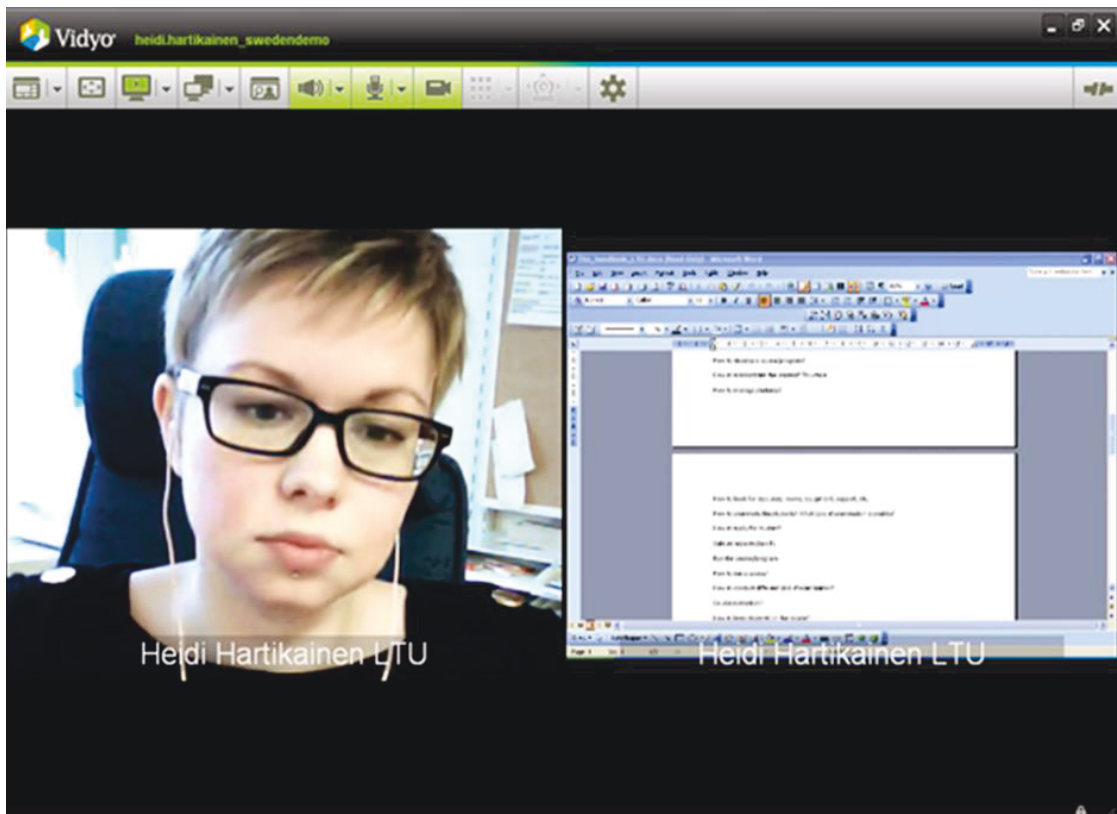


Fig 2.8 VidyoConference screen sharing function

### 2.2.4.2 User Experiences

*The VidyoPortal and VidyoDesktop were provided by Videra for a testing period during the BCBU+ project. While the audio and video quality of the program was indeed excellent, it lacked a lot of functionalities that would be needed to conduct E-Learning classes. This is most likely why the company has made it possible to integrate their solution with Adobe Connect. I would definitely suggest this as an option if there is a need for example to find a solution for smaller meetings and business environments.*

- Heidi Hartikainen

### 2.2.5 Microsoft Lync

Microsoft Lync is an enterprise-ready unified communications platform. Lync provides a consistent, single client experience for presence, instant messaging, voice, video and a great meeting experience [5].

Lync, in its present state, differ from Skype in one important area – who are the users. Since Lync is an enterprise-based system, the enterprise controls who are the users and who gets to connect with each other. In this way, friends or contacts outside Lync do not distract the users, as is for instance with Facebook, Skype and other related social media systems. Lync does allow users to contact other outside the enterprise, for instance a meeting with audio/video and sharing screen and to take over control on the remote participant etc. The other participants does not need to be on a Lync server but will be invited by the host of the meeting which is on the Lync Server.

However, since Skype also belongs to the Microsoft family, there is a connection between Skype and Lync enabling Lync users to connect to Skype users [6].

Lync being an enterprise system limits the free use. However, several universities in Norway have implemented Lync and within a year or so, all universities will have a Lync connection. Lync is also available at Finnish universities for personnel and students as part of the Microsoft Office365 tools. Recently all the tools are freely available at UOulu as Cloud service. This makes communication easy between fellow lecturer and students across different universities since it all takes place on the same platform.



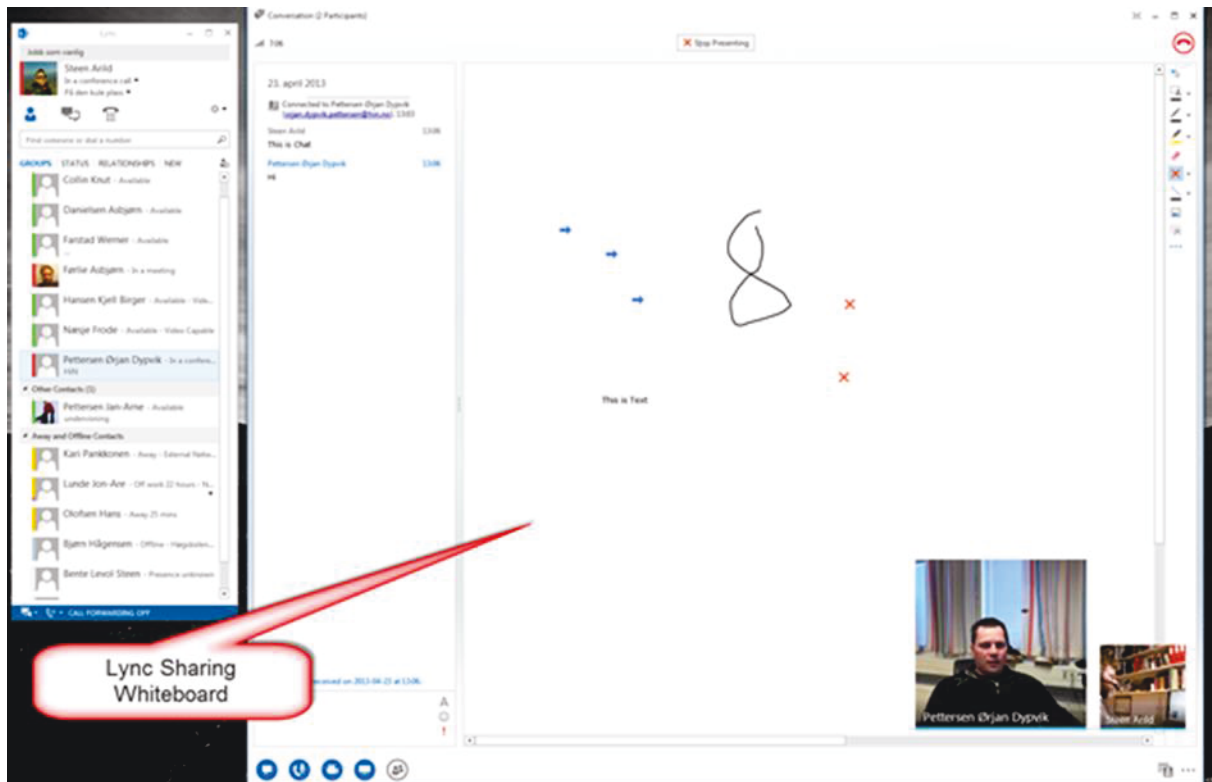


Fig 2.9 Lync in use at NUC

## 2.2.5.1 Features

The following list obtained from the Microsoft website [7]

Table 2.5 Features of Microsoft Lync

<b>Audio</b>	Provides touch-tone call along with IP based audio technology. Can also configure meeting with different levels of authentication to ensure communication stays confidential. Powerful scheduling with integration of Microsoft Office – Outlook, or Outlook Web App.
<b>Video</b>	Implements peer-to-peer and multiparty video. Video can be used to escalate chat and audio conference into a video conference. Supports High-definition video (resolution 1270 x 720; aspect ratio 16:9) and VGA video (resolution 640 x 480; aspect ratio 4:3). Includes panoramic view and speaker detection.
<b>Messaging</b>	Sending instant messages (chat) between 2 or more participants with record of history. Also possible with persistent chat (maintain an on-going discussion over time)
<b>User functions</b>	Whiteboard and polling. Program or desktop sharing. Attachments, file share and downloads are possible. Meeting view is customizable for how participants are portrayed in the



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	meeting. Group users into groups Presence feature: See whether a person is signed in, can detect several devices (PC, mobile device, IP phone). Choose your own privacy status as Available, Busy, Do Not Disturb, etc.
<b>Setup functions</b>	Using Lync, users can transition among PC, smartphones, tablets, phones and room systems with ease.
<b>Integrations</b>	Integrating with PowerPoint and OneNote. Possible with embedded media in PowerPoint.

### 2.2.5.2 User Experiences

*There are few user experiences where Lync is the propagator for distant learning. Several other reports on the use for guidance and instruction portrays great satisfaction. The Presence feature is flagged as useful.*

*However, all students at Narvik University College have access to Lync. Lync is new to the students, which is more customized to Facebook, Skype and Google type communication. We now start to see that students also pick up on using Lync, especially in communicating with lecturer. As a lecturer the tool is excellent for one-to-one, one-to-few, few-to-few communication giving follow-up instruction in connection with lecturing. It is also a great tool for communication between lecturer and other faculty and staff members. As the students can see if a lecturer is present, students can get immediate response on whatever topic challenge they are facing. If lecturer is not present, or chooses not to be available for students, there is always the option for using email.*

- Arild Steen

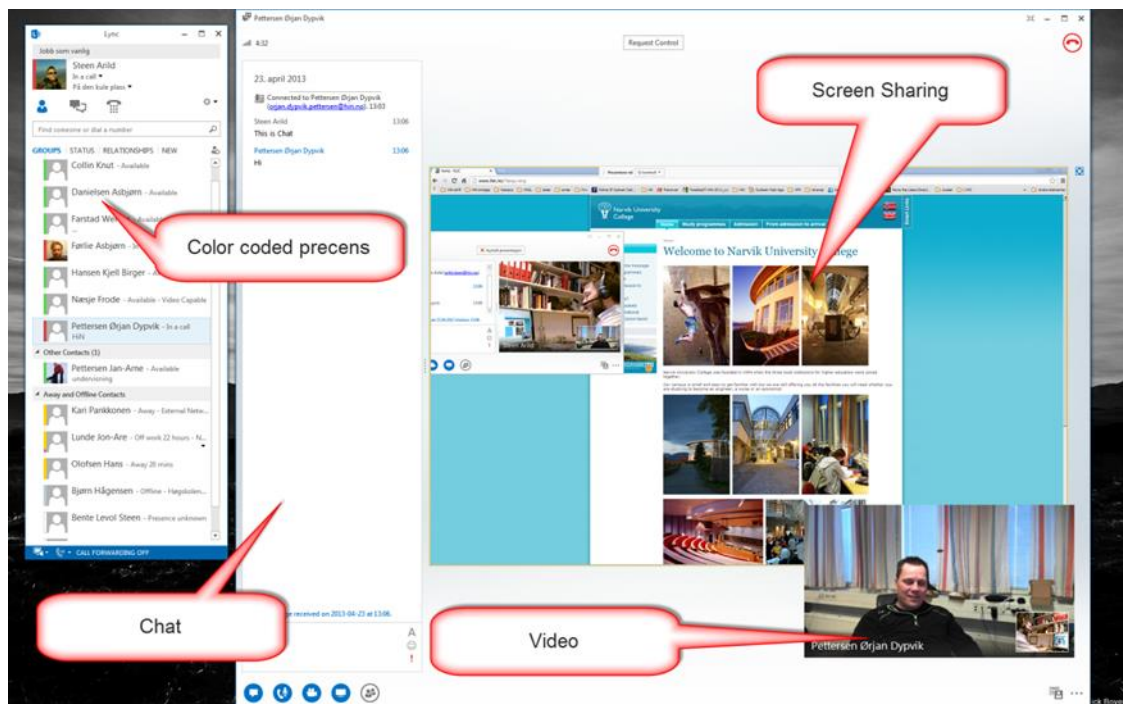


Fig 2.10 Lync in use at NUC

### 2.2.6 Sonicfoundry Mediasite

Mediasite provides a webcasting and a video content management platform to record, archive, search, analyse and secure presentations, Web conferences, lectures and training sessions. Mediasite players are based on Microsoft Silverlight for Windows and Mac. On Linux Mediasite version 6.0.2 and later supports on-demand presentation playback of H.264 content packaged as MP4.

Mediasite recorders with special hardware can capture sound and video from lectures automatically according to a scheduled recording setup. The recordings are automatically stored on special Mediasite servers which provides archiving and on demand streaming, together with administrative report and maintenance functions. The system also supports live streaming while the recording takes place.

The new Mediasite 6.1 includes a Mediasite Desktop Recorder which makes it possible to record content from PC's and laptops without the need for special hardware.

Deployment alternatives for Mediasite servers [15]:

- Mediasite Hosting Services, outsourced service to Mediasite.
- On-premise: Local installation of Mediasite Servers
  - In Norway this is a Uninett service for all universities. Uninett is responsible for the service; costs are shared among the universities.

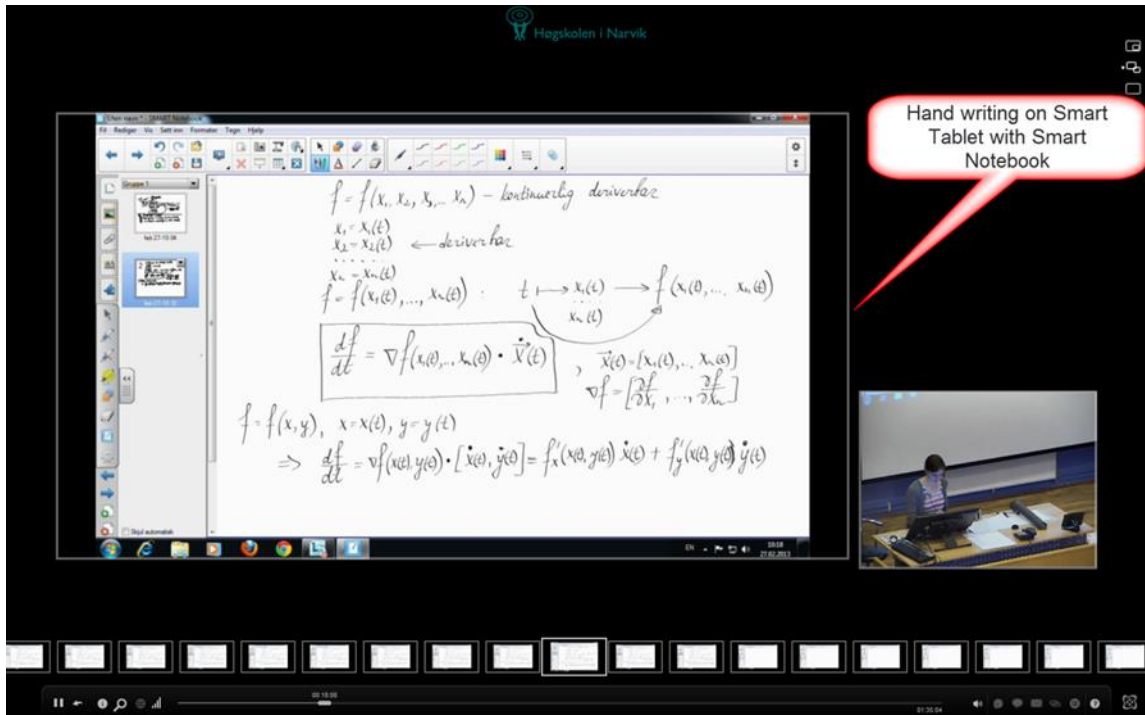


Fig 2.11 Mediasite in use at NUC

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### 2.2.6.1 Features

Table 2.6 Features of Sonicfoundry Mediasite

<b>Easy to use</b>	One-button or fully-automated recording. Operator-free start/stop recording schedules. Remote Web-based recording. No pre-uploading of presentation materials. Pause and resume any live or on-demand recording. Video and slide confidence monitors for error-free recording
<b>Live and on-demand streaming</b>	Record content from any source - laptop, tablet, whiteboard, document camera video conference and more. Webcast live from anywhere. Stream HD video and slides live and on-demand. Record on-demand content for users to watch at any time. Archive presentations in searchable Mediasite Catalogues (requires Mediasite EX or Mediasite Hosting). Publish to DVD/CD (ML models), USB or zipped folder to watch without an internet connection. Microsoft® Smooth Streaming support. Encoding from 56Kbps to 4Mbps
<b>Interactivity</b>	Questions to the presenter can be sent during the presentation, which will appear in the Mediasite Q&A panel. Questions can be answered orally or via email. Polls may be added to presentations.
<b>Presentation editing</b>	Crop, cut or replace video. Add, delete, or replace presentation slides. Adjust slide timings. Add and customize chapters. Editing history with ability to revert to a previous revision
<b>Recorder Management (requires Mediasite EX)</b>	Via the Web, access and remotely control any Recorder - start/stop/pause, slide advance, capture settings, content publishing and more. Confidence monitoring of audio, video and image signals. Centralized Recorder software updates.
<b>Interactive playback</b>	Watch on any device – PC, Mac, iPad, iPhone, iPod, Android, BlackBerry or Linux. User-controlled layouts, thumbnail navigation and chapters. Powerful keyword search. Custom branding and links to related materials. Presenter-viewer interactivity with polls and ask a question. Closed captioning support.
<b>Desktop Recorder</b>	Content can be recorded from PC's and laptops without the need for special hardware. Content types: screencasts with audio, slides with video and audio. Editing functions. Upload to Mediasite servers.
<b>Integrations</b>	Integration with room control systems (RL models). Integration with knowledge management platforms: Course or LMS like Angel, Desire2Learn, Instructure, Sakai and more. Enterprise content management systems. Training or continuing education portals. Event networking websites. BlogBlog

At NUC Mediasite RL recorders have been used for recording lectures in several auditoriums since February 2012. The recordings are published to the Uninett Mediasite EX servers in Trondheim, Norway.

Lecturers are using a document camera and/or a computer to present their material. Mediasite records the computer screen/document camera, together with audio from the lecturer's microphone and video from an overview camera in the auditorium. An overhead projector shows the same picture in the auditorium as on the computer screen or the document camera.

Many lecturers are using the document camera as a substitution for the blackboard. Notes are written during the lecture, displayed by the document camera and recorded.

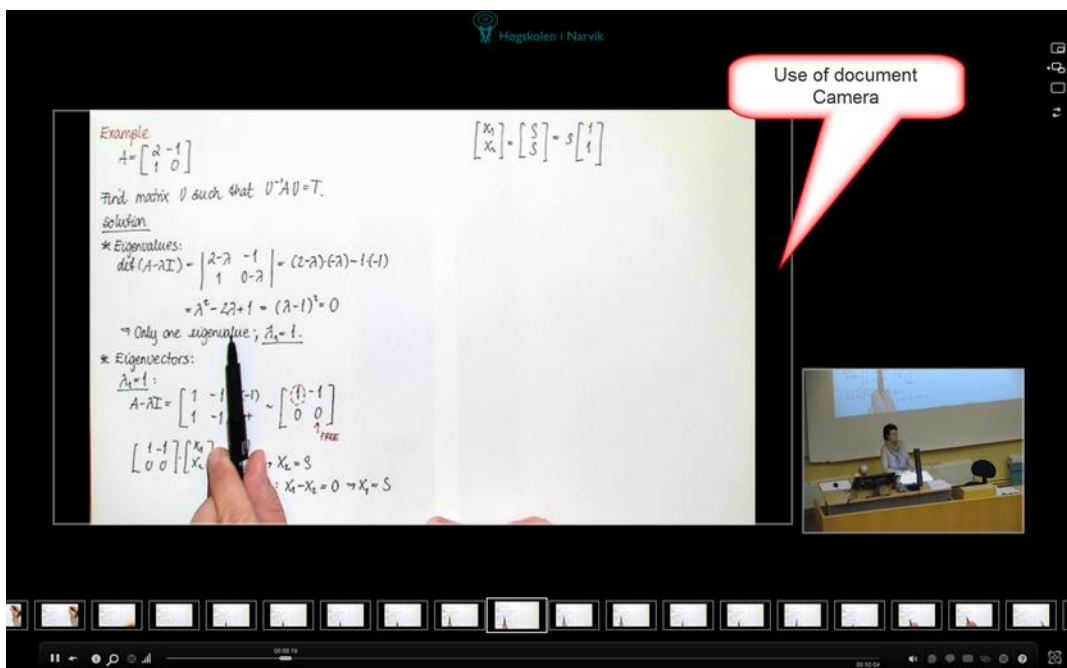


Fig 2.12 Mediasite use of document camera at NUC

Many teachers are very satisfied with this setup. Instead of writing to the blackboard with their back against their audience, they now will see the students while they are writing on paper using the document camera. All written notes are kept and one can easily go back to a previously presented —page—.

Lecturers can easily switch between using the document camera as in figure 2.12 or using PowerPoint, or another computer program, as in figure 2.13.

