Mobile Streaming Lab – leading to a modular Learning Environment

Daniel Pfuhl, *pfuhl@imk.fraunhofer.de* · Predrag Peranovic, *peranovic@imk.fraunhofer.de*

MARS Exploratory Media Lab
Fraunhofer Institute for Media Communication
Schloß Birlinghoven
D-53754, St. Augustin
Germany

Tel. +49 2241 143444
Fax. +49 2241 142133

Abstract. The *Mobile Streaming Lab (MSL)* is a portably and small media lab, which enables sending, receiving and editing of multimedia data at almost all locations. It is a transportable and modular tool, which fits very good in any streaming media application. The transmission as well as the archiving of different lectures is possible combining this tool and the *netzspannung.org* system.
This paper gives a short description of the *MSL* and describes a *LearningEnvironment*, which has been developed.

1. Build up an extra-dynamic e-learning environment at netzspannung.org

The existing system architecture of *netzspannung.org*[1] is providing highly individual Online Workspaces. Used as educational applications they will be extended in order to work as Shared Workspaces and provide the possibility of collaborative and cooperative working and learning. Using this technology will extend the possibilities of relaying knowledge in a completely different way. Working as the base technology *NetworkArchives* of next generation are responsible for the generation of content themselves. Assuming highly modular learning contents, the system has to provide a critical volume of data elements. Using the network information pool and underlying tools of *netzspannung.org* the connected sources of information will provide the ability of configuring the exploration and visualization of knowledge bases, learning environments and learning contexts.

1.1 Innovative concepts of Learning Environments

Using the Internet for educational purposes is still in the beginning. Often existing offline concepts will be transferred directly from the PC to the Internet without adaptation. So it seems to be clear that these concepts will only use a very small part of the widely spread features of distribution and linking of contents provided by the Internet.
As a platform *netzspannung.org* is able to provide a very large range of exploration of knowledge by using the already implemented interfaces, e.g. *Timeline* [11] and *SemanticMap*[12].

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[1] http://netzspannung.org

Furthermore there exist some new and innovative ways of extending the platform. Using the outlined techniques will result in a completely new and innovative way of cooperation between learner and teacher and also among themselves (peer-to-peer).
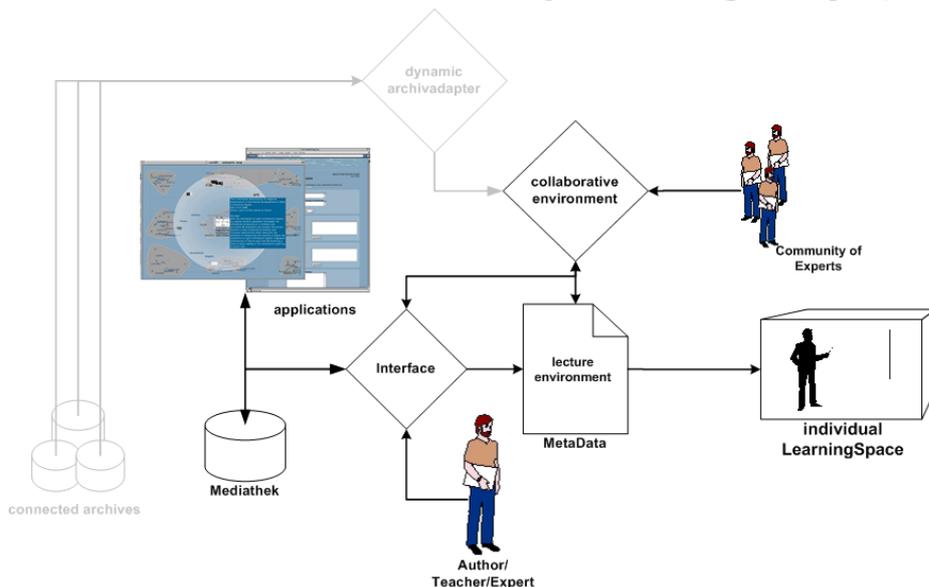
Acting as a mediator and provider of deployed supervised learning components the platform will build up a network of educational contexts, containing dynamic constructions of learning processes. Learners will be able to collect educational material ad hoc from different distributors and quickly adjust this to their personal learning context. On the other hand teachers would be able to arrange new courses as shown in Fig.1, respectively own tools and learning materials for distribution over the Net.

