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## Welcome to iTV of the future



The LIVE project will create novel content production methods and intelligent tools for interactive digital broadcasters. With this new approach Live Media Events such as the 2008 Olympic Games will be an innovative experience for TV consumers.

### Newsletter Number 1

The aim of this publication is to report on the progress and results of the LIVE project as they happen.

Each edition will briefly report on the progress of each work area as well as, present a selection of articles from the consortium on a specific research theme being addressed in the project.

This first edition provides an introductory overview of the nine main areas of work, along with their respective research issues and expected outcomes.



## Business and Exploitation



It is the objective of this work area to prepare a roadmap, aiming at the commercial exploitation of the R&D outputs of the LIVE project on a pan-European and global scale, thus paving the way for successful massive product and media service deployment.

### Research Issues

This work area is designed to cover supporting measures for the LIVE project related to market, commercial and socio-economic factors such as:

- | Driver/barriers for the uptake and deployment of LIVE project results
- | Technology market trends and content development

- | New business and revenue models related to LIVE project results
- | Opportunities for global co-operation
- | Exploitation and business planning towards the end of the project
- | Overall socio-economic impact in Europe and worldwide.

In the research, special emphasis will be placed on developing a consistent framework and appropriate methods for identifying and analysing the current and possible future technology market trends. This market watch will concentrate on digital interactive technologies, particular audiovisual and iTV technologies, and new developments in content production and provision that benefit from these technologies. The market research results will form a vital contribution to the LIVE knowledge map which will, in particular, enable to conceive business strategies for exploiting the results of the LIVE project in the relevant markets.

The markets addressed are Business to Business markets, involving iTV technology pro-

viders, service operators, content producers and programme developers and providers.

Furthermore, any relevant information on factors which effect changes in consumer behaviour will be included, as the broader uptake of iTV will only be achieved if people buy into iTV equipment and services, based on the perceived value added of such services.

### Expected Results

Continuous market information and respective analysis related to the broadcast and technology areas of the project. Information on the socio-economic impact of LIVE and practical business planning and exploitation strategy documents.

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# Staging & Content Research



The overall goals for this research activity are the design and development of new methodologies for the live staging and content creation.

Design principles for staging live media events and for content creation will be developed and workflows defined which support the collaborative staging by professional users. Tools and interfaces for the offline pre-production phase and the online production phase of the live staging of media events will be designed and created.

The interfaces will hide the underlying complexity of the media objects and the workflow requirements. Exchange and trade of media objects will be possible through these interfaces by linking to the infrastructure of the broadcasters.

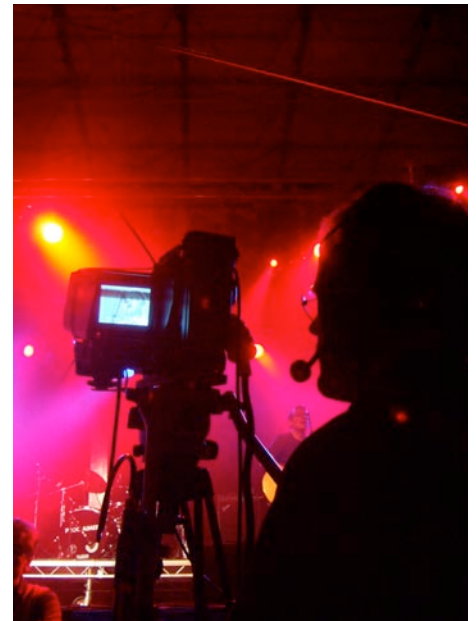
## Research Issues

We want to research dramaturgical concepts for staging. Questions to be answered are:

| How the instant feedback of the consumer can help the professional user (video conductor) to adapt and improve the live show to serve the consumer interests?

- | How can the instant consumer feedback be utilised?
- | What means parallel thinking for a new profession such as a video conductor?
- | How can a video conductor process all these parallel inputs and spontaneously create a parallel output, which should be a meaningful multi-perspective show.
- | Which tools can support the video conductor to do her/his work in the future?
- | Which pre-produced content can support the video conductor, when she/he has to improvise during the live show?

We will do research on methods and tools to enable the professional user to link live video streams at special (spontaneous) points in time, so that the consumer can switch channels due to her/his interests. How can the professional user stage content based and time-driven live video streams and get feedback from the consumers directly? Content based means that the professional user can link videos when the content demands it. If for example an athlete wins unexpectedly, in a live moderation about the Olympics the user can in this moment spontaneously link the winning video to a live interview with and (archived)



background information about the athlete. In addition links might be established to other competitions in the same sport discipline out of the archive.