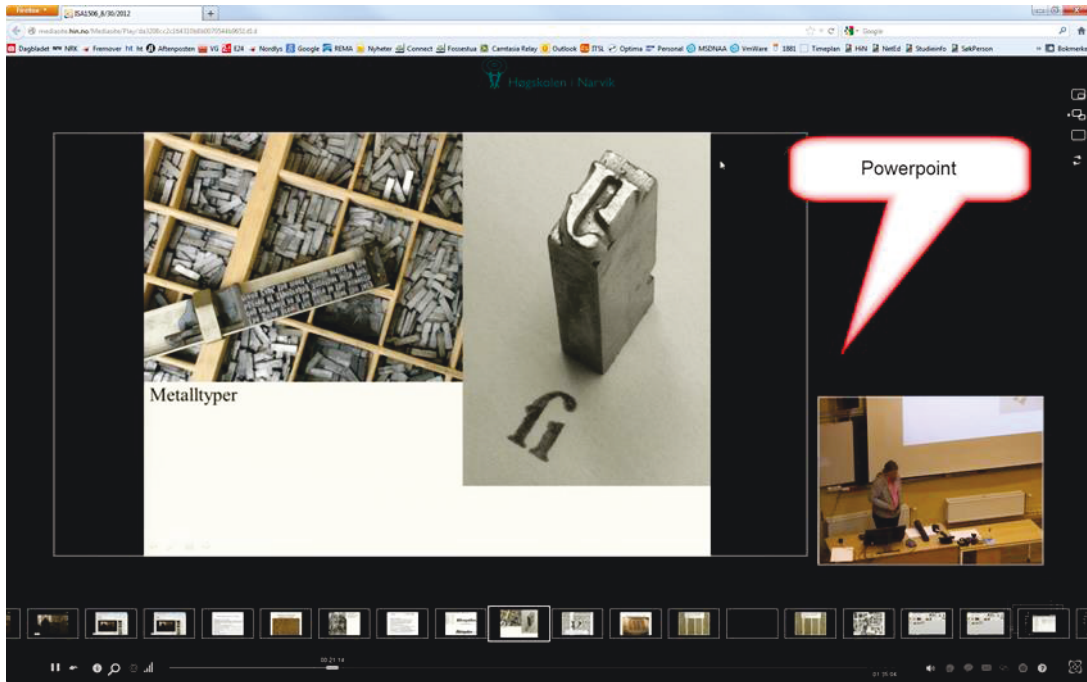


Fig 2.13 Mediasite interface sharing PowerPoint presentation

The Mediasite user interface supports navigation controls and different views as seen in figure 2.14.

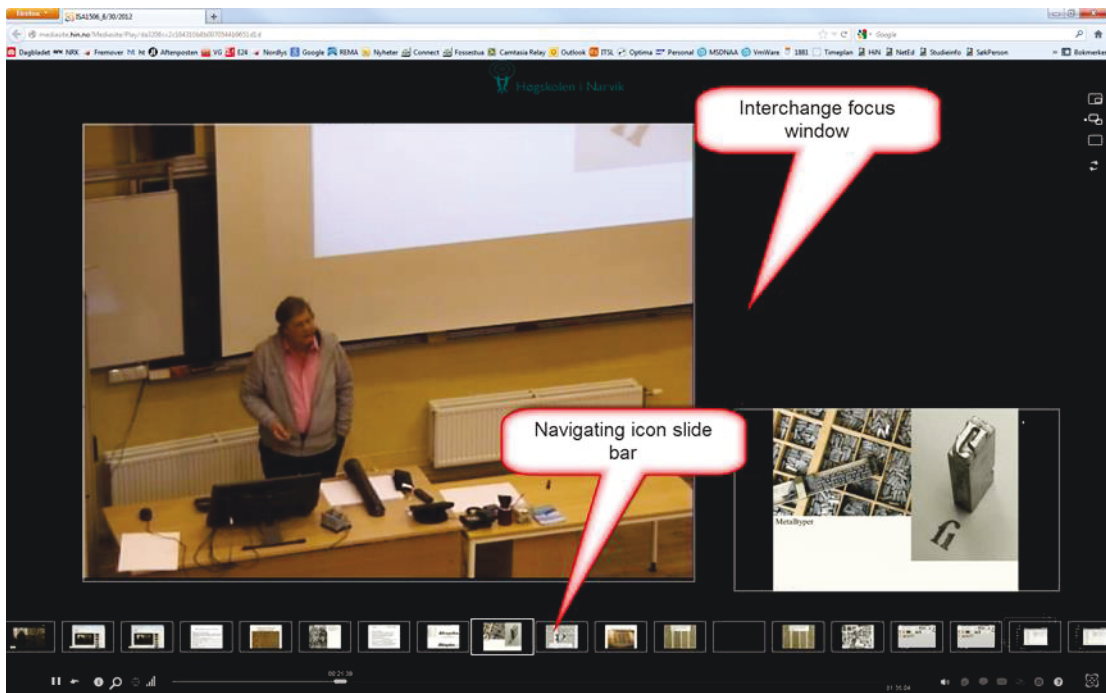


Fig 2.14 Mediasite in use at NUC

NUC are using automatic scheduled recordings. All lectures in a subject are scheduled for recording according to the timetable. All the teacher has to do is to turn on the document camera and/or computer and the microphone. Students can follow the lecture either live in the auditorium or on an Internet connected computer,



pad or mobile. In addition all lectures are recorded and made available for the students in the Learning Management System, It'Learning – similar to OPTIMA.

NUC has little experience with interactivity in Mediasite; the system is mostly used for broadcasting and recording lectures. However, the system supports both a Q&A and polls feature. Due to internal processing the broadcast is delayed to the viewer, NUC experience this to be approximately 15-20 seconds.

### 2.2.6.2 User Experiences

*The Mediasite system has given NUC a really boost in number of recorded lectures, and the students are very satisfied. They know that if they miss a lecture, or the subject is hard to understand, they can whenever they want, see the archived recordings, from anywhere and from whatever device they prefer. The main benefit here is the automatic recordings, which is setup at semester start according to the timetable for the lectures. Lecturers know that automatic recording is in place and technical difficulties are reduced to a minimum.*

- Knut Collin

## 2.3 How to Select a Web Conferencing System that Fits Your Needs

Selecting a Web Conferencing System to carry out your E-classes is not an easy task – many things need to be taken into account: The functionality you need, the technical infrastructure at your institution, the pricing and so on. Most likely you will need to have involved representatives of the teaching staff, the IT department and managerial departments so that all relevant viewpoints are addressed and all aspects of the possible implementation are taken into account. Nowadays it is however relatively easy to be able to test all of the considered alternatives for a period of time in your institution before taking the plunge and selecting one – and this is an option that should be taken advantage of.

**Functionalities:** This is the part that should be left for the teaching staff to decide, but you also need to take into account the students point of view.

It is important for the teachers to be involved to map out the functionality requirements of the system. Is the purpose to do more tutoring point to point, or to carry out bigger lectures where many people are connecting to view it? If point to point is what you are going for, then a small system like Skype could be your solution, if more participants are expected to join, and more functionality is needed then you should consider a dedicated tool suitable for E-Learning like Adobe Connect or iLinc.

If what is needed is a dedicated E-Learning tool, then you need to picture a typical classroom situation: what kind of tools do you need to carry out a regular lecture? Most likely you want to show PowerPoint slides to the students, you want to draw on the whiteboard, and you want to hand out materials – what other functionalities would you want from the technology? Do you want the students to be able to see your video; is it necessary for you to see them? Do you want to be able to break the students into breakout groups for example for discussions on certain topic; do you want to carry out pop-quizzes? Lecture recordings make it easy for students that miss the class to go and listen to them when they have the time.

In addition to looking at the functionality requirements from the viewpoint of the teacher, you should also consider them from the viewpoint of the student. Naturally when taking an E-Learning class the students are expected to have a web camera, a microphone and an Internet access from their computer, but will they need to install some client software into their computer, does the Web Conferencing solution work on Mac, on PC, on handheld devices etc. How much strain does it cause for their Internet connection? In addition you should take a note if there is enough functionality for the student to be able to participate as efficiently as possible, is there a possibility for them for example to chat to the teacher and to the other students, can they raise questions in the middle of the class, can they upload their own material if needed and so on.

**Pricing:** After a list of functional requirements has been decided upon, naturally the pricing of different solutions is an important factor that needs to be taken into account. The cost of different Web Conferencing solutions may vary depending for example on the deployment type: 1) Hosted solutions are used through a website and usually are subscription based with for example monthly fees. 2) On premise



deployed solutions are installed in the organizations own technical infrastructure and instead of paying a monthly fee you buy a combination of hardware and software and you run the service yourself. These on premise solutions are used in the same way as a hosted solution – for example through a web browser.

While hosted systems are easy to use, and something that a private user or a small company might consider, on premise deployments are usually recommended for large organizations as they are more flexible and usually offer more features and more configuration options for example for user accounts and for Web Conferencing rooms. Usually the starting costs of on premise solutions are high, but there are no extra monthly fees to take into account. Other important things to check are that there are no hidden fees included how much the vendor charges for technical support, for file recovery in case of an emergency and for yearly maintenance.

**Technical requirements:** If an on premise deployment is decided upon, there is naturally a need to look at the technical infrastructure of the organization. Some Web Conferencing solution providers deliver the software and the servers needed to run the service, while some just provide the software that will then be installed and run on the organizations own servers. The Web Conferencing solution provider will most likely help your IT department to set up the solution and they will be assisting if anything goes wrong while using the product.

There is a need to also look at the security features of the products before choosing one. Sharing information over the Internet always poses a risk, and the solutions should incorporate an intelligent security system that provides user registration and authentication as well as end-to-end encryption.

## 2.4 Summary

In this chapter we discussed the differences of Web Conferencing and Video Conferencing; we also offered some examples of Web Conferencing systems as they are better suited for distance education, enabling students to take part from where ever they want without having to invest in expensive equipment. In addition to the Web Conferencing systems introduced in this chapter, there are many more commercial and non-commercial tools available and new solutions are developed

continuously. Our introduction hopefully can provide a good starting point to select a solution that fits your needs but it is important to do a comprehensive search on the alternatives available before selecting one – each organization is different, and a solution that is perfect for one might not be as usable to another.

Before selecting between different Web Conferencing systems vendors, it is important to test out as many tools as possible. That way you can be sure that you get a solution that has all of the important functionalities needed, and that you are getting good value to your money. During the testing process, in addition to the functionalities and the pricing, one need to take into account also the technical and systems requirements of the tools. It is therefore valuable to have involved in the process the end users, the administrative staff and the IT department staff to be able to make a relevant decision.

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## 3 SELECTING A LEARNING MANAGEMENT SYSTEM

### 3.1 What is a Learning Management System?

Today's Learning Management Systems (LMS) are typically web-based and used by most education organizations to present and follow up course material to students. Students may register for courses, find course material, take assessments, deliver homework and complete courses by help of the LMS.

Teachers may deliver all their teaching material electronically in the LMS. They can track students, see their progress, communicate via chat or discussion forums with students and have assessments automatically or manually graded.

The LMS is often the primary communication channel between students and teachers. All information about running and archived courses is stored in the LMS. LMSs are web based, providing easy access from a web browser, without the requirement for additional software.

### 3.2 LMS Features

The following general functions are normally provided by an LMS [3]:

Table 3.1 General LMS Features

Feature	Description
Security	The LMS supports secure logon and authentication. Access control implemented for courses, student records and administrative functions based on roles.
Structure	Centralization and organization of all learning-related functions into one system, providing easy access to all necessary course information in curriculum for a student.
Registration	Student assignment to courses in accordance with curricula, automatically from administrative systems.
Delivery	On-demand delivery of learning content and experiences to

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	students as text and different multimedia formats.
Assessment	Creating and administering mandatory and voluntary assessments together with the collection, tracking, and storing of assessment data. Automatic and/or manual censorship of assessments.
Tracking	Tracking of student activities and progress in individual course modules, assessments and tasks, and the course as a whole.
Reporting	Extraction of information by teachers about students and courses, including the information that is tracked as described above. Exportation of reports to external systems.
Record keeping, archiving and reuse	Storage and maintenance of data about teachers, students and courses. Courses can be reused as a whole or parts of different courses may be recombined for delivery in a new course, original course should be archived
Personalization	Configuration of LMS functions, interfaces, and features by teachers, students and administrators to match personal preferences.
Communication	Discussion forums and live chat for students and teachers.
Integration	Exchange of data with external systems for students and teachers.
Information exchange	The LMS should be SCORM compliant to ensure information exchange with other systems
Administration	Centralized management all of the functions in this list.

### 3.2.1 Detailed List of Common Features

Most features are selected from the report choosing a Learning Management System [3].

#### 3.2.1.1 Secure Logon/Authentication

The LMS should use robust security architecture to maintain system access; encryption should be used for sensitive data and session activity. The LMS should support single sign-on and authenticate using external services like LDAP, Kerberos, Shibboleth, CAS or SSO SAML. This means that users who has authenticated to one of the systems at the University, will get access to the LMS without additional login. The LMS should only require one user logon only per LMS session.

#### 3.2.1.2 Course Authorization

The LMS should supports restricting access based on roles and user groups. Roles and user groups can be created and maintained by administrators and/or teachers.

Teachers or students may be assigned different roles in different courses. Students should belong to a set of default roles and/or user groups when initially created.

### 3.2.1.3 Registration and Integration

In order to get students registered for courses in the LMS this should be mostly automatically by data interchange with the administrative student registration system. When a student register or unregister for a course this should be propagated to the LMS. This will help the lecturer; he can be assured that all registered students can access the course in the LMS. The lecturer should also have the possibility for manually to add students to his courses.

### 3.2.1.4 General Features

The LMS should support the following general features:

Table 3.2 List of General Features LMS supports

Feature	Description
Ease and extent of LMS look and feel	The LMS should use standards for customization of look and feel to match organization's brand.
Learning Plans/Course Authorization	Student access to courses should be in accordance with his/her learning plan.
Student Information System	The LMS should support registration, matriculation, grading, etc.
Social Networking (discussion forms, live chat)	Should support one or more discussion forums in each course together with live chat
File/assignment upload	The LMS can upload file and multimedia elements in most standard formats
Vendor and Client Hosted options	Should be available both as outsourced and local installation
Email	Should have an internal email or use an existing external email system via secure communication.
Calendar function	Each course should have it's own calendar.
Personalized profiles	Teachers and students should have personalized profiles with pictures, bio, etc.
Course templates	
Multimedia support	The LMS should support multimedia elements in course modules
Search within course	Free text search in course should be available

### 3.2.1.5 Integration

The LMS should support the latest SCORM specification, currently SCORM 2004 4th edition. SCORM stands for “Sharable Content Object Reference Model”. This is a set of technical standards for E-Learning software products. SCORM defines how to create “shareable content objects” that can be reused in different LMSs. When the LMS supports SCORM, objects can be exported and imported between different LMSs. SCORM is the de facto industry standard for E-Learning interoperability and is defined by Advanced Distributed Learning (ADL) [6].

### 3.2.1.6 Group Work

The LMS should support student groups. Groups should be created automatic when students are registered for a course, different types of students (students in different study programs) should belong to different groups. As an example there could be one group for all students participating in the course, in addition groups for Campus students, distance students etc. could be created. This would help the lecturer in communication with the students. The LMS should also support manually creation of groups by the instructor or by the students. Randomly creation of groups of a certain size or a set number of groups should also be supported. Groups can be given access to group-specific assignments and activities.

### 3.2.1.7 Student Portfolios

The LMS should support student portfolios. Each student should be able to create and maintain his/her portfolio. The portfolio system should contain the necessary tools for the student to describe his/her Learning plans and progress, job skills, experience and to demonstrate skills. The system should support text, images and multimedia elements as well as personalization, look and feel customization.

### 3.2.1.8 Test Management

The LMS should support testing of student skills by use of tests or quizzes. Instructors should be able to create tests containing different type of questions and to give different weight to different groups of questions. The system should be able



to randomize the questions and answers and to select a defined number of questions from a certain group of questions. Tests should have activation and deactivation time that is handled automatic by the LMS, as well as a time limit and a limit on number of retries for the student. The LMS should calculate the result of the test automatically when the student has finished the test. The calculating algorithm should support negative scores for incorrect answers. The instructor should be able to specify when the results are available for the student, for example this could be when all students have completed the test or at a certain time. Instructors could also specify whether correct results are shown as feedback to the students or not. The system should support a MathML editor for the inclusion of mathematical formulas in both questions and answers.

### 3.2.1.9 Test Question Types

The LMS should support the following types of questions in tests.

Table 3.3 List of test question types

<b>Question type</b>	<b>Description</b>
Multiple choice	Many alternative answers are presented to the student, only one answer is correct.
Multiple answer	Many alternative answers are presented to the student, one or more answers are correct.
Matching	The student should find matching objects.
Ordering	Then student should set up the right order for a series of actions or tasks.
Jumbled sentence	The student should pick the correct sentence from alternatives where words are jumbled
Calculated	The LMS can generate individual numerical questions by the use of variables, each student will get different numerical values in question
Fill-in the blank	The student should fill in a missing word
Short answer	The student may write a short answer in free text
Essay	The student may write a long answer in free text
True/False	The student can choose between two choices for an answer, True or False.

It should be possible to add html code and media elements like images, videos and audio to questions.

### 3.2.1.10 Online Grade Book

The LMS should have a Grade Book for each student in a course. When an instructor adds an assignment to the course, the LMS can automatically add it to the Grade Book. Teachers can choose which elements to be included in the Grade Book. There should be a possibility for teachers to add details to the Grade Book in custom columns. Teachers can create a course grading scale that can employ either percent, letter grades, or pass/fail metrics. The Grade Book should be exportable to an external spread sheet.

### 3.2.1.11 Course Management

Teachers should be able to selectively release assignments, assessments, and announcements based on specific start and stop dates. Teachers can release materials based on a single criteria (date, grade, passed test etc.). Teachers can set up specific course content that is released on a specific date and must be completed by students before they continue with the course.

Teachers can personalize access to specific course materials based on

- Group membership
- Previous course activity
- Student performance

### 3.2.1.12 Student Tracking

The LMS System should support tracking of student activities. Teachers should be able to track the frequency and duration of student access to individual course components. Teachers can get reports showing the time and date and frequency students as an aggregated group accessed course content. Teachers can get reports showing the number of times, time, date and frequency of each student who accessed course content, discussion forums, course assessments, and assignments. The LMS should maintain usage statistics that can be aggregated across courses or across the institution.

### 3.3 LMS Survey

The following table contains different LMS comparisons tools and surveys:

Table 3.4 List of different LMS comparisons tools and surveys

Technology-Enhanced Learning Tools: A Survey of Use in European Higher Education [1].
Learning Management System (LMS) Evaluation 2011-2012, [2] <a href="http://blogs.butler.edu/lms/files/2011/08/executive-summary.pdf">http://blogs.butler.edu/lms/files/2011/08/executive-summary.pdf</a>
KREŠIMIR FERTALJ, HRVOJE JERKOVIĆ, NIKICA HLUPIĆ : Comparison of E-Learning Management Systems [4]
A. Lassila and P. Pöyry: Online Education and Learning Management Systems from Service-Centered Perspective [5]

### 3.4 Recommendations for Selecting E-Learning Platform

The ADL report [3] lists the main points to be considered when choosing an LMS. It would be advisable to follow these steps.

The following is an abstract of the ADL recommendation process for choosing an LMS.

1. From the list of common and detailed features described in 3.2 and 3.2.1 determine the main requirements for the LMS System.
2. Determine the budget for purchasing the system and associated support/training contracts, as well as any customization of the system.
3. Identify LMS candidates; should be systems that supports the type of learning required.
4. Set up a matrix with requirements, with weighting, from step 1 against the features provided by the LMS candidates in step 3.
5. Eliminate an LMS System candidate that does not fulfil desired requirements or are too costly.
6. Setup a detailed, features list for all of the remaining LMS candidate systems.
7. Compare the features list of the remaining candidates using a matrix with weighting.

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8. Contact the vendors for the three to five top scoring systems and ask for demonstration and references. Vendors should provide a demonstration system for hands-on access by the different user groups. Discuss customization with the vendors.
9. Further, develop the matrix in step 7 with information from step 8.
10. From the information gathered, make a decision.

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# 4 BUILDING THE BCBU+ VIRTUAL CAMPUS

One of the main activities in the BCBU+ project was to start the development of the Virtual Campus. The argument was to reduce the impact of geographical distances and travel times and costs in the academic cooperation. The partner institutions were linked together with jointly recognised Web Conferencing tools and Learning Management System (LMS) to start and enhance cooperation distantly over the Internet. This allowed the fast and easy exchange of academic materials, the delivery of parallel and joint courses across borders and simplified organisation over the web.

## 4.1 Equipping the Classrooms

The first steps were to build up Virtual meeting rooms for Russian partners and equip the physical rooms with basic infrastructure to allow meetings and Web Conferences and teaching virtually. Virtual rooms in the Russian universities are connected to existing technical facilities in the Nordic partners.

Plan for technical infrastructure of the Virtual rooms for Russian partner universities was done in the Department of Information Processing Science at UOulu. Budgeted list of recommended equipment and software tools is attached in the report (Appendix III). The installation work of Virtual rooms was done by Russian universities starting on autumn 2011 and ending in the beginning on 2013. The idea behind the Virtual rooms was to equip in each Russian partner university one room with sufficient infrastructure for multipoint online meetings, Web Conferences and teaching activities. The infrastructure budget for purchasing equipment was 7800€ for each Russian partner university. The main technical components consist of the following:

- computer running the software tools

- two laptops for user presentations
- two large screens/table TV-sets
- microphones, loudspeakers, headsets
- Web Conferencing camera
- peripherals and external devices

The infrastructure covered only the components, cabling and installation work inside the Virtual room. All backbone networking and Internet infrastructure was excluded in the project. All purchases were subjected to competitive tendering process to ensure the cost efficiency. National procurement legislation was taken into consideration. Purchases under 10 000 EUR must be reasonable and cost-efficient for their price. That was ensured with a lighter procurement process. In all cases the procurement process has been documented. If the university already has a contract with some supplier (chosen through tendering process) that supplier can be used if other requirements are fulfilled. Detailed specification of Virtual room is described on Appendix III.