Using the LOM standard developed by the IEEE we have a technical specification which makes is possible to describe courses and classify learning objects. Applying to this concept will make it possible to generate courses dynamically resting upon the metadata describing highly modular objects like pictures (static, animated), audio files and text. [9],[10]

Thinking of the extending metadescriptions of all disposable objects in the media pool and also of the interpretation of user behaviour (i.e. tests of learning success and learning behaviour) the system will be able to dynamically construct courses from modular learning objects according to the special individual knowledge of different users.

Leading to this intention the existing structures at *netzspannung.org* will be extended to give the author and the learner the possibility to collect metadata themselves manually. Furthermore the system will be developed to collect this data autonomously and even evaluate this data in the given context.

The final goal underlying the concept is a highly autonomous and dynamically construction of online learning courses based on modular learning objects. The objects will be placed in a media pool together with referring metadata describing these objects and open up the full possibilities of the Mediathek in a structured way. It also seems to be clear that without user interaction the system will not be able learning to work autonomously. So the first step is to provide a platform where experts (e.g. teachers) can build their own individual learning environments using the already implemented resources of *netzspannung.org*. These *LearningEnvironments* should be published by the author to make them accessible to a wide range of learners. As long as the *LearningEnvironments* can be built using the given resources of the platform, the creator also should be able to integrate his own material through special interfaces. Afterwards these integrated information resources can be used by any other user of the platform.

The advantage of this concept arises from the highly modular storage of learning objects which makes it possible to reuse them also in another context in addition to pedagogically built goal-directed individual learning courses.

1.2 The intention of Telelectures

The goal of *Telelectures* is to provide interesting recitations to selected universities in high quality broadband format live. It is intended to provide these possibilities to an audience which in a normal case would not be able to join these recitations.

Besides the geographical distance between the students, they'll get the chance to get to know the newest scientific research studies and opinions with the chance of discussing and learning together.

The interest of media-universities to follow this development is quite high. Compared to an old fashioned personal teaching lesson this gives the opportunity for the students to follow the recitation live and discuss it with other participations directly afterwards.

The critical financial situation of many universities makes it nearly impossible to invite interesting speakers. Telelectures will give students the ability to get to know the speakers in a way it would not be possible otherwise. For the universities this means a free participation with Telelectures and less financial effort as well as less managing tasks to do.

Publishing selected lectures will help building up a scientific high quality online archive for media related themes.

Like the things discussed before, this is also available for free to the public. Telelectures understand themselves as an active addition to learning methods at this time.

1.3 About the initiators of Telelectures: netzspannung.org

Telelectures are based on the initiative of the Internet platform *netzspannung.org*, which is on the other hand a dynamic portal of knowledge for digital cultures.

Chaining Media Art, Media Design, science and technology, the platform will communicate the widespread activities from the scene of Media Culture and build up a pool of information. *netzspannung.org* is providing an online archive for digital art, design and media technology using innovative interfaces like *Timeline* and Semantic Map to explore its resources. Artists, media-designers and programmers publish and present their work online at the platform. After that, similar contents will be added to similar virtual contexts as soon as their relations among each other will be checked. At the same time trustees, journalists and scientists are supported in making investigations actively by providing intuitive distributions of information.

Working together with editorially activities like the conference "cast01", the young talent competition "digital sparks" and the "journal", a high quality network of competence, will be established to connect experts.

netzspannung.org is a non commercial project. It is supported by the ministry of education and research and is initiated and will be further developed by the MARS Exploratory Media Lab of the Fraunhofer Institute for Media Communication.

The *netzkollektor* [10]is the central publication and presentation environment at the platform. Here the artists, designers, researchers as well as the theorists can use a tool to publish their projects, exhibitions, invitations to bid and tools. [13]

Using intuitive and easy to understand visualization methods like *Timeline* and lists the contents will be contextualized and prepared to be discovered in an explorative way.