The consumer is able to switch to one of these video streams, which are thematically interlinked to the video stream she/he just watched. The linking of videos has to be time driven, because the parallel streams are broadcasted and have to be synchronised due to time.

We want to do research on methods and tools to analyse and visualise the consumer feedback for the professional user in real-time: does the consumers like the video show in progress or not (voting / explicit behaviour) and how does she/he navigate through the offered streams (implicit behaviour)?

## Expected Results

As a result we expect a knowledge kit and tool kit for staging live media events. The knowledge kit shall include new methods, design guidelines and workflows for iTV broadcasters for online staging. The tool kit shall include the necessary tools and interfaces for the pre-production and the staging phase. We will deliver new iTV formats for broadcasters to stage any live media event e.g. elections. With new iTV formats we mean new design principles for creating live iTV productions.

We will propose design patterns which are content based approaches which stimulate audience interaction in order to stage multi-stream video shows in real-time, which can change due to the interest of the consumer. We will develop concepts and contents which can be "used" in several actual and future interactive networks (ip-based, mhp based, SD, HD, handheld etc.).

## Contact Person

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# Detection, Extraction & Annotation of Knowledge



The goals of this research theme are to develop new methods, tools and interfaces for detection, extraction (of knowledge) and annotation of video material and other resources.

A special focus is the in-vivo generation of knowledge, i.e. annotation of metadata at the point of content creation. More specifically this will include, Automatic offline and online detection and extraction of knowledge from media archives and from

live produced media and the annotation of media objects, Semi-automatic online annotation of live video material. Human annotation with meta knowledge about content will be used for constellations where automation is not possible (e.g. social

meaning), Automatic integration of knowledge and content from external resources, and Integration of all the above methods to support the staging process.

### Research Issues

This work area deals with the development of methods and tools to detect and extract information and metadata from audio-visual material. It has to be investigated how these methods support the annotation capabilities of the live staging process. Media streams should be enriched with additional information and metadata to produce media objects, which can be used for personalisation and offer semantic access. The research issues that will be addressed by this work area include:

- | How the currently unused potential of the content producers can be exploited and integrated into the staging process, by the semi-automatic online annotation of live video material. Which requirements on a formal model for live human annotation are given? How can methods and modules of automatic metadata generation be integrated in the annotation workflow?
  - | Which kind of interactive tools are needed for the semi-automatic annotation process. Which kind of link and recognition results must be available for the human annotator? How does one enable the annotator to select and add annotation results?
  - | How can huge existing media archives
- be made available for the live staging of media events? What kind of methods and tools are appropriate for accessing these archives, and which kind of content information is valuable for the staging process? How is semantic information extracted appropriately to the 'live' character of the event? How can multi-lingual content be handled?
- | Which kinds of methods are adaptable for the detection and extraction of information in live produced material? How is the live created metadata successfully exploited for the live production?
  - | Methods and modules to analyse the video data will be provided. Especially for the annotation of camera data video processing is important. Depending on the exact requirements of the annotation functionality several methods are considered. A video segmentation and key frame selection module which is able to process simple cuts but also dissolves and wishes will be provided. Existing text annotations in the video are important information. Other video processing modules are fast and robust face recognition, scene recognition (close-ups, field, spectators, human activity analysis) and scene clustering, detection of logos, advertising and flags in the video streams.
  - | For speech analysis methods and tools will be developed. The audio streams will be attached with relevant metadata. Here robust methods, like speech and speaker segmentation will be developed. To achieve high professional user acceptance

an appropriate lexicon size must be chosen. The grammars and the language models must be trained for the defined sports domain. To process a huge archive the speech recognition system must support sub word units, like syllables, to avoid the problem of out-of-vocabulary words. It is likely that the acoustic models for the ORF data must be adapted and optimised.

- | How can external information be assigned to media objects? Which kind of information is useful? Which kind of a formal model is appropriate (rules, heuristics, meta-descriptions) for this task?

#### Expected Results

Formal models and methods to exploit semantic knowledge on content by human annotation.

Tools and interfaces for the automatic detection and extraction of semantic knowledge in media archives and live produced audio-visual material for live staging.

A deeper understanding and tools for enhancing media objects with external knowledge, coming from different sources.

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## Personalisation & Feedback

The overall goal of this work area is the development of personalisation algorithms and data structures providing quality recommendations tailored for a particular end user (consumer) or a group of end users. This goal can be subdivided into the following goals: Definition and implementation of the user model structure. Defini-

tion and implementation of different feedback mechanisms and optimisation of their usage in the updating of the user model.