Photos below show examples of the equipped Virtual rooms in Russian universities. In addition to these four other Virtual rooms in Russian Universities were equipped. There was no need to equip virtual rooms for ULapland, UOulu, LTU or NUC as they already had virtual rooms up and running that could be used for the project purposes.

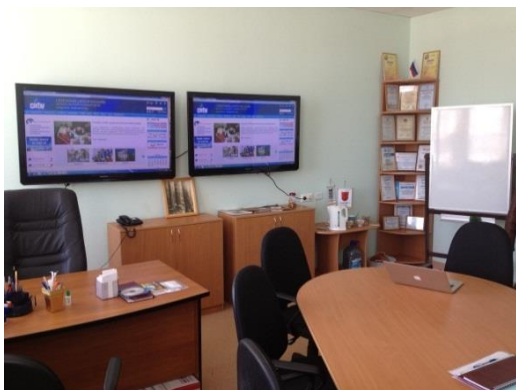


Fig 4.1 NArFU Virtual room

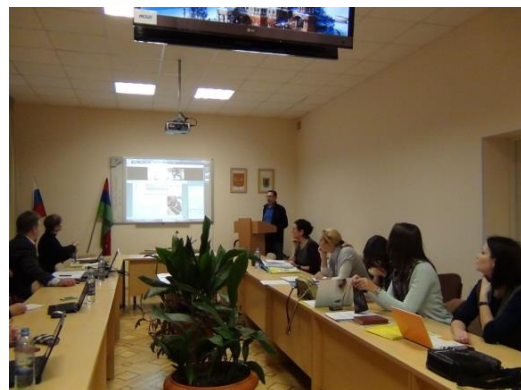


Fig 4.2 KSPA Virtual room



Fig 4.3 MSTU Virtual room



Fig 4.4 UOulu Virtual room

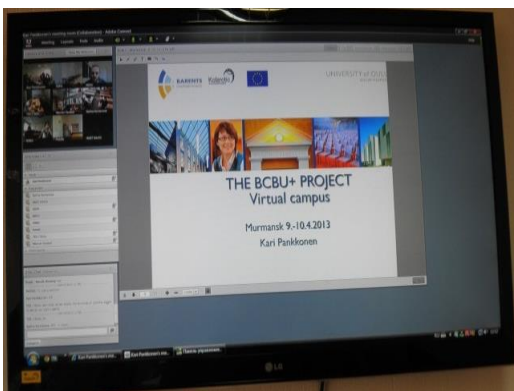


Fig 4.5 BCBU+ seminar in Murmansk

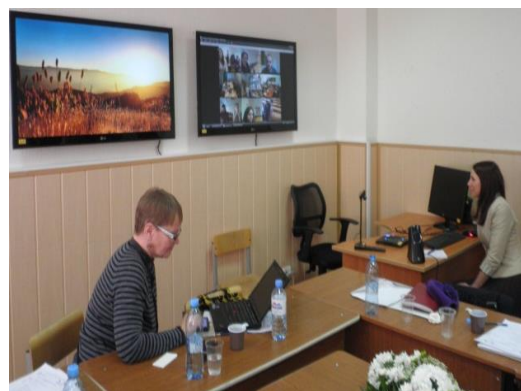


Fig 4.6 Final test in Murmansk seminar

## 4.2 Evaluating the Web Conferencing and Learning Management System

Potential Web Conferencing platforms and LMS for BCBU+ project were analysed together with UOulu and LTU.

### 4.2.1 Web Conferencing Systems

The research to find suitable Web Conferencing platforms for testing was started in June 2011 and was on-going until late 2012 consisting of several iterations and meetings and discussions between project partners.

The initial plan to research and define requirements for a Web Conferencing platform was done in collaboration by participants from LTU and UOulu. The plan included what kind of technologies needed to be researched for as well as a set of properties of each system that needed to be mapped. These properties included for example



the technical requirements of each system, pricing and functionalities. The first round of research was carried out by LTU and it resulted in a document that detailed 8 different commercial Web Conferencing and Video Conferencing technologies and consisted of 60 pages in total. The Web Conferencing and Video Conferencing systems included in this document were Skype, iLinc for learning, Adobe Connect, Marratech, Vidyo personal telepresence and Cisco WebEx Training Centre, Polycom Telepresence m100, and Tandberg Movi. The document was made available for all project partners through the BCBU+ OPTIMA workspace.

During this initial review, also a literature search on academic materials related to distance education was done. First, Google's scholar services were used to search with key words and phrases such as distance education, E-Learning and Web Conferencing, as well as with the names of different Web Conferencing and Video Conferencing technologies. The search was repeated using LTU library's Primo search system that can be used to search for different kinds of printed and electronic materials including books, articles and theses works. In addition to searching the materials readily available at the library the Primo system can be used to search 153 different databases including for example Academic Search Elite, ACM digital Library, Emerald and Science Direct. The search was limited to articles and books in the English language and it resulted in finding 151 articles. The articles were reviewed, and if they were found relevant, they were uploaded into the BCBU+ project common workspace in OPTIMA where they are accessible to all interested project partners.

After the initial investigation of Video Conferencing and Web Conferencing options was finished and involved project partners had time to review it, it was decided by experts at LTU and UOulu that only Web Conferencing systems were suitable for implementation in the scope of this project as they were better suited for E-Learning and provided easy access for both students and teachers through for example a web-browser. Another round of technology review was conducted by LTU, this time excluding Video Conferencing technologies, but including also a review of non-commercial Web Conferencing option.

This review included short introductions to Openmeetings, Big Blue Button, WebHuddle, Zoho, Bangle, Fuze meetings, Glance, ICU live, LiveOn, MegaMeeting,

Microsoft Live Meeting, Nefsis Web Conferencing, Netviewer GoToMeeting, Saba Classroom, Teamviewer, Teleskill Live, VenueGen, WiziQ and YuuGuu.

Participants from UOulu and NUC contributed to the technology review provided by LTU, offering their viewpoints suggesting different technologies for testing like for example Oovoo, Lync and Mediasite

### 4.2.2 Learning Management System

Based on steering group decision of BCBU+ OPTIMA was selected as the LMS platform to share project and teaching materials to each partner. The BCBU+ OPTIMA is running on ULapland server. It is also used as a learning environment for courses and workshops arranged during the project.

OPTIMA has been used as the main LMS at UOulu and ULapland over a decade so it has been thoroughly tested in use and found to be a good and useful tool. Because of this, no time consuming evaluation or testing process was needed in the scope of this project. For those that are interested, the general selection criteria and basic features of LMS are analysed in detail on chapter three.

## 4.3 The Testing Phase

Virtual rooms and the infrastructure have been used in test trials under supervision of UOulu and LTU with different Web Conferencing tools since autumn 2011. Test trials of the Web Conferencing systems started as soon as each of the Russian partner university has installed the entire infrastructure and thus have readiness to operative use of the Virtual rooms.

A total of five Web Conferencing technologies were selected for testing by experts from LTU and UOulu. Technologies selected after initial research about options available, as well as the participating universities suggestions and experiences during discussions. The technologies tested were Skype, ooVoo, iLinc, Vidyo and Adobe Connect. Testing and user trials with different Web Conferencing tools (see Chapter 2) were done under coordination of Universities UOulu and LTU.

LTU together with UOulu made a test plan for selected Web Conferencing tools (Appendix II). Test trials were performed with all the Russian universities in the project. The initial testing and setup for each technology was done by participants LTU and UOulu, and an informational package of the technology to be tested was sent to other organizations beforehand. The testing was carried out during 13 individual testing sessions with 7 partner organizations (excluding the initial testing by LTU and UOulu). The participants were mainly researchers and teachers of the universities, and they had their own IT support staff at hand to help out with the testing if needed.

Some challenges in the testing of different Web Conferencing systems were encountered during this project, which was only natural as so many participants from different countries and different organizations were involved. Some delays in the testing schedule were caused for example by conflicting timetables and there was a need to reschedule some testing situations many times. There were also delays caused because of the technical equipment needed was not delivered and installed in each organization according to the time plan.

Each of the testing situations was documented in an evaluation sheet. The testing sheet included an overall evaluation of the audio and video quality of the technologies, as well as comments sections on the most important functionalities. In addition we also evaluated bandwidth and stability of Internet access and the general usability of the tools and infrastructure. Training materials of the tools are available on BCBU+ project Learning Management System OPTIMA.

## BCBU+ Handbook

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The testing results for each 5 technologies are shortly summarized below.

Table 4.1 Test summary

Functions	Skype	AC	iLinc	ooVoo	Vidyo
Video Quality	OK, only available p2p	OK	OK	OK	Picture freezes
Audio Quality	OK	OK, some echo	OK, some cracking	OK	OK
Session recording	NA	OK	OK	NA	NA
Desktop sharing	OK, only available p2p	OK	OK	?	OK
Application sharing	OK	OK	OK	?	?
Whiteboarding	NA	OK	OK	NA	NA
Instant messages	OK	OK	OK	OK	OK
File sending	OK	NA	OK	Difficult	?
File uploading	NA	OK	OK	NA	OK
Break out sessions	NA	OK	OK	NA	NA

**Skype:** Out of all of the technologies tested, Skype was the most stable regarding audio and video and none of the test participants had any difficulties connecting or using it. Skype is however only recommended for groups with low number of participants and video is included only point-to-point. The program also lacks of important functionalities needed when conducting E-Learning, although some can be added through different add-ons.

**ooVoo:** Similar technology with Skype, connecting together a small group of people for an audio connection. It was however deemed to have much poorer handling and difficult logic.

**Vidyo:** A video conference system on Internet for groups up to 8-10 people. The solution is complimented widely on its HD video and excellent audio qualities, however, during our tests we found that the picture froze many times during the sessions. To be able to use Vidyo to its full potential one requires a powerful computers and a lot of bandwidth, which makes it less than ideal when talking about using it to connect groups of students with very heterogeneous equipment and differing Internet connection speeds. The program also lacks a lot of functionality that would be needed to conduct E-Learning. There is a possibility to integrate this with Adobe Connect to add the missing functionality

**Adobe Connect:** Audio and video worked well during all tests; however there was some echoing during some instances so using a headset or having enough space between your microphone and loudspeakers important. The system has all important functionalities needed for conducting E-Learning classes and was seen as easy to use for both teachers and participants.

**iLinc:** iLinc had all important functionalities needed for conducting E-Learning classes, and it was relatively easy to use, although not as easy as for example Adobe Connect. Video worked well on all testing sessions but audio had cracking problems that could not be solved even though we contacted IT support from the institution that provided the test room for us.

Based on the literature review, test results and user experiences of partners Adobe Connect was selected the tool to be used in the BCBU+ project. Skype was recommended for P2P contacts when possible as it is free, stable, easy to use and well known by all participants. As Skype however lacks functionality needed when conducting E-Learning classes, the choice of more advanced Web conferencing system was between Adobe Connect and iLinc.

The experiences from both systems during the testing were mostly positive, and they had the important functionalities needed for conducting E-Learning classes. However

the functionalities in iLinc were not viewed as easy to use as in Adobe Connect. During the test settings of both systems there were also some difficulties with for example echoing sound. For iLinc a solution to the audio problems could not be found even after contacting IT support. With Adobe Connect this was a matter of user equipment rather than shortage in the system, and was easily fixed with the use of headphones instead of loudspeakers. Also using good quality table microphones fixed the problem.

Adobe Connect has been widely in use at LTU, UOulu and ULapland for years and it has proved to be an efficient and reliable tool. Providing instructions and training for other project partners in Adobe Connect use was helpful to get familiar how to use Web conferring systems in regular online activities.

### 4.4 Experiences of the Web Conferencing System Selected

After Adobe connect was selected as the web conferencing tool to be used, a number of test trials has been arranged between the partners of BCBU+ project Test meetings were mainly arranged on UOulu's and NUC's Adobe Connect servers. ULapland established Virtual rooms in their Adobe Connect server for each Russian partner. During the Adobe Connect tutorial meetings key topics were; use of microphone, camera, chat, and collaboration tools with different layouts, meeting setups and meeting recordings.

To enhance the handbook status meetings, a proposal for having training sessions in the use of Abode Connect was executed. Training sessions were side product of the status meetings, but gave participants and collaborates the opportunity to get acquainted with Adobe Connect, setup of same, and to ask questions regarding same, to experienced users of Adobe Connect.

UOulu arranged the seminar "Working on line in the BCBU+ project" in Oulu 15.-16.11.2011. The seminar programme was focused on eLearning experiences in teaching and Virtual environments in the BCBU+ project from the user point of view. Number of participants in the course was 27.

Final test and demonstration of the Virtual rooms with Web Conferencing tool Adobe Connect was arranged in connection with the Murmansk seminar on 9.-10.4.2013. In this Virtual meeting all the project partners were present. Test environment consisted of Adobe Connect over Internet and each Russian university site used their Virtual rooms with the equipment purchased by BCBU+ project. The infrastructure is working well. Also Internet connections were stable and working well with the voice and image. Still it is important that the PC's and laptops running the connection have the similar software tools installed, especially that the Web browser and it's add in components are compatible with the Adobe Connect software. In general the IT personnel need to be aware of the proper set up for the computer running the web conferences.

Universities have started regular use of Virtual rooms with in their meetings and teaching activities. It is recommended to have more user experiences of Virtual Campus (including OPTIMA and Adobe Connect) from all of the project partners. User experiences will be collected and reported during the end of the BCBU+ project.

### 4.5 Recommendations

In the BCBU+ project plan one key activity was to equip each Russian partner university one room with sufficient infrastructure to enhance communication over web. The infrastructure budget was limited to 7800€ for each partner university. The physical rooms need to support on line meetings, seminars and teaching for small groups of people (10-20). In practice this means small/medium size meeting or seminar rooms. The model and set up for the rooms and equipment was based on the similar Virtual rooms at UOulu.

Equipment for Virtual rooms was based on search and evaluation on web portals and shops. Technical infrastructure is divided in 7 categories described in Appendix III. The infrastructure supports using the Web Conferencing tools, LMS and other software tools for multipoint or local use of the Virtual rooms. Virtual rooms in Russian universities are connected to existing network facilities and IT infrastructure allowing stable Internet access.

Technical test trials have shown the bottle necks and possibilities in which way the Virtual rooms will be equipped and used. The physical infrastructure needs to be easy for regular users without need for additional technical support. It is important to share user experiences of the Virtual rooms inside the universities. There is need to have an explicit plan of how to use, book, get technical support and keep the Virtual rooms in condition. In addition to the vital issue is sustainability of the Web Conferencing tools and LMS after the project ends. What is the role of OPTIMA and Adobe Connect in Russian universities in the future? The physical infrastructure allows use of any similar systems, it is more the question, and how the users adapt and learn to use new tools



# 5 Distance Learning - Use and Experience

## Selected Examples from BCBU+ Project

### 5.1 Introduction

The handbook editorial committee decided that all partners in the project should be invited to contribute to the handbook. Since the handbook is meant as guidance for setting up distant learning environment, the handbook editorial committee aimed for contribution that could exemplify “best practice” which had relations to the project. The format and style of contributions should be in fashion of a paper or article, but not shoehorned into a scientific paper format of some sort. Invitation to contribute was sent out, an administrative group was established, which constructed a delivery plan, and the editorial group took responsibility for the selection and revisions of contributions.

Part of the delivery plan was status meetings every fortnight. There was held eight status meetings using Adobe Connect. The delivery plan had scheduled three editorial committee meetings as well, but several of the status meetings converged into editorial committee meetings towards the end. Thus, there was held about an equal number of editorial committee meetings.

The handbook editorial committee received twenty different contributions from partners. Some partners submitted several, one as much as seven. The evaluation of contributions was performed continuously. At an editorial committee meeting in Luleå, all contributions were re-evaluated and a final set of accepted articles was decided upon.

The final accepted articles are presented in the following sections.

## 5.2 List of Articles

1. Developing Joint Master's Programme —Comparative Social Work":  
Experience and Best Practices  

Associate Professor, Dr Elena Golubeva  
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2. The Role of E-Learning Tools in Joint Teaching within the Bounds of CSW  
Master Programme in BCBU  

Head of Department of Social Work, Yuliya Petrovskaya PhD  
Page 62
3. Combined Training of IT Specialists with the Use of Virtual Campus Tools  

Senior Lecturer Evgeny Khaymin  
Page 66
4. Organizing Olympiads in Virtual Environment  

Associate Professor Oleg Lyash, and Senior Lecturer Irina Shungina,  
Page 72
5. Use of E-Learning Packages Based on Modular Rating Evaluation System in  
Distance Learning  

Associate Professor Valentina Vasukevich  
Page 80
6. Evaluating and Grading in Distant Learning Courses  

Assistant Professor Arild Steen and Assistant Professor Knut Collin  
Page 93

# Developing Joint Master's Programme "Comparative Social Work": Experience and Best Practices

*Associate Professor, Dr Elena Golubeva  
Institute of Integral Safety  
Northern Arctic Federal University*

As a result of joining by Russia of the Bologna Convention and of the social changes in the recent decades, the Russian higher education system is now subject to new development trends. One of them is switching by many Russian universities to a two-level (Bachelor and Master) system – a transition that requires major preparation, thorough analysis of optimal paths and creative endeavours to update curricula and methodology.

NArFU Department of Social Work, with its long-standing international relations with North European universities and the University of the Arctic and experience in student and teacher exchange, is not new to the issue of streamlining the degree programs. The work to maintain and develop practical training in social work in Russia started within the framework of 2001-2003 Russian-Finnish project, whose activities included the comparative analysis of the curricula being implemented in the universities in North-West Russia, Lapland, Kuopio (Finland) and countries in transition period Lithuania and Poland. Further projects – “Social Work and Civil Society in Neighbouring Areas: theory, practice, training and cooperation” (2004-2006, Finnish Ministry of Foreign Affairs) and Tacis CBC “Promoting Independent Living of the Elderly in Sparsely Populated Areas” (2004-2005, CBC European Commission) – have shaped and strengthened the cooperation between universities. They also served a platform for the Russian lecturers to gain experience in delivering lectures in foreign universities as visiting-professors, as well as to experience new cultures, acquire skills of operating new facilities and publish joint research and methodological materials. Over the years of cooperation with the foreign universities, the practices have been accumulated and analysed as to joint elaboration of research programs, writing and defending the comparative degree papers supervised by international professors and hosting summer international schools in

different aspects of social policy and work. The analysis of the curricula for social work students in Russia and abroad has enabled to define the common grounds in identifying the goals and areas of social work training, which target:

- the strategic and operating planning and research based on a variety of scientific approaches and methods;
- the development of research methods and procedures within the framework of various scientific paradigms (description, explanation and interpretation);
- scientific search that takes into account the specifics of the theoretical and practical social work-related studies being implemented in Arkhangelsk Region, North-West Russia, Barents Euro-Arctic Region and across the world;
- application of the potential available in Arkhangelsk Region, North-West Russia and Barents Euro-Arctic Region, as well as of the international expertise in social outreach that covers social policy and issues, the support in social adaptation and solutions to the dis-adaptation challenges in a given social environment;
- elaboration of the intervention and enrichment programs intended for migrant communities;
- cross cultural exchange between social work experts in Arkhangelsk Region, North-West Russia and Barents Euro-Arctic Region;
- Participation in legislative initiatives proposed by civil society organizations to improve social policy in the region; etc.

The above activities have shaped the understanding of how the education process should be rearranged according to the new requirements and in line with own methodology, and of the direction we should take to integrate our system into the European dimension and to enhance the graduates' competitive power in the labour market through introduction of the internationally recognized joint degree programs and diplomas. The joint degree programs/diplomas may, in turn, enable to:

- gather high competence together in the fields where one institution alone is too small/weak;
- become part of excellent networks;

- increase attractiveness of the study offers and recruit the best students;
- develop innovative studies meeting new demands in society;
- increase candidates' chances in the work market;
- increase competence – transfer of knowledge and study approaches;
- gain international recognition[1]

At the same time, there are numerous challenges that many universities are facing when developing and implementing the joint programs and among them are: differences in national and institutional legislation, regulations and procedures; high demand in resources; discrepancies in work load standards, academic calendars, application process, admission criteria; coordination of the cooperation and support to students; language barriers, different cultural traditions and ways of life.

It is only through the universities' combined effort that the above activities can be successfully implemented – through Barents Cross Border University, a consortium incorporating Universities of Oulu and Lapland, universities in Northern Finland, Murmansk, Petrozavodsk and Arkhangelsk. The joint activities of Barents Cross Border University target:

- sustainable social and economic development in Northern Europe;
- Cross-Border academic cooperation;
- meeting the demand in human resources in the border areas of northern dimension;
- introduction of Bologna process in Finland and in Russia;
- elaborated PhD programs and comparative research projects;
- enhanced multicultural professional skills[2]

The study courses are delivered by Cross Border University in the following formats/methods:

- on-line distance learning designed in close cooperation with partner universities; OPTIMA (student's personal account and member area for

posting study materials and written lectures, discussions); Learn Link (Virtual classroom);

- crash courses delivered by visiting lecturer;
- summer and winter schools;
- student exchange between partner universities and practical training abroad;
- jointly supervised master's degree theses and joint quality control

The BCBU Master's programmes cover four fields: social work, information technology, health and wellbeing, environmental engineering. University matching in each program is based on the participating universities' former cooperation and expertise in a given area. These four two-year study programmes are the EU Northern Dimension's central priorities. The programs follow the principles of the Bologna process.