2 The Mobile Streaming Lab
2.1 Description:

The basic goal of the *MSL* is to provide a fully-fledged networked multimedia environment, which can be set up in any space without a direct Internet connection. This environment should enable people to display, edit and broadcast broadband multimedia information. It should be mobile and modular so as to adapt to different spatial conditions and functionalities needed for a given application scenario. To achieve this, the development of the *MSL* comprises two distinct but strongly interrelated parts: (1) the technological configuration and (2) the product design for spatial configuration of hardware elements

2.2 Technical description:
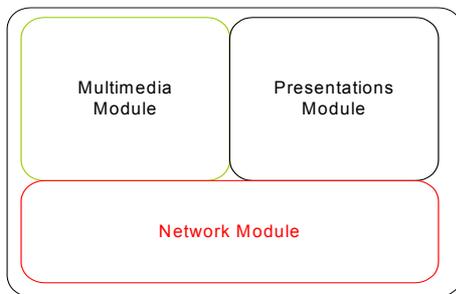
The technological set-up of the *MSL* comprises a set of different network, multimedia and presentation components, integrated in a logical multimedia system organized in a simple three-layer modular structure. The unit can be used for video/audio streaming, multimedia-based presentations or as a connectivity tool. The whole concept of the *MSL* can be based on three main parts: network module, presentation module, multimedia module.

This modular structure can be shown as a layered system where two layers directly depend on the third one.

Network module includes all the equipment necessary for the communication and enables free computers' location in the presentation module. Its main components are 10/100 MB Ethernet switch, router and wireless LAN base station.

Multimedia Module consists of video camera, wireless microphone unit, audio/video mixer, hardware MPEG-1/MPEG-2 encoder, audio amplifier, DAT recorder, VCR, DVD player and a PC workstation or laptop with good multimedia capabilities. High multimedia performance of this component enables real time audio/video encoding and live video/audio feed to the media server. In our case, media server is located at the FhG. The *MSL* delivers the streams to the FhG located media server, which distributes the streams using FhG network infrastructure.
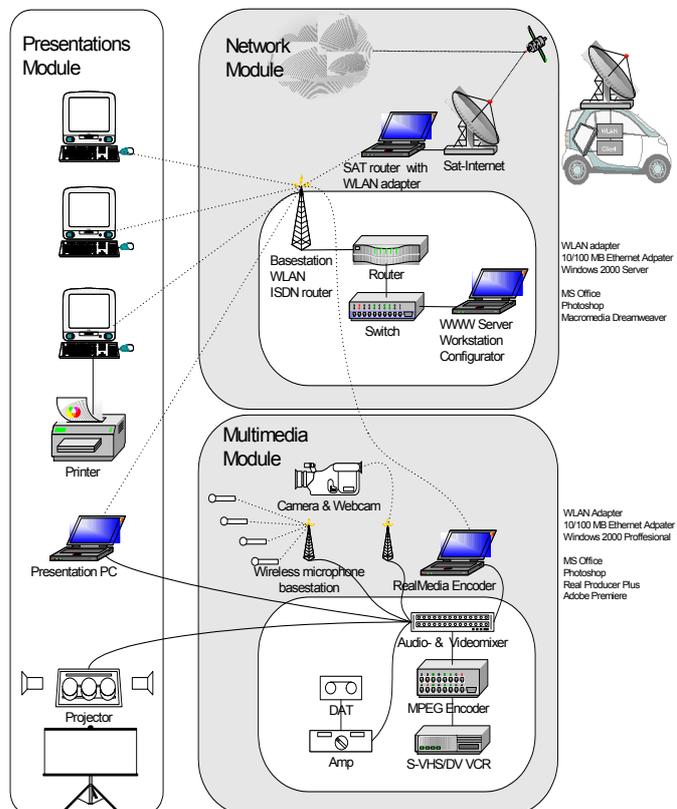
Presentation module was not thought to be very compact. It consists of several client computers (in our case iMacs) which can be easily administrated and have internal WLAN cards (AirPort, Apple).