Among the most interesting and successful contributions to the universities' joint activity are the jointly arranged master's programs delivered in the framework of the intensive course in Lapland University (2009), the winter school: "Social Policy and Human Rights" (2010 in Pomor State University, 2012 in Northern (Arctic) Federal University) and Summer school of CBU and BCBU: "Multidisciplinary Dialogue" (2012 in Rovaniemi). The students especially enjoyed the lectures delivered by the Finnish (European) and the Russian teachers and the comparative analysis of problems as seen by Russia and Europe (Finland), which stimulated a detailed multicultural discussion of various aspects of the material delivered and later found reflection in the master theses. In student's group report we got: "We understand how it is important to apply international experience in development of theory and practice of social work." In addition, such schools enabled informal communication setting and were a source of cultural experiences the students gained in museums, clubs and at exhibitions. This, too, is important for understanding cross/intercultural aspects of the social work. "When you live and think that perfect life is a dream, when you get into the dream, you understand what the reality is. It feels in small things: food in the student canteen is of the best quality, design in and outside the University, amicability and responsiveness of Finnish people." The Video

Conferencing facilities that were later installed increased both the audience of these schools and the availability of lectures, and enabled to cut down on travel expenses.

When delivering the joint program —“Comparative Social Work” in 2009-2011, we came across a number of the system challenges caused by the rigidity of training process that, in turn, results from the strict requirements of the second generation federal education standard in Russia. Moreover, the training process largely lacks integrity and is described as having weak interdisciplinary connections when developing the programs jointly with other institutions, and insufficient academic mobility as compared to the leading foreign universities due to insufficient funding. It has become evident during the first enrolment of students that the administrative practices within the programmes need common development. In this project special attention will be given to the exploitation of information technology in teaching and learning as their development seems important for implementing the master’s degree and later for the PhD degree education. It is vital that the opportunities for long distance teaching and studying are equal to all countries involved. Because long distances are causing more costs in remote northern areas than in the core of the central Europe, this development requires constant evaluation of the so far piloted programmes in order to identify best administrative and academic practices. A part of the best practices is the connection between working life and academic education. The development of training organisation network promotes the practice training in MA level and also forms a platform for collaborative research and development work especially in research education. There is a need to strengthen the link between teaching and practice. Furthermore, to ensure the quality of education the teacher training especially for practice supervising and English needs own intensive courses. Final goal is to continue the academic development towards Cross-Border PhD programmes in Russia and Finland and the Barents region.

The situation described above is encouraging the universities that participate in the Barents Cross Border University’s programs to source additional resources and opportunities to perfect the organizational and administrative aspects of the master programs by applying to Kolarctic Cross-Border Cooperation Program. The feedback from master’s students describes the research and training part of education process as interesting and useful, which is also confirmed by the peer review and the

certificate of distinction carried out and issued by the University of the Arctic. The developmental aims in the BCBU + project, for which the application for ENPI CBC is prepared, are part of neighbouring area co-operation between Finland and Russia in education and civil society. They are as follows:

- the co-operation between countries in the educational fields of master's degree programmes and later PhD programmes are aimed to be stabilized and institutionalized in the spirit of good neighborhood;
- the academic co-operation will be implemented according to Bologna process in co-operation with the Russian universities;
- special attention is given to the quality assurance in teaching;
- the programme aims at increasing teacher and student mobility

The partners of BCBU aim at widening their co-operation more and more towards multidisciplinary, and they are working together in creating the prerequisites for scientific research in collaboration with neighbour universities in Russia. The role of NGOs is taken into consideration in research activities, especially in the fields where there are already contacts with NGOs in EU countries, Norway and Russia. In the implementation of the project these contacts have a specific role when students have their period of practice and collect research material. The academic development of the above mentioned fields promotes the regional stability and more balanced economic and social development. Social work prevents inequality as well as escalation of the social problems connected with organised crimes; health and wellbeing education helps to prevent the widening of drug abuse and infectious diseases. The graduates and later on the PhDs in five academic fields will be supporting the development of society. Similarly, the project effort to strengthen the research component via PhD is expected to reinforce the Russian universities' position in the Arctic in the context of the global educational strategies, while the on-line education tools may boost the appeal of northern areas in the eyes of younger scientists and enable Russian universities to evolve as influential research centers, thus enhancing their graduates' competitive power in the international market.



### References

- [1] Astrid Elizabeth (Tromso University) presentation in Skolkovo session 27.12.12
- [2] Barents Cross-Border University <http://www.bcbu oulu.fi>

# The Role of E-Learning Tools in Joint Teaching within the Bounds of CSW Master Programme in BCBU

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There was an interesting experience of joint teaching within the bounds of BCBU Comparative Social Work master programme. This experience can be useful for organization of future joint teaching and study process in this MA-programme and others.

The name of joint course is —Social work with children, youth and families”. This course was developed by several teachers: Russian teachers (Yuliya Petrovskaya and Svetlana Petoshina) and teachers from Lapland University (Ulla-Maija Rantalaiho and Laitinen Merja). This course is given to second-year master students participating in CSW MA programme and includes three parts:

1. Social work with children;
2. Social work with youth;
3. Social work with families.

The main idea of this joint course is to join and compare Russian and Finnish theory, methodology, practice and problems and construct common scheme or model of social work in this field. Development and teaching of this course implies several lines of cooperation: cooperation between Russian and Finnish teachers, cooperation between teachers and CSW master students and also cooperation between students. This cooperation could be organized in different forms.

**Face to face lectures and workshops.** This form was used in September 2012 very successfully and was augmented with power point presentations which were downloaded into OPTIMA. Face to face lectures is traditional type of lectures and still used intensively in Russian pedagogical practice as one of the most effective types of lessons. They are used for presenting new material, concepts to students as a

review of some parts of the course, some topics. Material for these lectures are chosen and organized by teacher.

Face to face lectures demand more time and face to face meeting but this contact is valuable for establishing a common vision among students and teachers, between lecturers. Also such kind of contact gives opportunity to pay more attention to each student and to answer all questions. Usually material presented in lectures is more understandable.

Some lectures in the frame of the course —“Social work with children, youth and family” were less traditional and included different active forms: discussions, answering question, self-reflection, analysis of situations, etc.

**Discussions, consultations, exchange of information by E-mail.** This form of work was used in communication between teachers on the stage of preparing and elaboration of the course. The main task was to develop complex course including several parts. Every part belongs to concrete teacher. Before giving a course teachers should discuss a content of lectures, sequence of themes, tasks for students and their independent study. Also teachers should discuss the main methodological approaches to study of different aspects of concrete social problems. Teachers can exchange some interesting scientific materials.

E-mail consultation can be used in communication between teachers and students. For example students can get consultations doing some study tasks: essays, summaries, tests, etc.

Very useful and easy-to-use way to share study materials is **OPTIMA System**. It gives opportunity for teacher to download some materials of lectures, presentations. Students can download their works and papers on OPTIMA, to send results of their independent work.

One of the most optimal forms of communication during joint teaching is on-line learning and meetings using special programme. For example Adobe Connect Pro. This form of communication combines advantages of face-to-face learning and Virtual communication. It helps to make good contact. Including video and sound this form of communication makes an effect of personal presence. And at the same time

it gives an opportunity to give lectures from your office distantly. This form of cooperation between teacher and students at a distance from each other includes all components of study process (aims, content, methods, organizational forms, tools). It permits to reduce travel costs, rental costs. On-line lectures can be given to big number of students. And the main advantage is that distance on-line learning permit to make integrated educational environment.

Adobe Connect Pro is regularly used by teachers from Russia and Finland in the process of developing of MA programme Comparative Social Work. It helps to discuss all scientific, substantial and organizational aspects of MA programme, study process and cooperation. During ADOBE CONNECT-meetings teachers discussed questions connected with study guide, planning of scientific and study events, summer and winter schools within the bounds of BCBU.

The best way of communication within the bounds of joint teaching is combination of different forms of face-to-face and E-Learning. It also helps to develop scientific cooperation between Russian and Finnish teachers and researchers within the bounds of CSW MA programme. This cooperation can be and should be continued for example in common scientific researches, writing of scientific articles, development of common project. E-Learning tools are very useful in this process.

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# Combined Training of IT Specialists with the Use of Virtual Campus Tools

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Informatization of society poses new requirements on the professional competency of experts dealing with all sorts of ICT applications, which, in turn, manifests itself in informatization of the education sector. To the foreground also comes the necessity to streamline higher education system in the context of Bologna Declaration, i.e. to start applying modular approach to training, to introduce the rating-based assessment system when assessing students' academic performance, to update the methodology of training process and to arrange for academic personnel's activity in new environment, etc. It is therefore important to further enhance the existing training and re-training system though expanded use of various training formats offered by the multi-level education.

From this perspective, the quality of the programming specialist training largely depends on the trainees' ability to make use of present-day search, processing and systematization techniques as a prerequisite of the on-going pursuit of advanced knowledge.

The optimal application of both conventional and on-line technologies is enabled by the blended (combined) training. More and more focus is being laid today on on-line training programs, on fostering students' independent work in doing term projects and commissioned research and on enhancing lifelong advanced professional training.

The —Programming Languages” course we have recently developed covers the materials of lectures, tasks and laboratory practical work, as well as such auxiliary materials as videos and links to Internet resources. The course page features ‘oad maps’ that are normally offered by teachers to trainees before the term starts. The course also contains core theoretical and practical information on the technology of procedural, object-oriented and Delphi visual programming and is designed to efficiently train learners in creating applications.

Developed E-Learning course —Programming Languages” allow to acquire of competence in programming language theory and in efficient use of options offered by various programming languages for problem solving purposes.

Training will rely on point-rating system, with performance being assessed on a scale of 100 points.

This E-course comprises

1. Lectures. Arranged in 8 modules and supported by links to videos and additional materials, they offer theoretical knowledge.
2. Practical assignments (10 points) that target skills strengthening and knowledge application.
3. Laboratory work (55 points) that target testing of acquired theoretical knowledge in the given modules.
4. Testing (5 points), i.e. intermediate learning outcomes assessment.
5. Final examination (30 points), i.e. final academic performance (theoretical knowledge and problem solving skills) rating.

The —Programming Languages” course is available on Sakai on-line learning platform operated by NArFU server at <https://sakai.pomorsu.ru>. Access is provided upon authentication using user name and password.

Registered course trainees gain access to all theoretical content and guidance materials. There is a timeline for covering the material, which limits the time available for students to submit the assignments to be assessed. The materials are presented in a convenient format and can be easily downloaded, while some pieces of information are supported by videos and presentations.

Training will be arranged in a combined format, meaning that a certain portion of the material will be delivered during lectures and practical work while the rest will have to be covered by the trainees on their own, using the resources offered by the institute.

The course will end in face-to-face examination designed to assess the knowledge of the theoretical materials and the skills in applying the knowledge gained.

## **BCBU+ Handbook**

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A trainee's overall progress will be graded on a scale of 100 points, with the final grade converted into a 5-point scale and registered in student's record book.

As part of BCBU+ project, the partner universities have been installed with Virtual classroom software for hosting on-line lectures and webinars via different means of communication. To post their content and trainees' progress assessment results, participants may use the options of Adobe Connect Pro or LMS OPTIMA.

OPTIMA is a high-quality and cost-efficient online environment developed by Discendum together with its customers. Over 200 different educational institutions, businesses, associations and other organizations have chosen OPTIMA for implementing their training projects online. OPTIMA is available as a hosted SaaS service (Software as a Service), which means you can use it anywhere over an Internet connection. Discendum provides hosting, software updates, data security, technical support, training consultation and integration services for OPTIMA.

The Discendum OPTIMA service solution is an innovative learning environment, which offers opportunities to utilize different learning models and pedagogical ideas. It incorporates efficiency and versatility, as well as the diversified group work and collaborative features required for demanding project-based learning.

The structure of the learning environment is highly modular. It consists of objects, which serve as nodal points in the learning process. Within these nodal points, supervisors, user groups and individual users can combine static documents, exercises, discussions, comments, bulletins etc. in numerous ways.

The system also allows for posting content through such basic tools as Text-editor, HTML-editor, and Web-editor. A tutor, thus, enjoys a greater scope of the advantages offered by web documents, as it is possible to create links to outside sources such as web-pages or videos. Student-teacher and student-student interaction and feedback are maintained through such LMS OPTIMA tools as forum and chat. Adequately used, all these resources also allow for team work and the problem-solving process to be arranged in brainstorm mode.



Calendar, a tool for scheduling an educational pathway, enables setting of the deadlines for material submission and the general description of the E-course structure.

It is possible, with LMS OPTIMA tools, to translate the Programming Languages E-course onto this system's platform and enjoy its benefits. The courses being developed as part of BCBU+ will be also delivered in English – to master's degree students taking international training programs.

Another product making use of the potential of the on-line training is Adobe Connect. Adobe Connect is a solution format for hosting on-line business meetings and instructive teaching. Among its primary advantages are

**Availability.** Adobe Connect does not require installation of any extra software. A conventional workstation's web browser and flash player will suffice.

**Interactivity.** Adobe Connect is suitable for both smaller meeting and large-scale conferences (with up to 2500 attendees). All attendees may be classified into three groups: initiators, presenters and listeners.

The initiator, whose function is to invite users, passes the floor between listeners;

The presenter, who can make his workstation screen visible fully or partially (a certain application only), may also pass the right of voice;

Listeners may ask each other questions – addressing everybody or privately a certain attendee – or signal standard requests (to ask a question, to speak up, etc.);

Provided they have webcams (and permitted by initiator), all attendees may communicate images of themselves;

**Simplicity.** Adobe Connect does not require installation of any tailored software. A conventional workstation's web browser and flash player will suffice. The user interface is easy to navigate and not congested with menus or buttons.

The Adobe Connect-based webinars enable to host video and audio broadcasting, representing of presentations, possibilities of holding forum and chat, interviewing,

broadcasting desktop, immediate transferring of remote management to any of the webinar participants. Included into the project lecturer may request providing a Virtual room in the Adobe Connect system and then conduct classes using all system services, which open possibilities of distance-learning. In my course "Programming Languages» a Virtual room which was created for me will be used for seminars and projects discussions, this increases opportunities for joint work of students and teachers and enhances student-teacher interaction. The Adobe Connect recording function offers two more features that can be advantageously used in on-line training. The first one would be in-demand with students who may miss a webinar or fail to understand materials and thus may use the opportunity to go through them again when and where convenient. The second feature allows for hosting webinars in a format other than the real-time, i.e. as an instructive video session with presentations and other interactive tools.

Arranged on-line, the combined training does facilitate perception of material by students, allows more room for handling content independently and sourcing the required information by using the on-line resources. With the support from BCBU+ resources, it is planned to expand LMS OPTIMA and Adobe Connect Pro application to the disposal of the Institute of Mathematics, Information and Space Technologies. Delivered in English, the developed E-courses are expected to enhance the interaction between Barents universities and to foster implementation of joint international master's degree programs.

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# Organizing Olympiads in Virtual Environment

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## Abstract

The article describes MSHU experience in using automatic checking system by teachers from IT and General Technical Sciences Department. It also elaborates on possibilities of using such systems in study process and organizing programming Olympiads.

Key Words: programming, Olympiad, contests, programming tasks check-up

Intensive introduction of information technologies (IT) in different human activities contributes to forming a type of information environment which builds up user's working space. Constructing this type of space is also characteristic for today's education system which is accumulating information and communication technologies. This leads to the fact that students work not only directly with each other and the teacher but also communicate by means of today's information and communication technologies in a particular educational environment. We believe that *Virtual educational environment* is a multilevel and multifunctional system comprising today's programming and hardware tools of E-communication for interaction of learning process stakeholders(1). This educational space may include a number of components (for example, teachers, students, learning materials, visualization systems, automatic check-up tools in programming tasks) which are joined together through today's web-technologies.

When training future specialists in different IT aspects a great role plays the skill of not only using ready-made program products but also of developing them. Importance of this skill is reflected in today's education system where programming is highly represented. For instance, A. P. Ershov in defining key Information Science areas represent programming as an independent area along with such areas as theory of computational experiment, theoretical basics of computation, statistical theory of information and artificial intelligence.

One of the tools of enhancing students' programming skills can be programming Olympiads. They are a contest between students for best completion of programming tasks. As a rule the tasks require from students not only programming skills but also serious mathematical and logical knowledge, knowledge in the field of algorithms theory, operations and quantitative methods.

History of holding programming contests on the world level started in 1997 with the world team programming championship among teams from higher education institutions from all over the world (ACM International Collegiate Programming Contest). Since then these contests have been held annually with the steadily growing number of participants which is the evidence of steady interest in such kind of contests from the one hand, and a demonstration of growing demand for specialists capable to find solutions in extreme conditions for a short period of time on the other. It should be noted that students' participation in these contests motivates them to study mathematics and programming more seriously. Besides, students gain an experience of individual and team performance.

One of the tools for enhancing programming skills among students can be programming Olympiads. At Murmansk State Humanities University three programming contests are held annually: in autumn, winter and spring. Autumn and spring Olympiads are traditional and held face-to-face among students and school pupils according to ACM rules. Winter Olympiad is organized as an E-marathon and within one week students solve a wide range of Olympiad tasks at any time suitable for them. All the tasks, prepared by the teachers, are automatically checked using a special programming tasks check-up system. One of perspective steps in this direction can be international arctic programming Olympiad for BCBU students. This will enable to enhance motivation of both students and teachers and add contest character to their work.

As a rule, all the tasks developed by teachers for Olympiad are checked in automatic mode with assistance of special programming tasks check-up system.

Today there is a big number of solutions for arranging and holding this kind of contests. Modern automatic programming tasks check-up systems can be classified according to the type of access into online and local. To the first type belong check-up systems

with only online work option and without any possibility to install the software to the university's computers. The following systems can be referred to this type:

- Website of Internet Olympiads for pupils in Saint-Petersburg
- Website of Moscow online Olympiads
- Website of —Programming Olympiads at PhizTech”

The second type of check-up systems can be represented in program products which can be installed on university's server and access to them can be obtained through a web-interface. Here are some examples:

- contestester (<http://www.contester.ru/>);
- eJudge (<http://ejudge.ru/>);
- uJudge (<http://code.google.com/p/ujudge/>).

It should be noted that in spite of similar functionality (a web-interface, many programming languages, Russian interface) of such systems, the easiest system in terms of installation and administration is the automatic solutions check-up system of Contester.

Contester is a system for tournaments and individual tasks solving in Olympiad programming (sports programming). Initially, the system includes a wide set of Olympiad-type tasks. The system supports a wide range of compilers for different programming languages, like C++, Object, Pascal, Java, C# and Visual Basic. One of its advantages is possibility to work both in Linux and Windows operational systems.

It is noteworthy that Contester uses a system of rules developed for programming contests (ACM-ICPC). ACM-ICPC rules system is designed for teams of not more than 3 people. Contest time is limited to 5 hours and consists of 8-12 tasks. Contesters should solve given tasks and send them to the server for check-up. If the solutions are not correct, the teams are given penalty points (20 minutes). Ultimately, the winner is the team which solved the biggest number of tasks with minimal number of wrong solutions.

Each solution is compiled with the server compiler, and then the solution is checked with a set of tests. If the solution outbound file does not correspond to the correct solution, a message about wrong solution to test X (X is the test number) is given on the screen. The system enables to strictly set the time for each test and in case of exceeding the time limit, a relevant message is given as well.

Contester System consists of a HTTP server, testing module and database. Access for users is provided through a web-interface and any of today's available web-browsers.

The system is designed for two kinds of users: testers and administrator.

A tester has limited authorities and can only register, get access to programming tasks and reference system, send the solutions for a check-up and view the check-up results. Each user can view the tournament table and discuss the tasks in the forum incorporated into the system.

The System Administrator has a wide range of authorities and can add new tasks and set up the programming contest. It should be noted that until recently Contester tournament system supported only one administrator's session but latest versions provide for several administrator accounts in the system. This enables to pass administrator authorities to programming teachers. Each teacher with such advanced authorities can easily use this system in study process. In this case, teachers can create new accounts, add new tasks, configure new test assignments, and view the students' solutions.

Starting from version 2.3 Contester tournament system enables to distribute check-up workload to several servers thus considerably increasing the system response in general. As a rule, this kind of scale is needed only for large-scale events like programming championships or Olympiads.

Installation process can be divided into three stages.

The first stage consists of installing compilers of programming languages. It is noteworthy that compilers installations before the tournament system installation lets avoid problems with further automatic detection of installed compilers.

The second stage comprises installing Contester tournament system into the dedicated server. In case of installation in Linux OS it is necessary to install database server of firebird.

The third stage includes organizing access to the local network via Internet. At this stage one should configure the tournament system by setting up the port for all users and the option of automatic server running. For this purpose Contester should be added in the services list. At this stage there is a possibility of automatic server start and Contester should be added in the list of automatic start services.

As an extra instalment stage we can mention organizing access to the check-up server through the Internet.

There are several ways to arrange this kind of access:

1. Use an independent IP-address for Contester server;
2. Use redirection command to internal resource from the institution's web-server;
3. Use a Virtual Private Network.

The first way is the easiest in terms of practical implementation because it is less time-consuming to configure it from administrator's side. In the second case the administrator should additionally activate institution's web-server capacities in redirecting external requests to internal resources. For example, for Apache web-server one should activate proxy\_http module and add redirection commands to the configuration file.

The last option of access arrangement requires from users a high level of networks technologies skills. One of the easiest variants of arranging this kind of access can be using specialized VPN-Hamachi server. When using this log-in option one should install additional software both on this server and users' computers. After that it is necessary to initiate creating a Virtual network and disseminate its parameters among users.

After the set-up system users can get access to it via the web-interface at the address given by the administrator.



This means that availability of access through a web interface and quite simple set-up and instalment enable to integrate this programming tasks check-up system into already institution's existing software facilities or BCBU network.

Using this kind of systems in the study process, apart from their main purpose (holding contests), makes it possible to use the teacher's time more effectively because at initial learning stage many typical tasks can be checked in automatic mode. In its turn this gives the teacher time for individual work with students and students receive check-up results more quickly as well as a stimulus to develop their programs testing skills.

According to O. V Yakimenko the best form of problems solving is not only sample algorithm implementation but also a creative solution gained during an independent problem analysis. Solutions check systems make it possible to put into practice problem-based approach (3) to learning programming. The fact that in the simplest case test pairs for incoming and outgoing data for checking student's solutions are used makes it possible to carry out analysis of student's performance without analysis of the algorithm itself. In this way, rational use of automatic solutions check system enables to provide for —power reserve” which facilitates forming anticipatory thinking functions. (4; 5; 6)

One of important advantages of using tournament systems is future IT teachers' involvement in such systems from position of both an administrator and user.

Using Contester system for a long time has revealed some peculiarities. For example, Contester makes it possible to use a wide range of today's available programming languages (C++, Pascal, java, C#, python etc.)

In its turn it creates some problems in the practical side of contests arrangement. Because some programming languages provide a wide set of functions (for example, C#, python) which provide quick tasks implementation. But from another hand it takes more time to implement similar functions in other languages (C++, Pascal). In its turn it creates certain difficulties in practical side of contests organization because solving problems using Olympiad programming languages (for instance, C# or

Pascal) is often more time-consuming than a similar solution obtained with rich functionality of such programming languages as C# and Python.

In order to solve this kind of problem Contester functions in two modes: study mode and contest mode. Study mode covers the whole range of languages and this makes it possible for teachers to work with any necessary programming language in the study process. In contest mode administrator leaves available only those programming languages which are in the same —weight category”.

Summarizing our experience of holding annual Olympiads, it is possible to observe students' growing interest in programming which is reflected in forming permanent teams who regularly participate in university and other institutions' contests as well as increase in general students' performance in programming

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# Use of E-Learning Packages Based on Modular Rating Evaluation System in Distance Learning

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## Abstract

The article concentrates on using E-Learning packages based on modular and rating evaluation system placed in LMS MOODLE for Life Safety students. The article elaborates on opportunities and shares the results of using LMS MOODLE for internship management. It also gives ground for effectiveness of joint research between students and university and school teachers and enhancing possibilities of E-packages in E-Learning.

## Key Words

E-Learning package based on modular and rating evaluation system, LMS Moodle, E-Learning, technology, Life Safety, Life Safety teacher, research

Recently more and more attention has been paid to enhancing learning process quality and introducing E-Learning technologies. One of the main tools used in E-Learning is E-Learning package and its quality has a considerable impact on education quality in general.

In conditions of today's society development training teachers is of high importance. Today a teacher cannot organize research, reasonably demand from their student's high level of learning material assimilation, well-formed competences and competent research experiments if he/she is not able to use modern advanced educational technologies, does not use multimedia equipment in class, and does not use didactic potential of ICT and E-Learning technologies.

In this direction at Murmansk State Humanities University teachers from Life Safety and Basic Medical Training Department are conducting active and systematic work on enhancing the process of training Life Safety students. with specialization in Information Safety. E-Learning technologies are being introduced solely on scientific

basis which makes it possible to teach in a new way, form important professional qualities, develop not only pedagogical but also research thinking of students and enhance informational competence of future specialists.

Taking into account practice-oriented specifics of Life Safety course and Life Safety teacher's work aimed not only at giving theoretical knowledge but also at forming concrete practical skills and competences, training Life Safety students at MSHU is carried out using advanced pedagogical tools, methods and technologies including those which implement didactic potential of ICT and E-Learning technologies. These technologies enable to: change existing traditional study process model at higher education institutions; actively use Internet resources; timely check quality of specialists training; develop E-resources for studies purposes as well as for checking students' knowledge and skills for further using in LMS.

Let's consider it at the example of the key course for Life Safety students taught from the end of the second year till the end of the fourth year called —Theory and Methods of Teaching Life Safety”. Students follow this discipline with certain difficulties which is due not only to the fact that its total workload is 372 academic hours but also because the course comprises two pedagogical internships and two additional modules (Using Modern ICT in Study Process and Audio Visual Learning Technologies) as well as one course paper and graduation thesis. In this respect a strong need arises in making study process logical and proper distribution and further alternations of theoretic, practical and research students' training. Secondly, teachers should have an opportunity to give new knowledge to students, develop practical professional skills and competences based on multidisciplinary and integrated approach.

It became possible to solve the above challenges by stimulating the department teachers to use E-Learning packages based on modular rating evaluation system which were later actively used in E-Learning.

Introducing E-Learning packages in learning process creates new pedagogical tools thus giving new possibilities. This changes teacher's functions and considerable widens' a share of students independent learning.

E-Learning package is a thematic, detailed and structured learning material which is delivered to learners via the Internet or on CDs/ DVDs. From pedagogical design perspective, E-Learning package should contain all the necessary material for independent learning including a bloc of practical and test assignments for knowledge control. Besides, unlike a printed textbook, E-Learning course should be developed in such a way so it could provide

- a more detailed structure of the course content
- interactivity – a possibility to change the learning material depending on learner's actions as well as to change learning trajectory
- hyper textual structure of theoretic material (links to definitions) and a system of links to electronic text and graphic materials, E-Libraries and other educational resources
- different practical and testing assignments for self-evaluation, gained knowledge control (tests, exercises, individual and group assignments)

MSHU teachers started their work in 2006 with developing a unified model of an E-Learning package based on modular and rating evaluation system. They gave the following definition to an **E-Learning package based on modular and rating evaluation system** as a totality of structure elements (instructive, conceptual, content, methodical, control and evaluation) and tools of integrated influence on students aimed at developing their information activity, information interaction, learning and teaching materials automation and students' performance control implemented as an educational resource and used for forming knowledge, skills and competences within the course.

Being a modern learning instrument for students, E-Learning package based on modular and rating evaluation system is developed by a teacher or a group of teachers with the aim of:

- introducing innovative learning technologies,
- efficient management of students' independent work
- implementing learner-centered approach

- organizing efficient students' cognitive activity by means of rational combination of different ways of learning material introduction based on didactic potential of ICT

The above gives a teacher a possibility to:

- help students in learning and making their theoretical knowledge systematic
- form practical skills and enhance their current skills and competences
- rationally use and combine different educational technologies in learning process
- present learning material in different ways (text, graphics, audio, video, animation etc.)
- systematically control education quality
- efficiently organize and monitor students' independent work
- implement learner-centered approach
- manage students' cognitive activity
- cooperate with students in interactive mode at any time, place and rhythm using E-Learning technologies

E-Learning package based on modular and rating evaluation system has the following advantages:

- clear course structure
- possibility to trace connections between the course elements
- visualization
- vision of learning prospect
- learner-centered approach in learning
- multi-functionality
- possibility of self-control and self-assessment
- integrity

- accumulative principle of student's performance evaluation
- forming independence
- training in choosing own learning trajectory and taking responsibility for it
- forming a subject position in learning

In order to confirm relevance of using E-Learning package based on modular and rating evaluation system an experiment was carried out in 2006-2012 first at the Department of Life Safety and Basic Medical Training within —Life Safety” specialization and then in the whole university.

Developing E-Learning packages at Russian higher education institutions is a significant task these days and it requires following not only classical didactic principles but also principles relevant for E-Learning: variability, equality, openness, independence, interactivity, modularity etc. (1, 4, and 6)

Russian and foreign practice demonstrates prospectively of using modularity principle in education which implies integrity, completeness and logic of learning material design in the form of separate modules. A module is a functional learning unit which integrates learning content as learning elements and technologies of using them. Using modularity principle in learning process is very efficient and will be further called in this article modular learning technology. Pedagogical technology enables to make the learning process as a clearly structured system of successive operations leading to success in learning (9, 10, and 11). Using modular learning technology in E-Learning package makes it possible to represent the learning material as an integrated pedagogic system in which each element (module) is connected with other elements (modules).(3)

The module structure consists of the following elements: objective (general or specific); content (lectures, assignments for seminars and lab works); reading material (additional and reference literature); control (start, current, intermediate, final), assessment procedures (2). At the same time a learner has an opportunity to change all the module elements and manage the learning process. According to P. A. Utsavichene in modular learning a learner can independently achieve concrete objectives in the process of work with a module (12, 13). He chooses his individual



way of following the learning programme taking into account his own needs and capabilities. Teacher's function varies from giving information and control to consultations and coordination.

Along with modular learning technology, point rating system of evaluating students' performance is used when developing E-Learning packages. Point rating system is a system of points accumulation which reflects students' performance and their creative potential. At the same time, it takes into account all the student's activities connected with acquiring knowledge, skills and competences. Point rating evaluation system is used for evaluating specialists training quality and meets the demands of Bologna process in which European cooperation in knowledge quality control is aimed at using a system of clear and comparable grades, criteria and methodologies. Being in accordance with common European requirements, point rating system enables to give an objective evaluation of student's competences in each discipline by means of current, final and intermediate control within 100-points scale with further transfer into ECTS system and defining students' rating.

When technologies of modular learning and point-rating system are united, it is possible to speak of modular rating evaluation system which implies following a certain discipline (as well as internship, graduation thesis) in modules and each module is evaluated in points by means of control and final rating (2).

However, when using modular rating evaluation system in E-Learning packages teachers face some challenges. First of all, teachers should have a clear understanding of evaluation methodology in 100 points system and further transfer of students' points into Russian four - grade grading system and European ECTS system. Secondly, in order to give objective evaluation of students' performance, a teacher needs to develop not only clear assignments system but also effective evaluation criteria. Thirdly, modular rating evaluation system requires wide use of ICT for processing a large amount of data and having fast feedback between students and teachers. As a result of searching for solutions to the above problems connected with learning achievements evaluation, a large-scale experiment was carried out at MSHU among students with specialization in —Life Safety” and special methodology and E-tools were developed and incorporated in learning process

including detailed recommendations on how to use point rating evaluation system at different learning stages and in different kinds of academic activities. (2, 3, 4)

LMS Moodle was chosen for carrying this experiment and incorporated in study process for “Life Safety” students and it was confirmed that students became able not only to use teacher’s learning materials at any time and place but also build their own learning trajectory and achieve set academic and research aims.

It can be considered in more details at the example of pedagogical internship. Being an important and significant stage of future Life Safety teachers training, a 5-week pedagogical internship is rather complicated. Students teach only in high school (9-11 forms) and combine the functions of Life Safety teacher and homeroom teacher. Students also simultaneously carry out psychological and other kinds of research.

In this respect when enhancing their pedagogic competence connected with fulfilling key Life Safety teacher’s functions and forming important professional qualities, students solve a number of tasks which include:

- consolidate and deepen their knowledge, skills and competences gained at university
- master different methods, technologies and techniques of giving a Life Safety lesson, extracurricular activities
- test innovative learning technologies —“modular learning”, —“hypertext lecture”, —“Social and psychological training”, “ICT”, “E-portfolio”
- control over students' learning achievements using modern evaluation tools based on ICT
- enhance their own teaching skills with regard to requirements to teacher's work and analyze their own and colleagues' teaching.

Taking into account today's tendencies in Russian education connected with increasing use of E-Learning technologies, in 2011-2012 students were for the first time offered to complete a difficult but not less interesting and significant task of taking part in research conducted by teachers from Life Safety and Basic Medical Training Department and Psychology Department on the premises of research

laboratory —ICT Educational Technologies in the North” (<http://www.mshu.edu.ru/moodle2>). The research objective was studying a possibility of widely using and incorporating ICT and E-Learning technologies into Life Safety students' internship and school course of Life Safety Basics.

In order to carry out the experiment leader of research laboratory —ICT Educational Technologies in the North” and MSHU teachers did a large-scale organizational work.

1. Practical training of methods, technologies and techniques of using LMS Moodle was organized for teachers by means of developing and using personal E-Learning packages based on modular rating evaluation system in different academic disciplines (Theory and Methods of Teaching Life Safety, Modern ICT in Learning etc.)
2. Skills of using ICT technologies were purposefully developed for Life Safety students for practical use within learning process at schools and universities.
3. Students were taught technologies of developing personal “E-portfolio” and “E-Learning package based on modular rating evaluation system” in LMS Moodle for school course of Life Safety.
4. A seminar was held for headmasters, deputy headmasters and school Life Safety teachers on the topic of “Modern ways of organizing internships for Life Safety students at educational institutions in Murmansk and the Murmansk region” and the following topics were discussed: use of modern pedagogical, ICT and E-Learning technologies at Life Safety lessons; incorporating LMS Moodle in Life Safety course both for regular pupils and home schooling pupils.

Altogether, at the preparatory stage 32 students, 5 university teachers and 7 school teachers were involved. The preliminary work enabled to start experimental research in using E-Learning technologies within Life Safety discipline in LMS Moodle right since the first day of students' internship.

At 17 general education institutions in Murmansk and the Murmansk region (schools, gymnasiums and lyceums) 400 Life Safety lessons for 725 pupils of 8-11 forms as

well as 130 extracurricular activities were given by trainee students and further developed and put in LMS Moodle. All the students had an opportunity to run their own projects connected with developing E-packages based on modular and rating evaluation system. 32 students and 4 trainees developed and put 6 Study Life Safety courses in LMS Moodle and took part in the contest —“The Best IT Teacher”.

For the first time 120 high school pupils had a chance to follow Life Safety course using LMS Moodle and E-Learning technologies. In the result it was agreed about carrying out joint research with the aim of deeper integration of academic and university science for enhancing highly qualified staff training in the sphere of information educational technologies and coordinating joint research and incorporating it in teaching practice in the North.

It should be noted that absolute advantage of using ICT and E-Learning technologies in LMS Moodle in the course of students' internship is that students' participation in research conducted at Life Safety and Basic Medical Training Department encouraged them to activate their own research. Students were able to define the topic of their year paper on —“Theory and Methods of Life Safety Teaching” as well as their graduation thesis.

A significant result of university and school teachers work became establishing in LMS Moodle a broad database of E-Learning content on Life Safety which included:

- supportive notes for Life Safety lessons
- plans of extracurricular activities
- lessons analysis, photo and video reports, speeches from teacher-parents meetings

These materials contributed to exchange of pedagogic expertise and efficient time management when preparing to the lessons and activities within Life safety course.

All the students' materials put in LMS Moodle were timely evaluated by supervising teachers. Evaluation objectivity was reached by using modular and rating system. In the result of control activities done during the whole internship period in LMS Moodle and using E-journal of students' performance control students developed high-quality

personal E-portfolios. The latter can be further used when searching for a job, applying for a master or PhD programme or teaching career.

In conclusion, summing up internship results, we can mention some important (but not realized under general conditions) positive aspects which became possible owing to active use of LMS Moodle: continuity of learning process due to systematic interaction between all the stakeholders; efficiency in solving current issues; regular control, evaluation, consultations and coordination.

After students' pedagogic internship was finished it was decided to continue the research work between MSHU teachers and research laboratory —ICTEducational Technologies in the North”.

In general, summing up the results of using E-Learning packages based on modular and rating evaluation system, we can mention a number of positive moments:

1. borders of academic disciplines were broadened by means of active co-creation between all the learning process stakeholders;
2. efficiency of solving study and research tasks;
3. integrating different learning technologies with further development of teaching and learning materials.

The experience described above is a demonstration of how E-Learning packages can be used for enhancing education quality. E-Learning packages can be used when running BCBU master programs and it is a good way to stimulate learning activity, control students' knowledge and make education more learner-centered and effective.

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# Evaluating and Grading in Distant Learning Courses

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## Abstract

This Article is a review of challenges regarding student skills evaluating with the traditional on-campus methods, and how they extends to distant learning. Solutions that have been devised to tackle challenges are discussed. The first part of the article describes the methods and how they apply to distant learning and the latter describes some of our experience in practicing.

## 1 Background and Challenges

Traditionally paper based, no-aids exams, still perform well of evaluating a student's theoretical skills. New pedagogical methods and the use of computer based information systems spur new methods for evaluating student skills and progress. Ultimo the 90's the Norwegian Government lounged new directions for evaluating pupils in the primary and lower secondary school (1-10). Portfolio assessment was one of several improvements one sought to implement [1]. This influenced on higher education and a transition over several years has evolved, implementing new pedagogical methods for teaching and evaluation

Learning Management Systems (LMS) such as It's Learning (ITSL), [2] Class Fronter, (CF) [3] Optima [4] and the alike, also improved over the years. They included useful testing tools, both in the form of multiple choice and essay style answers. These testing tools was gradually adopted as equals to paper based exams. The use of testing tools available in several LMS, led to more frequent testing during the course semester. This again, lead to a more distributed grading over the whole semester. Students did not have to rely on a single exam as the finale grade, which was an improvement. These LMS also incorporated mechanics to support the governments' directives for new pedagogical methods such as portfolio-based assessment.

The use of LMS and testing tools then over time moved all student information, evaluation, testing and administrating of a single courses and curriculum over on a digital platform. The next obviously step was to move the course content from the black board to a digital board using computers. The lecturing, administrating and communication with students take place via Internet-based tools. This is where we are at now. All courses for all programs in Bachelor Engineering at Narvik University College (NUC) are distributed real time and/or as a recording of the lecture. Lectures are available in our LMS, and all information and communication exchange with students is done with adjoining Internet-based tools. This is not fully implemented for our entire master's program. The same techniques are in use, lectures and courses are transmitted real time and recorded, but each individual lecturer will have to decide to do the deployment. For our bachelor degree, the university board has decided that all programs are to use distant learning technology.

Since the complete curriculum, including all courses, are accessible on the Internet for our Bachelor programs, NUC gained students residing all over Norway, abroad as well. This was expected, but soon emerged a challenge regarding testing and evaluating.

All tests and exams, being on paper or digital, are traditional proctored and performed on-campus. When NUC gained students studying and residing off-campus, the proctoring had to be in place. There were two main alternatives. Either the student had to travel to Narvik, stay overnight, or the student self must organize proctoring with an acceptable organization, institution, or govern. Acceptable amongst several are police, other university, municipal, and study center collaborating with NUC.

Since the frequency of testing has increased due to the use of Internet-based tools, this meant increased proctoring, both on-campus and for those off-campus. NUC received at some point complaints about cost reaching as high as NOK 5000,- for proctoring, travel and accommodation for each test. The general rule was about three such tests per semester per course. This was an example on the extreme end, but was a wakening to a rising challenge: how to proctor test and exam for both campus and distant learning courses, keeping cost, workload, and administration, to a minimum for both the student, lecturer and the administration.

In continuation of proctoring for on- and off-campus, yet another challenge emerged. The new challenge was proctoring and administration for courses with large number of students (150+ students). In the event of a 5 hour, paper based essay-style exam for 150+ students, the time needed to mark all answers is considerable. Also worth mention is the event of a 45 minutes digital test (for instance multiple choice) for 150+ students on campus. This require equal amount of available computers at the same time. The proctoring for such a test is challenging. Not to mention that this should take place, on average, three times a semester.

NUC is facing what all other institutions struggles with in respect to testing and evaluating student skills in online-distributed courses: the cost of proctoring and administration (both for students and institution), how to assure student identity, and how to control the use of aids and avoid cheating.

### **2 Cost of Evaluation**

What is acceptable cost of evaluating student skills, both for the student and the institute? There is always an incentive to keep cost as low as possible, but evaluation does have a price.

#### **2.1 For the Student**

For the students on campus the cost is negligible. For NUC's larger population of student on distant learning situated all over the country and abroad, there is a significant cost for the individual student in getting a grade. This manifest itself as travel cost, proctoring cost and fees for administration and premises. In unfortunate cases this amounts to a rather large sum, as much as NOK 15.000,- is reported for 3 proctored digital exam. NUC cannot stand by and accept such large cost. NUC is still in the process of investigate and experiment with different types of evaluation techniques. The aim is to reduce possibility of cheating with identity and aids. If acceptable methods can be established through computer based information system, this will contribute to reduced cost for the student.

Govern by NUC exam regulations and other guidelines and rules, depending on the type of exam, the student on a distant learning course must by own virtue organize, for NUC, acceptable location and proctor for all tests and exam. Several official

institutions and other collaborative bodies are acceptable for NUC. The majority of these locations charge some fee for the use of their facilities, which the student must pay for. In addition, NUC has an exam administrative fee for setting up, collecting and transmitting the exam paper from student to examiner. The examiner normally consists of a lecturer and an external examiner. The minimal cost of each test for a distant learning student is NOK 500,-. This is the administration fee. Then proctoring and locations cost can vary from zero and up, but several students have mentioned NOK 1000,- per test. For a course with 2 – 3 partial exam this mounts to NOK 3.000,- – NOK 4.500,- in fees for the student.

### **2.2 For the Institution**

The main driving factor for the institute is time. The evaluation and marking paper based exam takes time. Normally an experienced lecturer uses 15-20 minutes per exam for a 5 hour written paper based exam. For a normal class of 30 students, this is 10 hours. For a 100 students' class this amounts to a full workweek (34 hours). An examiner have difficulty marking all exams in one stretch. It is common to see that marking an exam set takes a couple of weeks to complete. In the NUC exam regulations, there is an exam-grading limit for 3 weeks. Thus, the student will have to wait for 3 weeks to know if he/she passed or not.