2.3 Application: Streaming

The central technological part is media streaming. This is an area, which for professional use demands very good knowledge of network architecture and protocols, video and audio compression techniques, standards and operating systems. The whole area of distributed multimedia systems is a prerogative for professional streaming media developers and users. On the other hand, technical changes and improvements in mobile computing have brought us to the point where almost every single user can experiment with basic streaming functionality. The problem that still remains is making professional-level streaming more user-friendly for professional scenarios as well as accessible to inexperienced users.

In this context, an essential element of the *MSL* is the streaming module that offers an intuitive control tool for integrating diverse encoding and streaming hardware and software components.

At present it is based on a dual Pentium, Windows 2000 Professional PC with the following extensions and services:

- MPEG-1/MPEG-2 network broadcast hardware encoder (Minerva VNP-201),
- ViewCast Osprey video capture cards
- RealMedia, Windows Media and QuickTime encoding plug-ins.

This combination implements an "all-in-one" encoder with a web interface for managing customised audio/video profiles and controlling the delivery of streams to the streaming server. The media server is based on Kasenna MediaBase software, which supports creation of multiformat video description files. This means that the media server can dynamically select the appropriate delivery stream based on a client request. It further supports live video storage during the encoding process as well as both unicast and multicast streaming of high-quality (MPEG-2) video. There are several products and research projects [3], [11], [12] dealing with this area, but none of them supports high quality MPEG-1 and MPEG-2 broadcast quality and real time archiving. Compared to them, the *MSL* can be used for both – high and low quality streaming and archiving.

The described configuration provides a flexible environment for providing and managing a dynamically scalable range of streaming quality: from common 28.8k modem RealMedia streams to high-bandwidth MPEG-2 streaming.

This in turn enables on-line users of *netzspannung.org* to use *MSL* as a streaming tool for generating their own streams and distributing them over the *netzspannung.org* streaming server using TCP/IP or some other protocol, without need for some special streaming knowledge. In other words, this is the infrastructural basis for experiments with live on-line events integrating several or many participants [1], [2].

The *MSL* is able to publish all well-known media formats simultaneously in different bandwidths. Hardware and software are building a user-friendly production environment. They are providing a complete place for stage management: up to six video sources can be connected, mixed and edited.

2.4 Experiments and prototypic use of the MSL

**a. innovative format for conferences: Two-way-communication at „Memoria Futura"
1999**
At the symposium "Memoria Futura", hosted 1999 by the IMK.MARS, in addition to the local
speakers experts had been invited which took part using the internet providing their own con-
tributions. Using a combination of streaming and text-based ad hoc input of contents the col-
lecting process for contents has been extended. Experts could follow the speeches by using live
streaming and were able to give comments [5]

b. „Iconic-Turn": High bandwidth streaming for educational purposes (2002)
Tele-Lectures are an Internet format for the educational materials distribution. It has been
presented in cooperation with Burda-Akademie in Munich which organized "Iconic Turn"
lectures series. During these lectures in summer semester 2002, famous artists and scientists
are going to present their work and knowledge at the Ludwig-Maximilians University (LMU)
in Munich [4].
The lectures and presentations will be transmitted over German research network (DFN) and
distributed as high quality MPEG-1 and RealMedia streams to several German universities.
The video streams will be after decoding projected on big screens to students and professors
at the chosen universities. The live streams will be captured during the transmission, and will
be offered as video-on-demand materials afterwards.
This Tele-Lectures model is an extension to the traditional lectures' organisation, which adds
the possibility of building electronic lecture halls. Comparing to the reception at home (one-
way data transmission), it enables the communication between the listeners at the universi-
ties.

Conclusion:
In this paper we have described models and concepts for extending existing structures and
applications as well as information channels in order to build a new way of learning envi-
ronment. Existing techniques and interfaces are developed to act in a global network with the
intention to provide access to connected knowledge bases.
An important part of the whole framework which is already in use is the *MSL*. Doing the first
step in the direction of distributing knowledge and building ways for distribution of knowl-
edge is done at this stage.
The goal of the activities of *netzspannung.org* is to support experts in distributing their
knowledge in a way they want to do this, as well as supporting other users exploring the
knowledge bases with intuitive interfaces.

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