In order to reduce time on grading an exam, other techniques and digital tools are used. This, however, moves time consumption over from grading to administering and setting up these other techniques and digital tools. For instance, an essay style paper based exam takes about a couple of hours to construct and a couple of days to mark and students get their grade in about three weeks. Using a digital testing tool to construct a mixed question type online exam can take as much as a week to test and finalize. Taking the exam takes the amount of time the exam was decided for, but marking can be done instantly automatically and the student get the grade as he/she finalize the exam and leave the premise.

Another time consuming activity have emerged. Since students on distant learning quit often have a full time job in addition, they wish for different times they can take the test/exam on. This is a request NUC tries to accommodate. The test or exam then is available at different times. This increases the time spent on administering,

setting up and creating the exam. If the course runs annually, one saves in subsequent setup of the exam. The workload is then shifting from marking an exam, to setting it up, and there is a significant time saving in doing so.

### 3 Research

We have identified a number of parameters that relates to the cost of evaluating student skills. The level of detail can be increased by specifying details for each type of exam. For instance, paper based exam can be essay style, multiple choice, short answer, or a hybrid. We have separated the cost for an institute and a student since there are some difference in identified parameters. Table 1 and Table 2 present these parameters.

Table 5.1 Institute Cost

What	Institute cost																							
Where	On campus								Off campus								Mix on/off campus							
Exam type	Portfolio		Oral		Digital		Paper		Portfolio		Oral		Digital		Paper		Portfolio		Oral		Digital		Paper	
Pedagogical influence	Original	Modern	Audience	Sensor	Computer	Smartphone	Essay	Scema	Original	Modern	Audience	Sensor	Computer	Smartphone	Essay	Scema	Original	Modern	Audience	Sensor	Computer	Smartphone	Essay	Scema
Proctor	n/a	n/a							n/a	n/a							n/a	n/a						
Non proctor																								
Large # students																								

Table 5.2 Student Cost

What	Student cost															
Where	On campus								Off campus							
Exam type	Portfolio		Oral		Digital		Paper		Portfolio		Oral		Digital		Paper	
Pedagogical influence	Original	Modern	Audience	Sensor	Computer	Smartphone	Essay	Scema	Original	Modern	Audience	Sensor	Computer	Smartphone	Essay	Scema
Proctor	n/a	n/a							n/a	n/a						
Non proctor																

The next step is to investigate closer the relationship between identified parameter, if needed, rearrange the parameter, and if findings so do require, add new parameters. The identified parameters are addressed with the cost per exam. The idea behind is to identify if there are some types of exams that stand out for certain needs in evaluation with respect to the cost of arranging an exam. We need also be aware that the type of exam influences on the learning method [6]. Thus, we need to

address the pedagogical influence of the different types of exam. All the above-mentioned parameters are subjects of further investigation in a separate research.

### 3.1 Pedagogical Aspect

In which way does exam and examination form influence on the students learning. This question was raised by University of Oslo in an in-depth questionnaire in 2000 [6]. Some of the findings was that students find it positively to vary among examination types. They also reported that writing skills plays a big role on the exam, but students receive little training in writing. Students also pointed at the exam question and the exam situation as a whole, dictating the use of memorizing techniques of curriculum. Moreover, the students mentioned that studies should qualify for work life, but find that the exam situation is rather distant to the “real employment”. Other more recent reports and surveys support this view [7] [8] and indicates that the exam form do influence on the way both teaching and learning is done.

## 4 Exam at NUC

The most common methods for student evaluation at NUC is the classical on-campus, paper-based 3 to 5 hour proctored exam. This is a changing. With the introduction of distance learning, there is a shift towards using the whole specter of exam types.

Exams are divided in a subset of different types as mentioned in chapter 0. In addition, partial exam is common in use. Two to three partial exam constitute a full exam. Partial exams are distributed over the whole course and normally attached to some pedagogical elements in the course. For all types of exam, there is a returning question of cheating. Either cheating on identity, aids, or both.

### 4.1 Student Identity

Student identity is the most important attribute for an exam. For proctored exams, ID card are presented and verified. For non proctored exams, identity presents a challenge. Depending on the type and mode of the exam, several techniques are designed to handle identity. It is still often difficult to verify the identity of the work

handed in and constitute an exam answer from the student. The use of aids on the exam is also a challenge. There are techniques devised to ensure that only allowed aids are in use, that being books, notes, or digital tools such as computer and Internet.

### **4.2 Proctored Exams**

On-campus students present a student ID to the proctor before exam starts. This is also the case when the student takes a proctored exam off-campus. When the exam uses digital tools (computer), additional validation takes place when students log on to an online service. This is also the case for off-campus exams using digital tools. The proctor controls the use of aids. When computers are used for the exam, proctor is positioned behind students where the computer screen are in view.

### **4.3 Proctoring Exam in Net Meeting**

When there is a low number of students taking the exam off-campus, proctoring can be done via Adobe Connect online meeting. This coincide with the ordinary on-campus exam. For this to be acceptable, the student sets up a webcam and microphone positioned so that the work area and the student is visible. Web camera and microphone must be on during the whole exam, and the meeting is recorded. The student present student ID to the camera. This method is tested at NUC with participants both in exam room at NUC, in another room at NUC, and with participant at home. Participants have embraced the method that relieves them from travel.

Due to web camera resolution, it is not feasible with more than six participants in each meeting – preferable not more than four. The limit is to whether one can see fine details of the work area. Several additional meetings are set up if needed. As with traditional proctoring methods, this technique is not fool proof. However, there is an element of prevention in the idea of a recorded exam.

There are challenges regarding sound/microphone and set up for each individual student/participant. One should plan enough time in advance to test and get everything up and running ahead of time for the exam start.

### 5 Portfolio Assessment

With distant learning in the rear view mirror, the most desirable is to have students use digital tools (computer) to perform and deliver exams. This reduces cost induced due to the distance and administration. An alternative is to use portfolio assessment. Portfolio assessment is applied in a couple of ways. First there is the original intended —collective evaluation of all student work as a whole”. A secondary way is the —collective average evaluation of individual work in the portfolio”. Using portfolio assessment relaxes the demand for providing student ID. The element of cheating, both on student ID and the use of tools is still there. Cheating can be addressed by designing the exercise or assignment so they remind impassive to what aids are used.

The first and original intended implementation of portfolio assessment is to evaluate all student work collected in the portfolio as a whole in the end of the course. Some general guidelines applies, such as to give feedback on each individual work and thus the opportunity to improve or adjust accordingly. There is a maturation in this process. In the end, the student selects which of his/hers work to put in the evaluative portfolio, which in turn is graded. The most common type of content in this implementation is written essay style material.

This method is potential loaded with a high cost for the institute. If the number of students is low, this is can be manageable. Since the interaction with each students individual work is high, this is a time-consuming activity. There is the opportunity to have students work in groups to reduce the amount of interaction. Still this is a time-consuming activity. Group forming across between campus and non-campus student is an additional challenge.

The second interpretation of portfolio assessment is the use of portfolio as a collection of various work, which then is individually are graded. The final grade for the portfolio is then an average over the individual marked student work. In this interpretation, there is not necessarily any maturation and improvement of the individual student work. The individual elements in the portfolio can consist of a wide variety of elements such as multiple choice exams, essay style work, drawings, and



multimedia. There is much less interaction with the student work and thus spent less time evaluating each individual deliveries.

Both implementations of portfolio assessment give student and teacher flexibility in several ways. Wide variety of type of content, distribution of evaluative workload over the whole course (not just one exam in the end), maturation, to mention a few.

With respect to distant learning, which variant of portfolio assessment to use depends on the number of students on the course, the subject and how much resources available to do the evaluative process.

## **6 Experience at NUC**

### **6.1 Introduction to Computer Science**

Introduction to Computer Science course for 160 students, 5 study credits. This is the first computer course for Bachelor engineering students in all disciplines except Bachelor Computer Science students.

The course is divided in 4 modules:

- Module 1: Introduction to computers and internet basics and information security.
- Module 2: Databases introduction and MS Access hands on.
- Module 3: Spreadsheets introduction and MS Excel hands on.
- Module 4: Programming introduction and practice in MathLab.

#### **Formative Assessment:**

Each module will have one or more multiple-choice tests. The tests are voluntary for the students, but students are encouraged to take the tests. The students can take tests at any time and number of attempts is unlimited.

#### **Summative Assessment:**

Two multiple-choice tests with grading, each test must be completed and passed by the student, each test will weight 50% of final grade. All tests are proctored in order

to ensure identity and the use of aids under the test. The first test is setup after completing module 1 and 2, the second test when module 3 and 4 are finished.

### 6.2 Multiple Choice

For the summative assessment, each test will have 1.5-2 times as many questions available as will be presented to the student. Questions from this pool is randomly chosen and presented to the student. In order for this to work, the different questions should be on the same difficulty level. The LMS system used at NUC supports categories, which helps in this area. Questions can be categorized in pools with same level of difficulty, each pool should have 1.5-2 times the number of questions as should be chosen by the system and presented to the student. Questions are randomly chosen by the system from the different pools, this ensures that two students sitting next to each other very seldom will have the same question on their computer screen.

Below is an example of a setup at NUC, here there are six categories. The categories can also have a different number of points factor, this is number of points for correct answer.

Table 5.3 Example of a setup at NUC

<b>Category</b>	<b>Number of questions to student</b>	<b>Number of questions available</b>	<b>Points</b>
Excel easy	5	10	1
Excel moderate	5	8	2
Excel difficult	3	6	3
MathLab easy	5	10	1
MathLab moderate	5	10	2
MathLab difficult	3	6	3

In the setup there are 50 questions in the available pool, each test will have 26 questions randomly chosen from the six different categories. The maximum score for this test will be 48 points.

Students have limited time for the test, typically 1 hour to complete. The test when the student start answering the questions. A clock is displayed on the webpage so the student knows exactly how much time left. Number of attempts to complete the test is set to 1, this ensures that there is only one attempt for each test.

In order to protect against students guessing answers to questions, the test can be setup using a penalty for wrong answer. The score will be reduced based on the number of incorrect responses and the number of possible choices.

### **6.2.1 Question types**

The LMS system supports ten different question types, in addition to eight basic types question, the system support long and short written textual answers. To test the student's skills in problem-solving and higher-order reasoning textual type answers can be used. At NUC, textual type questions are often used in computer programming tests, like MathLab. The disadvantage with these types of questions are that they normally must be censored manually. While the other question types can be censored automatically, textual type questions do have a function where the system can look for certain words or phrases. Finding these in an answer, equals to a correct replay. However, as ambiguity and orthography plays a certain role in textual answer, there is a probability for the censoring system to fail in given circumstances.

### **6.3 Surveillance**

All tests are proctored in order to ensure identity and the use of aids under the test. Qualified personnel do this in the classroom/computer lab for campus students. Distance students can take the test at a local NUC approved institution (police, university, public school or similar).

### **6.4 Cheating**

Today cheating is not seen as a major problem for campus students since the teachers in the actual subject proctor all tests. There is an unresolved debate going whether a teacher should be doing the proctoring or not. Most teachers are well aware of different communication techniques, which can be used electronically by the students. When proctoring is done by less technically educated personnel this will present a problem and should be addressed. Digital examination is currently a project in work by Uninett [9], results from this project will be considered for future exams and tests.

## 6.5 Identity

All students must identify themselves in order to take the tests, this is vital to ensure the right identity for the candidate. Today this is done by manual identification by the proctor. An ongoing project at NUC is studying the use of biometric identification to ensure students identity, and to ensure that the student is actually doing the work at the computer. This solution includes the use of tools from BehavioSec [10].

## 6.6 Aids

During the test the student may use all electronic and printed material. The student can use the web and Internet, together with written and printed documentation. No communication, oral or electronic, with others are allowed.

## 6.7 Results

The following table shows the final grades for students in 2010 and 2011 in subject IGR1514 Basic Computer Science at NUC.

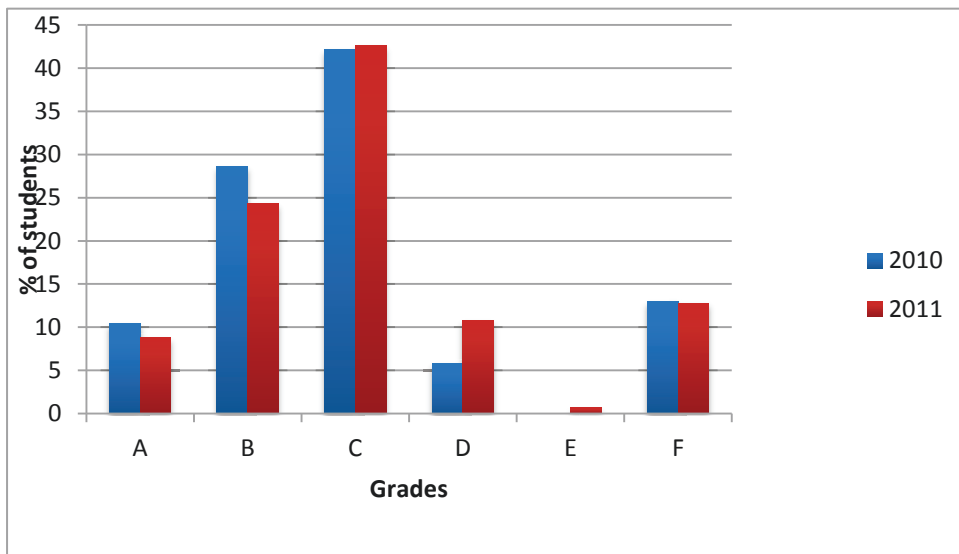


Figure 5.1 Grade statistics in subject IGR154 for 2010 and 2011

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# APPENDIX I

## WEB CONFERENCING SYSTEMS AND TECHNICAL REQUIREMENTS

### Appendix I-A: Skype

#### Hardware and System Requirements

The following list of Hardware and System requirements obtained from the Skype website (2013, [1])

#### Hardware Requirements

To be able to use Skype one only needs a computer, broadband internet, a webcam and some loudspeakers.

#### System Requirements

Table A-1: Windows System Requirements

<b>Version</b>	Windows XP Windows Vista Windows 7 (32-bit and 64-bit versions supported)
<b>Processor</b>	At least 1GHz
<b>RAM</b>	At least 256 MB
<b>Additional software</b>	DirectX v9.0 or above

Table A-2: Mac System Requirements

<b>Version</b>	Mac OS X v10.5 —“Leopard” Mac OS X v10.6 —“Snow Leopard” (32-bit and 64-bit versions supported)
<b>Processor</b>	1GHz Intel processor (Core 2 duo)
<b>RAM</b>	1GB
<b>Additional software</b>	The latest version of QuickTime

Table A-3: Linux System Requirements

<b>Version</b>	Ubuntu 8.10+ 32-bit Ubuntu 8.10+ 64-bit Debian Lenny Fedora 10+ OpenSUSE 11+
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	Dynamic Static
<b>Processor</b>	At least 1GHz
<b>RAM</b>	At least 256 MB
<b>Additional software</b>	Qt 4.4.0 D-Bus 1.0.0 libasound 1.0.18 Pulse Audio 0.9.16 (recommended) BlueZ 4.0.0 (recommended)

### Price

Skype currently offers a free version, a pay as you go version, different subscriptions, and premium and enterprise versions depending on what features of Skype you would like to use.

The Skype website (2013, [2]) lists the prices as follows:

- The basic version of Skype is free, but is only meant for personal use.
- The pay as you go version starts from 1.9 cents per minute (+ a connection fee)
- The monthly subscription starts from 0.9 cents per minute
- Skype premium starts from 5.99 euros per month.

The Clicks and Mortar blog (2011) offers this interesting viewpoint to the use of Skype in Universities –A lot of schools and colleges have used the tool for free since its launch in 2003; but if you read the fine print it was always intended for personal use; if you were using it as an enterprise tool in the way that most schools and colleges are using it, you should have been paying for an enterprise license.”

Table A-4: Pricing for the enterprise license for Skype manager (Skype website (2013, [3])

Features	Skype Credit	1 month subscription	3 month subscription	12 month subscription
Live chat support	Included	Included	Included	Included
Group video calling	Not available	€5.99 (€6.98 incl.VAT) /month	€4.01 (€4.61 incl.VAT) /month. 33% discount (until	€4.01 (€4.61 incl.VAT) /month. 33% discount (until

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Features	Skype Credit	1 month subscription	3 month subscription	12 month subscription
			March 31, 2011)	March 31, 2011)
Call phones and mobiles (US only)	from 1.9 (2.2 incl. VAT) € cents/min	€1.95 (€2.24 incl.VAT) /month	€1.85 (€2.13 incl.VAT) /month - 5% discount	€1.23 (€1.41 incl.VAT) /month - 15% discount
Voicemail	Not available	€1.75 (€2.01 incl.VAT) /month	€1.67 (€1.92 incl.VAT) /month	€1.25 (€1.44 incl.VAT) /month - 17% discount
Online Number	Not available	€5.25 (€6.04 incl.VAT) /month	€3.35 (€3.85 incl.VAT) /month – 33% discount	€2.08 (€2.39 incl.VAT) /month - 50% discount
Call forwarding	from 1.9 (2.2 incl. VAT) € cents/min	Call forwarding is included to any countries covered by your calling subscription.	Call forwarding is included to any countries covered by your calling subscription.	Call forwarding is included to any countries covered by your calling subscription.

### Problematic Issues

Some network administrators have banned the use of Skype on for example corporate, governmental, and educational networks for reasons like inappropriate use of resources, excessive use of bandwidth, and security concerns (Tehrani, 2005).

### Functionality

- Conference calls can be with up to 25 people but they do not include video.
- There may be some distortion, either voice and/or video quality, due to lag time when more than a few people are on a Skype conference at the same time (Michaels and Wang, 2011).
- Group video calling can be between three or more people (up to a maximum of 10). For the best quality, Skype recommends calls with only up to five people. To use this, one user also needs a Skype premium version or subscription
- Skype does not include whiteboard or call recording, and you need an add-on to do this. Examples of suitable add-ons and integrations include:



- For call recording and podcasting: Pamela for Skype (Pamela website, 2013), also check out other options on recording Skype website presented for example on the Digital Inspiration website (2013)
- For whiteboarding and desktop sharing: Yugma – Skype Edition (Yugma website, 2013)

### **Customer Service**

There have been reports that the Skype customer service leaves a lot to be desired, for example that it does not provide any official means to contact customer support, but only offers indirect assistance through its Web portal and contact email addresses. There is no E-mail or phone number for complaints about billing errors (Charny 2005; Keating 2005).

### **Security**

Most of the security concerns on Skype arise from the facts that it is a peer-to-peer program, and its source code is not open even though it is a freeware. Garfinkel (2005) explains that a security analysis of Skype is complicated because of several factors.

- Security of a conversation depends on many factors, including the security of the computer on which Skype is running and the network over which the conversation follows.
- The Skype protocol is both proprietary and secret, and the only sources of information are statements from the company about its security and reverse-engineering.
- Skype is a peer-to-peer system, and the security can be affected by third parties in the network that are unknown to those in a particular conversation.
- Skype can update itself every time it runs, and the security over the overall system can change without warning or even a change in appearance.

Biondi and Desclaw (2006) analyzed the security and methodology of Skype and found a number of security issues with the security model. The main security threats that they identified in their conclusions are as follows:

- Hard to enforce a security policy with Skype
- Jams traffic, can't be distinguished from data exfiltration
- Incompatible with traffic monitoring, IDS
- Impossible to protect from attacks (which would be obfuscated)
- Total blackbox. Lack of transparency.
- No way to know if there is/will be a backdoor
- Fully trusts anyone who speaks Skype

Woo (2006) discusses the possible concern of using Skype on university campuses. He identifies problems like bandwidth consumption if large files are transferred, and letting Skype transfer some of it costs for running the service to the university by granting it access to their network. He also identifies security as a threat but to a lesser degree. Users can transfer malicious files over Skype, for instance, but phone calls and chats are well-encrypted and do not pose much of a network-security threat. He also explains that, Skype like other software that operates on peer-to-peer networks can potentially open up a user's computer to unauthorized access (ibid). Berson (2005) performed an independent evaluation on Skype security on the version 1.3 source code and found that the implementers of Skype implemented the cryptographic functions correctly and efficiently.

Zhu and Fu (2010) explain that one of the main reasons for the popularity of Skype VoIP services is its unique set of features to protect privacy of VoIP calls such as strong encryption, proprietary protocols, unknown codecs, dynamic path selection, and the constant packet rate. In their paper, they propose a class of passive traffic analysis attacks to compromise privacy of Skype VoIP calls. The proposed attacks are based on application-level features extracted from VoIP call traces. The proposed attacks are evaluated by extensive experiments over different types of networks including commercialized anonymity networks and their campus network.

The experiment results show that the proposed traffic analysis attacks can greatly compromise the privacy of Skype calls.

### **Reconnect**

Garcia (2010) talks mostly about the social features of Skype 5.0, but also offers his experiences on call reconnecting. He found Skype 5.0 proficient at automatically reconnecting a call that was interrupted due to network conditions. During a live video call, he killed the network connection. Both the affected PC and the remote caller received on-screen prompts stating that a connection problem occurred, along with advice on what could be the problem and an alert stating that the application would try to reconnect. After re-establishing the WiFi service, he found the call typically reconnected within 2 to 5 seconds—no redialing. But Skype will stop trying to reconnect about one minute after the dropped call if network connectivity is not restored.

### **Responsiveness to Bandwidth Variations**

De Cicco et al (2008) investigated Skype Video in order to discover to what extent this application is able to throttle its sending rate to match the unpredictable Internet bandwidth while preserving resource for co-existing best-effort TCP traffic.

They found that a Skype Video call uses the frame rate, the packet size and the video resolution in order to throttle its sending rate to match the network available bandwidth. The obtained results have shown that a Skype Video call roughly requires a minimum of 40 kbps available bandwidth to start and it is able to fill in a bandwidth up to 450 kbps. Thus it can be said that a video flow is made elastic through congestion control and adaptive codec within that bandwidth interval. They also measured that a Skype Video sending rate exhibits a large transient time when it keeps increasing to match an increment of the available bandwidth. Moreover, we have found that in many scenarios a Skype video call refrains from fully utilizing all available bandwidth, which means that a video call is not performed at the best quality that a network would permit. Regarding coexistence with TCP flows, Skype Video seems more aggressive than the TCP because of the FEC action that unresponsively increases the bandwidth even when losses are experienced. Furthermore, they have found that when congestion is present on the reverse path,

Skype Video unduly reduces its sending rate. Finally, they have shown that Skype Video employs an adaptive FEC action that is roughly proportional to the measured packet loss ratio (De Cicco et al 2008).

Garcia (2010) explains that Skype now does a better job of letting users know what may be causing audio or video quality problems. Alerts pop up to notify users when there's not enough bandwidth available for video, advising them to downgrade to just audio for better sound fidelity. He did discover an issue that arises if users ignore Skype's warnings that a network connection is too slow for video. If Skype needs to reconnect the call after an outage, the application will re-establish only the audio portion of the call by default. However, if no network shortcomings were detected prior to the outage, the video would be re-established automatically.

Available and configured accessory devices are no longer buried in a settings menu during a call. With an audio or video call active, you can press the Call Quality information button near the bottom of the screen to access a dialog box that presents available microphones, Webcams and speakers, with controls to adjust levels. You can also access quality assessments for my PC (whether you have the power to use audio or high-quality video, or if you need to update video drivers) and your network. For example, according to Skype's tools, a connection with a near-802.11g-equivalent WiFi connection (65 megabits per second) only rates for medium-quality video, while a 130M-bps 802.11n data rate qualifies for high quality video Garcia (2010).

## Appendix I-B: iLinc for Learning

### **Hardware and System Requirements**

The following list of hardware and system requirements obtained from the iLinc website (2013, [1]).

To participate in iLinc the students' needs a computer with internet access (preferably *broadband*) and a voice card. Also needed are loudspeakers and a microphone or a headset. iLinc software is available for windows and mac (not for Linux).

### **System Requirements**

Table B-1: Windows System Requirements

<b>Operating systems</b>	Windows 7, Windows Vista Windows XP, SP3
<b>Browsers Supported:</b>	Internet Explorer 6.x, 7.x, and 8.x Firefox 1.5 and above (recommend Java)
<b>Processor</b>	1 Ghz or higher
<b>Memory (Minimum):</b>	128 MB 256 MB or higher recommended 1 GB for Microsoft Vista
<b>Bandwidth Required:</b>	56Kbps 256Kbps recommended (minimum DSL)
<b>Display (Minimum):</b>	1024x768 or higher, with 16-bit color
<b>Native Data Transport:</b>	HTTPS with AES over port 443
<b>Required for Viewing Recordings:</b>	Adobe Flash Player 9.x
<b>Internet Audio (VoIP)</b>	Full duplex sound card Speakers (USB headset recommended) Microphone with noise cancelling 100 Kbps available bandwidth HTTP port 80 (port 443 recommended) Best performance over UDP 11730
<b>Video</b>	Webcam (to send video) 1.3 Ghz or higher processor speed 1 GB Memory (RAM) 100 Kbps available bandwidth HTTP port 80 (port 443 recommended) Best performance over UDP 11730 [Please note that we do not support Internet Audio,

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	Webcam Video, or Recording Playback on PowerPC machines]
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Table B-2: Mac System Requirements

<b>Operating systems</b>	OS X 10.6, OS X 10.5 (Intel)
<b>Browsers Supported:</b>	Safari™ 2.0 and higher, Firefox 1.5 and above, Java Runtime Environment (JRE) 5.x or higher
<b>Processor Speed:</b>	1 Ghz or higher
<b>Memory (Minimum):</b>	256 MB, 512 MB or higher recommended
<b>Bandwidth Required:</b>	56 Kbps, 256 Kbps recommended (minimum DSL)
<b>Display (Minimum):</b>	1024x768 or higher, with 16-bit color
<b>Native Data Transport:</b>	HTTPS with AES over port 443
<b>Required for Viewing Recordings:</b>	Adobe Flash Player 9.x
<b>Internet Audio (VoIP)</b>	Full duplex sound card Speakers (USB headset recommended) Microphone with noise cancelling 100 Kbps available bandwidth HTTP port 80 (port 443 recommended) Best performance over UDP 11730 [Please note that we do not support Internet Audio, Webcam Video, or Recording Playback on PowerPC machines]
<b>Video</b>	Webcam (to send video) 1.3 Ghz or higher processor speed 1 GB Memory (RAM) 100 Kbps available bandwidth HTTP port 80 (port 443 recommended) Best performance over UDP 11730 [Please note that we do not support Internet Audio, Webcam Video, or Recording Playback on PowerPC machines]

### Requirements for Installed Edition

iLinc can be installed on a single server or on multiple servers. For either scenario, to deliver a reliable service it is recommended that the servers meet the following requirements. These requirements have been validated by iLinc throughout the development and testing of the server architecture.

### Microsoft Windows Server 2003 SP2

- 3-GHz or faster processor
- 1 GB RAM (2GB RAM for over 500 concurrent users)
- 150 MB hard disk space
- 100 Mb Network Interface Card (NIC) supporting TCP/IP
- Internet Information Services (IIS) 5.0 or 6.0
- Remote mail server (for email invitations and reminders) or local SMTP
- SQL Server 2005\*, iLinc embedded database or MySQL (5.0)
- Microsoft PowerPoint 2000 or higher (.ppt format needed)

### *Bandwidth-related Features & Requirements:*

Data transport is native HTTP on port 80; firewall and proxy server friendly  
Voice and video on either UDP 11730 or HTTP 80

### **Price**

You can purchase the software as a service or as a self-hosted application. Pricing and licensing varies significantly (Online meeting reviews website, 2011). The iLinc website (2013 [2]) states that you can get iLinc for learning starting from 71 dollars (about 53 euros) per month with an annual plan

### **Problematic issues**

The reviews made of iLinc were all mostly positive, with very little problems posted (Top ten reviews [1], No1 reviews, Business-software.com, webconferencing.org).

Some of the problems that could be identified as are as follows:

- Confusing licensing options - You can use iLinc as a service (starting a \$49/mo) or download the software to your own server. There are also several versions of the application designed for specific use cases - e.g. webinars, meetings, remote support, and online learning (Online meeting reviews, 2011).

- iLinc can be expensive (Online meeting reviews, 2011).
- Some functions are slow in loading and the handling of the tool is not intuitive, which spoils the fun of Web Conferencing, even though many good and useful features are offered (Web Conferencing test).
- The iLinc user's blog (2008) discusses some performance issues that they have noticed when creating a Virtual networked community of faculty, staff, and students on UCLA campus. One concerns iLinc users who use Macs; generally, the audio quality of VoIP has been less than optimal, and it has taken a couple of practice sessions to make the audio intelligible, because Macs transmit at a different bit rate. USB headsets work best. A second issue has arisen when Mac and PC users intermingle. There are problems with PC users at half duplex, having to reset the audio wizard in order to restore being able to hear the remote participant. Finally, the iLinc client has sometimes failed to launch on Macs, giving an error message about a missing resource file.



### Appendix I-C: Adobe Connect

The Adobe Connect buying guide introduces three different kind of deployment options for Adobe Connect; Hosted, on premise and Managed (Adobe website 2013 [1]).

- **Hosted:** Start collaborating immediately with just a Web browser, Flash and an internet connection. Adobe manages everything for so there's no hardware or software to install, setup or maintain. Hosted installation offers
  - Immediate account access
  - Low initial investment
  - Reliable, redundant system architecture, high-bandwidth Tier 1 hosting center.
- **On-premise:** Deploy Adobe Connect behind own firewall and integrate it with existing IT infrastructure, giving you complete control over how you set up and manage your environment. On premise installation offers
  - Choice of the network topology that meets your organization's reliability, scalability and accessibility requirements.
  - Integration with your organization's existing video telephony devices supporting SIP/H.264, servers and applications, such as VoIP, LDAP directory server, Jabber, and Microsoft SQL Server.
  - Ability to customize and extend the capabilities of your Adobe Connect software solution.
  - Control over usage and maintenance costs.
  - Ability to optimize performance with edge servers.
- **Managed services:** Outsource IT management to Adobe and they will take care of installation, upgrade and management while you retain the benefit of control, additional security options, and customizability of an on-premise deployment. A managed services deployment offers:
  - Rapid time to value
  - Single-tenant hosted environment

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- Failover between geographically distributed data centers
- 24x7 solution monitoring
- Designated success engineer and special support points of contact
- General maintenance, upgrades, and updates performed for you on your schedule
- High degree of customization and flexibility, including single sign-on (SSO), Learning Management System (LMS), and video integration

### Hardware and system requirements

The following list of hardware and system requirements was obtained from the Adobe website (2013 [2])

#### Client system requirements: Hosted and licensed deployments

Table C-1: Windows System Requirements

<b>Version</b>	Windows XP Windows Vista Windows 7 (32-bit/64-bit editions with 32-bit browser)
<b>Processor</b>	1.4GHz Intel Pentium 4 or faster for XP or Windows 7, 2GHz Pentium 4 or faster for Vista
<b>RAM</b>	512MB of RAM (1GB recommended) for Windows XP or Windows 7, 1GB of RAM (2GB recommended) for Windows Vista
<b>Additional software</b>	Microsoft Internet Explorer 6, 7, 8, or 9 (32 bit only); Mozilla Firefox 3.x or higher; Google Chrome, Adobe Flash Player 10.1 (or later) for all users (hosts, presenters, participants, and administrators)

Table C-2: Mac System Requirements

<b>Version</b>	Mac OS X v10.4, 10.5, 10.6 (Intel); Mac OS X v10.4 (PowerPC)
<b>Processor</b>	500MHz PowerPC® G3 or faster or 1.83GHz Intel Core™ Duo or faster processor
<b>RAM</b>	512MB of RAM (1GB recommended)
<b>Additional software</b>	Mozilla Firefox 3.x or higher; Apple Safari 4.x or higher; Google Chrome, Adobe Flash Player 10.1 (or later) for all users (hosts, presenters, participants, and administrators)

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Table C-3: Linux System Requirements

<b>Version</b>	Presenters/hosts: Ubuntu 10 (32 bit), Attendees: Ubuntu10; Red Hat Enterprise Linux (RHEL) 4.x or 5.x; Novell SUSE® 9.x or 10.x
<b>Additional software</b>	Mozilla Firefox 3.x or higher, Adobe Flash Player 10.1 (or later) for all users (hosts, presenters, participants, and administrators)

Table C-4: Solaris System Requirements

<b>Version</b>	Solaris 10 for attendees only
<b>Additional software</b>	Mozilla Firefox 3.x or higher, Adobe Flash Player 10.1 (or later) for attendees only

Table C-5: Mobile Devices System Requirements

<b>Apple</b>	devices running iOS 4; compatible with Apple iPhone 3GS, iPhone 4, iPad, iPad 2, and iPod touch (3rd or 4th generation recommended).
<b>Android</b>	devices running Android 2.2 (or higher) with Adobe AIR® 2.7 (or later) for Android; compatible with HTC EVO 4G, Motorola Atrix, Motorola Droid X, Motorola Xoom, and the Samsung Galaxy Tab.
<b>Blackberry</b>	devices running BlackBerry Tablet OS (QNX) 1.0.6 or higher with Adobe AIR® 2.7 (or later) for BlackBerry; compatible with BlackBerry PlayBook

Note that simultaneous teleconference activity is restricted when using a carrier that does not support simultaneous data and voice. For devices that do not meet these requirements, meetings can be attended in the browser if the device meets the following requirements: Mobile OS with Flash Player and AIR support (Flash Player 10.1). Attending via the Adobe Connect™ Mobile app is recommended.

### Virtual Environments

- Citrix XenApp6
- Adobe Flash Player 10.1 for all users (hosts, presenters, participants, and administrators)

### Additional Requirements

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- Bandwidth: 256Kbps (512Kbps recommended) for participants, meeting attendees, and end users of Adobe Connect applications. Connection: DSL/cable (wired connection recommended) for Adobe Connect presenters, administrators, trainers, and event and meeting hosts.

### Server system requirements: Licensed deployments only

Table C-6: Windows Server Requirements

<b>Versions</b>	Microsoft Windows Server® 2003 with Service Pack 2 or Windows Server 2008 R2
<b>Virtual environments</b>	VMware ESX 4
<b>Database</b>	Microsoft SQL Server 2005 with Service Pack 3, Microsoft SQL Server 2008 with Service Pack 1
<b>Hardware requirements</b>	3GHz dual-core Intel Xeon® processor (2GHz quad-core Intel Xeon or faster recommended) 4GB of RAM 2GB of available hard-disk space for Adobe Connect Enterprise installation, 150GB of available hard-disk space for content storage; disk space requirements will increase as more content is stored NTFS file system (FAT32 file systems not supported) DVD-ROM drive Adobe Connect Server deployment with SSL enabled SSL Hardware Accelerator or built-in Connect Enterprise software SSL Adobe Connect Server deployment on virtualized systems: VMware ESX 4
<b>Shared requirements</b>	<b>storage</b> Disk specs: 10,000–15,000 RPM — Fibre Channel preferred Network link: TCP/IP — 1GB I/O throughput or better Controller: Dual controllers with Active/Active multipatch capability Protocol: CIFS or equivalent
<b>Network requirements</b>	100Mbps Ethernet (1Gbps recommended)
<b>Port requirements</b>	1935 (RTMP), 80 or other HTTP port, 443 if SSL is enabled; 25 for SMTP (optional); 1433 for external database (optional)
<b>LDAP directory servers</b>	Microsoft Active Directory Lightweight Directory Services (AD LDS — formerly ADAM) on Windows Server 2008 R2 Active Directory Application Mode (ADAM) with Service Pack 1 for Windows Server 2003 Active Directory for Windows Server 2000, Windows Server 2003, or Windows Server 2008 R2

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	<i>Adobe Connect can be deployed with any LDAP-compliant directories. The above LDAP directory servers have been tested with Adobe Connect.</i>
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Table C-7: Adobe Connect Edge Server Requirements

<b>Versions</b>	Microsoft Windows Server 2003 with Service Pack 2 or Windows Server 2008 R2
<b>Processor</b>	3GHz dual-core Intel Xeon processor (2GHz quad-core Intel Xeon or faster recommended)
<b>RAM</b>	2GB of RAM (4GB recommended)
<b>Network requirements</b>	100Mbps Ethernet (1Gbps recommended)

Table C-8: Universal Voice Using Flash Media Gateway System Requirements

<b>Supported operating systems</b>	Microsoft Windows Server 2003 (32 bit) with Service Pack 2
<b>Hardware requirements</b>	2GHz quad-core Intel Xeon processor (3GHz quad-core Intel Xeon recommended) 4GB of RAM 2GB of available hard-disk space for installation; 10GB of available hard-disk space for operation NTFS file system (FAT32 file systems not supported) CD-ROM drive
<b>Network requirements</b>	TCP/IP — 100Mbps (1Gbps recommended) Port 5060 TCP An additional two ports are required for each concurrent meeting that uses Universal Voice; these ports are configured as a range (example: 5,000–6,000 would support 500 meetings using Universal Voice) 100Mbps Ethernet (1Gbps recommended)

In order to use Universal Voice, you will need to install and configure Flash Media Gateway. Flash Media Gateway needs to be configured to place calls through a SIP-compliant end point that allows calls to be routed to your preferred audio Conferencing service.

While Flash Media Gateway can be installed on the same system as the application server, it is recommended that it be installed on a separate system.

### Price

The Adobe website does not offer any direct information on the cost of different deployment options, the buying guide (Adobe website 2013 [1]) only gives this information:

- Hosted deployment: An annual subscription contract (annual maintenance and support is included)
- On premise deployment: A perpetual license agreement (annual maintenance and support fees are required)
- Managed services deployment: An annual subscription contract (annual maintenance and support is included)

### **Problematic Issues**

Adobe (2013, [3]) offers their own list of known issues in the software, the list includes points such as

- Sharing a high quality video feed to 8-10 users results in high CPU usage, pixelated video at the start of the feed, unexpected pauses, and slow responsiveness from the Meeting room
- If two users are typing simultaneously to the same Note pod, then all of the text entered may not appear
- When recording is made offline in an Add-in which is not maximized, the resulting offline recording shows only what is visible within the Add-in window

The reviews made about Adobe Connect were mostly positive (Dawson, 2010; Wainhouse research 2009; Top ten reviews [2], Beck 2010; Infotech research group; Mackie, 2010; Gartner, 2010) the problems that could be identified are as follows:

- Because of Adobes multiple deployment options, licensing can be difficult to understand.
- Although good on bandwidth, abode's support for multiple webcams for video is still determined by the participants CPU and available bandwidth.
- Not designed for remote desktop technical support

Zuduk et al (2009) discuss the importance of the human factor in the success of the use of Adobe Connect and explain that the following problems were identified when testing Adobe Connect with 12 participants from different European countries:

- The audio connection was poor from time to time. The problem was not a technical one, but a human misuse. At one connection the participants kept the microphone on and the background noise affected some presentations but was not aware that they are generating the sound problems. Other participants tried to communicate with them via chat, but they did not observe the messages addressed to them. Adobe Connect was doing the job of indicating the source problem (the connection points with the microphone on were indicated by a green microphone symbol), but the participants failed to find a way to communicate, to call attention to the individuals that were generating the problems (Zuduk et al. 2009).
- Another possible inconvenient aspect was that not always was clear who is speaking, due to an incorrect position in relation to video camera. Also it was not to easy seeing facial expressions and nonverbal gesture of the people in the foreground and impossible of those in the background

### Appendix I-D: Vidyo Personal Telepresence

#### Hardware and System Requirements

VidyoRouter specifications from Vidyo Website (2013 [1])

VidyoRouter is an essential component of the VidyoConferencing infrastructure. VidyoRouter performs transcode-free packet switching over common IP networks.

Table D-1: VidyoRouter System Requirements

<b>Capacity</b>	Simultaneous connections: 100 HD
<b>Power Supply</b>	Input: 100-240v ~, 4-2A, 50-60Hz Output: 250W Non-Redundant (auto-ranging)
<b>Dimensions</b>	Form Factor - 1U rack mount Dimensions (HxWxD) without ear and bezel Height - 1.67”(42.6 mm) Width - 15.5”(393.7 mm) Depth - 17.1”(431 mm)
<b>Gross Weight</b>	17.76 lbs (8.058 kg)
<b>Rack Support</b>	ReadyRails static rails for tool-less mounting in 4-post racks with square or unthreaded round holes or tooled mounting in 4-post threaded and 2-post (Telco) racks
<b>Ports</b>	2x RJ45 LAN ports - 100BASE-TX, and 1000BASE-T 1x External Serial Port 2x USB2.0 ports 1x eSATA port 1x VGA port
<b>Operating Environment</b>	Operating Temperature (for altitude ≤ 900m or 2952.75ft): 10°C to 35°C (50°F to 95°F) Non-Operating Temperature: -40 to 65° C (-40 to 149° F) Operating Humidity Range: 10% to 90% (non-condensing) Non-Operating Humidity Range: 5% to 95%
<b>Regulatory</b>	Safety: EN 60950-1:2006, A11:2009 / IEC 60950-1:2005 ed2 EMC: EN 55022:2006 +A1:2007 / CISPR 22:2005 +A1:2005 +A2:2006 EN 55024:1998 +A1:2001 +A2:2003 / CISPR 24:1997 +A1:2001 +A2:2002 EN 61000-3-2:2006 +A1:2009 +A2:2009 / IEC 61000-3-



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	2:2005 +A1:2008 +A2:2009 EN 61000-3-3:2008 / IEC 61000-3-3:2008 Australia C-TICK Class A; Argentina IRAM; Canada NRTL ICES Class A; China CCC Class A; Croatia KONCAR Class A; European Union CE Class A; Germany TUV IECEE IECEE CB; Israel SII Class A; Japan VCCI Class A; Mexico NOM; Moldova INSM Class A; Nigeria SONCAP; Norway NEMKO Class A; Russia GOST Class A; South Africa NRCS SABS Class A; South Korea KC Class A; Taiwan BSMI Class A; United States NRTL FCC Class A; Vietnam ICT Class A.
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VidyoPortal specifications from Vidyo Website (2013, [2])

VidyoPortal is an essential component of the VidyoConferencing infrastructure with enterprise-class management tools accessible through a browser-based interface and the capacity to support tens of thousands of users.

Table D-2: VidyoPortal System Requirements

<b>Capacity</b>	Registered Users: Up to 10,000 Active Users: Up to 2,500 Tenants: 100
<b>Power Supply</b>	Input: 100-240v ~, 4-2A, 50-60Hz Output: 250W Non-Redundant (auto-ranging)
<b>Dimensions and Gross Weight</b>	Form factor - 1U Rack mount Dimensions (HxWxD) without ear and bezel Height - 1.67" (42.6 mm) Width - 15.5" (393.7 mm) Depth - 17.1" (431 mm) Weight - 17.76 lbs (8.058 kg)
<b>Rack Support</b>	ReadyRails™ static rails for tool-less mounting in 4-post racks with square or unthreaded round holes or tooled mounting in 4-post threaded and 2-post (Telco) racks
<b>Ports</b>	2x RJ45 LAN ports - 100BASE-TX and 1000BASE-T 1x External Serial Port 2x USB2.0 Ports

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	1x eSATA Port 1x VGA Por
<b>Operating Environment</b>	Operating Temperature Range (for altitude ≤ 900m or 2952.75ft): 10°C to 35°C (50°F to 95°F) Non-Operating Temperature Range: -40°C to 65°C (-40°F to 149°F) Operating Humidity Range: 10% to 90% (non-condensing) Non-Operating Humidity Range: 5% to 95%
<b>Regulatory Compliance</b>	Safety: EN 60950-1:2006, A11:2009 / IEC 60950-1:2005 ed2 EMC: EN 55022:2006 +A1:2007 / CISPR 22:2005 +A1:2005 +A2:2006 EN 55024:1998 +A1:2001 +A2:2003 / CISPR 24:1997 +A1:2001 +A2:2002 EN 61000-3-2:2006 +A1:2009 +A2:2009 / IEC 61000-3-2:2005 +A1:2008 +A2:2009 EN 61000-3-3:2008 / IEC 61000-3-3:2008 Australia C-TICK Class A; Argentina IRAM; Canada NRTL ICES Class A; China CCC Class A; Croatia KONCAR Class A; European Union CE Class A; Germany TUV IECEE IECEE CB; Israel SII Class A; Japan VCCI Class A; Mexico NOM; Moldova INSM Class A; Nigeria SONCAP; Norway NEMKO Class A; Russia GOST Class A; South Africa NRCS SABS Class A; South Korea KC Class A; Taiwan BSMI Class A; United States NRTL FCC Class A; Vietnam ICT Class A

VidyoDesktop specifications from Vidyo Website (2013 [3])

As an endpoint in the VidyoConferencing deployment, VidyoDesktop software delivers transcode-free Video Conferencing

Table D-3: VidyoDesktop System Requirements

<b>Version</b>	Windows: XP, Vista, 7; Mac: OS X 10.5 or higher; Linux: Ubuntu 10.04, 10.1, 11.10; Debian 5.0, 6.0.3; Fedora Core 14, 15, 16; and SLC 5, 5.7 (see <a href="http://www.vidyo.com/products/vidyodesktop">http://www.vidyo.com/products/vidyodesktop</a> for current list of supported systems)
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<b>Processor</b>	Minimum: Pentium 4 Recommended: Core 2 Duo 2GHz
<b>RAM</b>	Minimum: ; 1 GB RAM. Recommended: ; 2 GB RAM
<b>Additional</b>	DirectX v9.0 or above

Table D-4: Devices and Accessories

<b>Webcams</b>	Standard: USB webcams. Recommended: Logitech C920, C910, B910, and Webcam Pro 9000; Creative Live! Cam
<b>Headsets</b>	Standard: USB headset with echo cancellation. Recommended: Logitech B530; Microsoft Lifechat LX-3000; Plantronics Headset with Plantronics US% Adapter 01, Voyager Pro UC v2 Bluetooth, SAVI-740
<b>Speakerphones</b>	Standard: USB speakerphone with echo cancellation. Recommended: ClearOne Chat-50, Chat-150; Jabra SPEAK 410; Phoenix Duet MT202-PCO; Plantronics Calisto 420, MCD100

### Price

The Vidyo Website itself does not offer any pricing information, and Vidyo and Vidyo's resellers keep their pricing details closely guarded. (VCinsight, 2012). However some reports have detailed that Vidyo provides Video Conferencing that's as good as the competition for a fraction of the cost. For what the competition charges \$6 per minute, Vidyo can deliver for 3 to 5 cents. And it does across multiple routers to multiple locations, enabling perfect video, blip free anywhere there's Internet (Red herring, 2012). Hippensteel (2010) offers a more concrete example of the pricing, telling that Vidyo offers a starter package for \$7,000 that includes all of the infrastructure and perpetually licensed software necessary to deploy desktop video-Conferencing to 75 administered users and the ability to host up to five concurrent multi-point connections.

The following pricing information is offered by Pihlman (2009) who explains that Vidyo offers an annual subscription model for Ports and Seats:

- HD Conferencing Ports cost \$750-\$1000 per port per year

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- Number of registered users on the VidyoPortal costs \$25 per seat per year
- VidyoDesktop Installs (PC or MAC) per machine cost \$5 one time (upgrades and re-installs don't consume an Install)
- Perpetual licenses pricing is available.
- Guest users don't require a seat license but consumes an install.
- Also available VidyoRouter Event Ports which enables additional ports on the VidyoRouter for duration of 7 days.

**VidyoPortal:** an appliance to manage UsersSystem's components and meeting. Includes VidyoRouter functionality for small deployments up to 50 ports costs \$6,000 (one time)

**VidyoRouter:** a base appliance to host VidyoRouter Ports, can host up to 100 HD Ports – costs \$6,000 (one time)

**VidyoGateway:** appliance to connect with Legacy Videoconferencing endpoints costs \$9,950

Annual Maintenance fee is charged only on appliances.

### **Problematic Issues**

Most reviews done on Vidyo products are positive, praising for example the audio and video quality (See for example Pihlman 2009; . There have however been complaints that the pricing options are confusing, and that audio and video quality when using the vidyo desktop software is dependent on the connection speed. lower bandwidth gave choppy, pixelated video and clipped audio (VCinsight, 2012).

## Appendix I-E: Microsoft Lync

### **Hardware and System Requirements**

Requirements obtained from Microsoft website 2013 [1].

Recommended Hardware for Front End Servers, Back End Servers, Standard Edition Servers, and Persistent Chat Servers

Table E-1: Recommended Hardware for Front End Servers, Back End Servers, Standard Edition Servers, and Persistent Chat Servers

<b>CPU</b>	64-bit dual processor, hex-core, 2.26 gigahertz (GHz) or higher Intel Itanium processors are not supported for Lync Server server roles.
<b>Memory</b>	32 gigabytes (GB)
<b>Disk</b>	8 or more 10,000 RPM hard disk drives with at least 72 GB free disk space. Two of the disks should use RAID 1, and six should use RAID 10. - OR - Solid state drives (SSDs) which provide performance similar to 8 10,000-RPM mechanical disk drives.
<b>Network</b>	1 dual-port network adapter, 1 Gbps or higher (2 recommended, which requires teaming with a single MAC address and single IP address)

Table E-2: Recommended Hardware for Edge Servers, Standalone Mediation Servers, and Directors

<b>CPU</b>	64-bit dual processor, quad-core, 2.0 gigahertz (GHz) or higher - OR - 64-bit 4-way processor, dual-core, 2.0 GHz or higher Intel Itanium processors are not supported for Lync Server server roles.
<b>Memory</b>	16 gigabytes (GB)
<b>Disk</b>	4 or more 10,000 RPM hard disk drives with at least 72 GB free disk space - OR - Solid state drives (SSDs) which provide performance similar to 4 10,000-RPM mechanical disk drives.
<b>Network</b>	1 dual-port network adapter, 1 Gbps or higher (2 recommended, which requires teaming with a single MAC address and single IP address)

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### Client and Device Hardware Support

Table E-3: Client - Recommended Hardware for Lync 2013 and the Online Meeting Add-in for Lync 2013

<b>Computer/processor</b>	Intel Pentium 4, AMD Athlon 64, or equivalent
<b>Memory</b>	2 gigabytes (GB) of RAM
<b>Data and Voice</b>	Minimum 1.6 gigahertz (GHz) or faster processor. We recommend 2.0 gigahertz (32-bit or 64-bit).
<b>Video</b>	See Lync Client Video Requirements from Microsoft website 2013 [2]
<b>Display resolution</b>	1024x768 required
<b>Graphics hardware</b>	Support for Microsoft DirectX 9 application programming interface 128 megabytes (MB) of graphics memory (minimum). We recommend 256 MB of graphics memory. Windows Display Driver Model driver Pixel Shader 2.0 in hardware 32 bits per pixel
<b>Telephony</b>	Microphone and speakers, headset with microphone, or equivalent device(s). Recommended devices: Phones with the —Optimized for Microsoft Lync” logo (see Phones and Devices Qualified for Microsoft Lync from Microsoft website 2013 [3] for a list) Phones that run Lync Phone Edition
<b>Video source</b>	USB 2.0 video camera or Polycom CX5000 HD device (RoundTable device)
<b>Bandwidth Requirements</b>	See Network Bandwidth Requirements for Media Traffic from Microsoft website 2013 [4].

### Device Hardware Support

Specific hardware configurations must be in place before deploying IP phones and analog devices. IP phones running Lync Phone Edition support Link Layer Discovery Protocol-Media Endpoint Discovery (LLDP-MED) and Power over Ethernet (PoE). To take advantage of LLDP-MED, the switch must support IEEE802.1AB and ANSI/TIA-1057. To take advantage of PoE, the switch must support PoE802.3AF or 802.3at.

To enable LLDP-MED, the administrator must enable LLDP by using the switch console window and set the LLDP-MED network policy with the correct voice VLAN ID.

In addition, if your deployment includes analog devices, you must configure the analog gateway to use Lync Server, and the gateway must be one of the following:

- An analog telephone adapter (ATA)
- A PSTN analog gateway
- A Survivable Branch Appliance that includes a PSTN analog gateway
- A Survivable Branch Appliance that includes a PSTN gateway that communicates with an ATA

To learn how to configure an analog gateway, see "Planning to Deploy Analog Devices" at <http://go.microsoft.com/fwlink/p/?LinkId=268537> in the Lync Server 2010 TechNet Library. (Analog devices work the same way in Lync Server 2013 as they do in Lync Server 2010.)

### **Mobility Support**

With Lync Server 2013 mobility, users have access to Lync 2013 functionality on their mobile devices. Supported mobile devices include the following:

- Supported Apple iOS devices
- Windows Phone
- Android
- Nokia

For details about mobility features and requirements, see Planning for Mobility at Microsoft website 2013 [5].

### **Price**

The cost of implementing Lync as a communication platform varies among countries. Depending on implementation of what parts of Lync, there are different pricing schemes for the volume of users and what parts of Lync (licensing and acquisition).

Depending on implementation, there may be also be a cost connected to the use (call to public (mobile) phone). If implementation is only internet communication, there is no cost connected to the use. To get exact pricing, consult a vendor.

### **Server**

Lync server 2010 Enterprise Edition ca. \$3 000,-

### **Problematic Issues**

Lync is targeted against small group communication. It is designed for 250 users in conference, but there are supports for large meetings, up to 1000 participants. Cost of implementation is significant.



### Appendix I-F: Sonicfoundry Mediasite

#### Hardware and System Requirements

##### Recorders

Two main types of recorders exist, one type (RL) for permanent mounting in cabinet or similar, the other type (ML) is a mobile recorder.

##### Mediasite RL Recorder

Designed for lecture halls, smart classrooms, conference or training rooms and auditoriums. Integrates with familiar room control systems from Crestron®, AMX™ and Mediatech.

##### Mediasite ML Recorder

Ideal for on-the-go webcasting, live events, conferences, hybrid events and tradeshows. The rugged, portable design moves easily from location to location and can be ready to record in minutes.

##### Mediasite Servers

###### Mediasite EX Application Server

Depending on the streaming options you want to make available to your viewers (live and/or on-demand; desktop and/or mobile), one or more media servers is needed.

- Microsoft Windows Streaming Media Services 2008
- IIS Media Services 4.0
- IIS Progressive Download 7.0 or 7.5
- Intel Xeon Quad Core 2GHz with 4GB RAM or more
- Microsoft Windows Server 2008 or 2008 R2

##### Media Server

- Intel Xeon Quad Core 2GHz with 4GB RAM or more
- Microsoft Windows Server 2008 or 2008 R2

- Microsoft SQL Server® 2012, 2008 or 2005; or SQL Express Server 2012, 2008 or 2005

### **Mediasite Database Server**

- Intel Xeon Quad Core 2GHz with 4GB RAM or more
- Microsoft Windows Server 2008 or Microsoft Windows 7
- Microsoft .NET Framework 4.0

### **Desktop recorder**

The new Desktop Record in Mediasite 6.1 provides all the tools needed to quickly capture, upload, edit and publish rich video. This can be done from any PC or Mac without additional hardware. The Desktop Recorder module is part of the Mediasite User Generated Content Module which also includes My Mediasite. My Mediasite is a web based dashboard which provides access to the Mediasite Desktop Recorder, the Mediasite Editor and Media Upload. The Mediasite Editor provides editing functionality for video recordings while the Media Upload lets the user upload recordings to a Mediasite EX server.

Requirements for client systems:

### **My Mediasite**

- Microsoft® Internet Explorer® 9 or later; Google Chrome™; Firefox® 5.0 or later; Apple® Safari® 5 or later
- Microsoft Silverlight® 5

### **Mediasite Desktop Recorder**

- Mac OS® X 10.7 or 10.8; Microsoft Windows® 7 or 8 (running in Desktop mode)
- 2.4GHz Core™2 Duo CPU or equivalent
- 4GB RAM
- At least 1GB free disk space
- Built-in or external camera and microphone

### **Price**

Mediasite ML and RL recorders are expensive, there is considerable uncertainty to the prices given here, these must only be seen as a guideline.

Mediasite RL recorder: approx. NOK 150.000,- This includes 1 year service and a Mediasite EX server license required for each recorder. Each recorder must have a maintenance agreement which includes the Mediasite EX server license, approximately NOK 15-20.000,- per year per recorder.

### **Mediasite Servers:**

- On premise deployment: In Norway all Universities have a common installation provided by Uninett ( ala Swedish Sunet). Costs are shared by the universities and depends on amount of storage and capacity used . A Mediasite EX license required for each recorder attached.

### **Problematic Issues**

Mediasite is a lecture captioning and webcasting system. The system has not the functionality for interactive meetings like Adobe Connect. Tools available for a presenter includes polls and chat, with these tools interactivity with the audience is possible. There is however a processing delay in the recorder, NUC experience this to be approximately 30 seconds. Due to this chat functionality is seldom used.

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## APPENDIX II

### WEB CONFERENCING SYSTEM EVALUATION SHEET

#### A. Adobe Connect test with Murmansk State Technical University (MSTU)

Time: 04.10.2012. 15.00-16.000 Finnish Time. Adobe connect room:

<http://connectpro oulu.fi/karipankkonen/>

Participants:

Kari Pankkonen, Oulu University (UOulu)

- Connection speed (actual\*<sup>1</sup>). Oulu-Petr: Ping 104ms, DL 65,80 Mbps, Upload 3,45 Mbps
- Connection speed (promised): Unknown.
- 

Heidi Hartikainen, Luleå University of Technology (LTU)

- Connection speed (actual): Ping 29 ms, download 91.47 Mbps, upload 44,70 Mbps
- Connection speed (promised): Unknown.

Ekaterina Zvonkova, Murmansk State Technical University (MSTU)

Stanislav Kolpakchi, Murmansk State Technical University (MSTU)

- Connection speed (actual): Murmansk Oulu ping 97, download 17.86 Mbps, upload 2.02 Mbps
- Connection speed (promised): Unknown.

Test results:

FUNCTIONALITY	COMMENTS
Number of attendees (and full capacity)	4, one connecting from LTU, 1 from Oulu. 2 persons from MSTU connecting from their video conference room.
OS's used	LTU: Windows 7

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<sup>1</sup> The actual speed was measured for all participants using the internet service speedtest.net



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Video quality	Video Quality was very good.
Audio quality	Audio quality is very good.
Session recording	Available, not tested during this sessions
Desktop sharing	Available and tested without problems
Application sharing	Available and tested without problems
White boarding	
Sending instant messages	Tested without problems
Sending files (ppt, word, pdf, jpg)	Available, not tested
Uploading files (ppt, word, pdf, jpg)	Available and tested.
Breakout sessions	Available, not tested
Co-browsing	Tested through application sharing
Voting pod	Available, tested without problems

### Other notes

The discussions centered on the functionality of adobe connect; what can you do if you are a host, a presenter, a participant. All of the important functionalities were explained even if they were not tested.

Ekaterina raised a question to Kari if it is possible to adjust the divide the picture in their classroom: as they have multiple screens, can they view the Video from Kari on one screen, their own picture on one, and for example the whiteboard one screen. Kari explained that this is not possible. But as a teacher of a distance class in a room like MSTU has, you can use one screen to show your slides, one screen to display your own video, and the last screen for example then to show adobe connect room.

Kari did not notice to add Heidi to —Presenter” status on Adobe Connect. As she remained just a participant, she could not use her microphone or her camera during the test.

### B. Skype test with Murmansk State Technical University (MSTU)

Time: 04.10.2012 on 16.00-16.20 Finnish Time. Skype free version tested.

Participants:

Kari Pankkonen, Oulu University (UOulu)

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- Connection speed (actual<sup>\*2</sup>): Ping 104ms, download 65,80 Mbps, upload 3,45 Mbps
- Connection speed (promised): Unknown.
- Skype id: karipan

Heidi Hartikainen, Luleå University of Technology (LTU)

- Connection speed (actual): Ping 29 ms, download 91.47 Mbps, upload 44,70 Mbps
- Connection speed (promised): Unknown.
- Skype id: eemeli\_82

Ekaterina Zvonkova, Murmansk State Technical University (MSTU)

Stanislav Kolpakchi, Murmansk State Technical University (MSTU)

- Connection speed (actual): Murmansk Oulu ping 97, download 17.86 Mbps, upload 2.02 Mbps
- Connection speed (promised): Unknown.
- Skype id: kolpakchiss

Test results:

FUNCTIONALITY	COMMENTS
Number of attendees (and full capacity)	1 from LTU, 1 from
OS's used	LTU: Windows 7
Video quality	Video quality was very good, however as the skype premium version does not support group video, we could only see each other for about the first 30 seconds. From point to point it was excellent.
Audio quality	Audio quality was also very good.
Session recording	Not available
Desktop sharing	Not available
Application sharing	Not available

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<sup>2</sup> The actual speed was measured for all participants using the internet service speedtest.net

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White boarding	Not available
Sending instant messages	Available, tested
Sending files (ppt, word, pdf, jpg)	Available not tested
Uploading files (ppt, word, pdf, jpg)	Not available
Breakout sessions	Not available
Co-browsing	Not available
Voting pod	Not available

### Other Notes

The testers agreed that this was a good option for point to point communications with students, for example when tutoring them. Skype is very easy to use and the connection of very good quality both in audio and video.

It is however not suitable for bigger lectures even with the premium version as even though there the video would be available for a bigger number of people, it is still recommended for only 10 people. Also the premium version lacks important functionality.

## APPENDIX III

### Equipment for Virtual Rooms

Equipment for Virtual Rooms in Russian Universities	Piece	Per/Piece	Total
1. table tv 52" /48", 2 sets/virtual room	2	1 200 €	2 400 €
accessories needed to install on the wall	2	225 €	450 €
2. computer (PC) to virtual class room	1	1 000 €	1 000 €
cables etc.	1	50 €	50 €
3. table microphone i ClearOne Chat150	1	400 €	400 €
4. loud speakers to virtual room	1	100 €	100 €
5. web camera to virtual room	1	200 €	200 €
6. labtop 2 pieces/Russian universities	2	1 000 €	2 000 €
docking system for labtops, extra mouse and keyboard	2	150 €	300 €
7. extra display unit to labtop 21-24"	2	170 €	340 €
cables etc.	2	180 €	360 €
installation work	2	100 €	200 €
<b>GRAND TOTAL</b>			<b>7 800 €</b>

Equipment is recommended full fill as minimum the following technical features of reference equipment.

1. <http://www.lg.com/ie/tv-audio-video/televisions/LG-lcd-tv-47LK530T.jsp>
1. Intel Core i3 or i5, 4gb RAM, NVidia GeForce GTX550
2. See: <http://www.clearone.com/usb-speakerphone.html>
3. <http://www.logitech.com/en-gb/speakers-audio/home-pc-speakers/devices/5861>
4. <http://www.logitech.com/en-us/for-business/products/webcams-headsets/devices/6068>
5. [http://www.asus.fi/Notebooks/Versatile\\_Performance/K53SV/](http://www.asus.fi/Notebooks/Versatile_Performance/K53SV/)
6. <http://www.lg.com/ie/it-products/monitors/LG-led-monitor-E2210PM.jsp>

It is important to follow the technical features of equipment (not brands) and a rule of origin. The above-mentioned brands of equipment (LG, ASUS) don't necessarily fulfil the rule of origin. The concrete models are just examples to find out the technical features.

#### Rule of Origin and Certificate of Origin:

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All supplies purchased must originate from EU or from an eligible country (EU, Russia, and Norway). The country of origin is deemed to be the country in which the goods have undergone their last, economically justified, substantial transformation. This means for example the country where the parts of a computer have been composed together to a final model. According to Financing Agreement, Public Russian organizations follow ONLY the Russian national legislation.

The supplier must certify the origin of the goods. The certificate of origin can be in Russian, not necessarily in English. The certificate is needed for the expenditure verification. See more information from BCBU+ project implementation manual (pages 6-7).

All purchases must be subjected to competitive tendering to ensure the cost efficiency. For contracts exceeding 10.000 EUR, an offer must always be requested from at least three suppliers. National procurement legislation must also be taken into consideration.

Purchases under 10 000 EUR must be reasonable and cost-efficient for their price. That must be ensured with a lighter procurement process. In all cases the procurement process must be documented. If an organization already has a contract with some supplier (chosen through tendering process) that supplier can be used if other requirements are fulfilled.

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