Definition and implementation of the content selection algorithms. These will be based on content-based and collaborative approaches with additional capability

to provide content recommendations for groups of users. The algorithms (as well as the data structures) should enable provision of online and off-line content recommendations, depending on the requirements given by the user. Development of a personalised content recommender system.

#### Expected Results

The expected results of the research undertaken in this work package are implemented personal content recommender systems, providing recommendations and selections of content items targeted for the end user(s).

The system will include the user modeling structures, implemented algorithms for personalised content selection implemented algorithms for the interpretation of provided feedback and corresponding mechanisms for updating the user model.



The selection of most interesting/useful content for the user (consumer) from the available amount of content requires user-oriented procedures and structures. Possible selection processes are based on information about the consumer's preferences, stored in a user model and on the description of content items. Other approaches analyse the similarities among consumers and use them as the basis for generation of content recommendations.

The updating of information about user's preferences stored in the user model requires reliable feedback mechanisms, providing information about user's attitude towards particular content items. Therefore, the main goal of this work pa-

ckage is the definition and implementation of the structures and mechanisms that will provide the personalisation functionality.

### Research Issues

The main research issues can be classified into the following categories:

- | Identification of the structure of the user (consumer) model. To some extent this structure depends on the metadata standards used for descriptions of content, but also on the expected field of usage.
- | Identification of the most appropriate and efficient feedback mechanisms (explicit/implicit) and synthesis of both

approaches into a common updating procedure.

- | Selection of appropriate content selection algorithms. Combination of content-based and collaborative filtering mechanisms into a more efficient hybrid recommender. Related to this issue are also the requirements for online and offline selection processes.
- | Incorporation of context-aware knowledge contained in ontologies with the personalised content recommender.

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## Intelligent Media Framework



The main focus of this work area will concentrate on the development of intelligent media objects that allow for the interaction of cognition based content knowledge with social based consumer knowledge (connect item based knowledge with user based knowledge).

### Research Issues

The intelligent media framework provides media asset management functionality for the acquisition and permanent update of a set of meta-data associated with the media assets relevant in the live staging process (i.e. live content and archival material). The framework reacts to real-time interrupts (e.g. a program change) and triggers the recommendation process. Based on recommendations (which depend on the consumer profiles, video conductor), appropriate media assets are selected and prepared for play out.

In this way our idea of intelligent media objects is strongly associated with the scientific field recommendation systems. The basic functionality of recommendation systems is usually divided into item based filtering and user based filtering methodologies. Item based filtering embraces all methods, which provide cognitive knowledge about the content of media objects (feature extraction, content based filtering, object recognition, automatic meta data generation etc.). User based filtering on the other hand seeks for knowledge about the behaviour and interests of users (collaborative filtering, social filtering, user modelling, real-time profiling etc.). The intelligent media framework has to connect item based knowledge with user based knowledge in such a form that the media content itself is in the position to find its way to an interested audience.

Our approach of interaction of content based items with user based items is novel and bears a series of research challenges. Some of the basic scientific and software engineering questions are:

- | Which kind of item based meta-data and moving object tracking, camera movement, face recognition, etc.) have to be extended to meet the challenges of user based social interactions.
- | What knowledge about the user is essential and should be used as keywords for human live annotation? Can any kind of knowledge automatically be extracted from user interactions, which is appropriate to support content-based analysis methodologies?
- | How can the interaction between item

based knowledge and user based knowledge be realised? What kind of metaphor is suitable to describe, investigate and implement the interaction of user items with content items? Is for example –an agent view with respect to productivity better than a biological motivated view of cell interaction and keying?

- | What software architecture is suitable for broadcasting environments? The architecture has to meet the demands and constraints of state of the art television platforms as well as the requirements modern software engineering methodologies.

### Expected Results

- | Development of methodologies combining item based knowledge with user based knowledge in such a form that the media content itself is in the position to find its way to an interested audience within the intelligent media framework
- | General agreement on the methodology that will be used to combine item based approaches with user based approaches to realise intelligent media objects. This result feeds into the basic system architecture.

### Contact Person

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The main objective of this work area is the integration of the tools and methods of the various technical work areas (staging and content research - Intelligent Media Framework) into a running system on the basis of the basic architecture which is developed in Requirements and Systems Specification. The creation of an overall system for the real-time staging of life events poses various technical and practical questions.

One key question is concerned with the selection of one or more appropriate distribution systems, which will depend on several criteria. First, the functionality of the intelligent media framework will impose special demands on the distribution (broadcasting) system. Also the client application and the usage of a back channel (consumer feedback) will be of major importance. Second, the LIVE project will consider the availability and propagation of the coming interactive TV environments. Various current approaches and standards are in question:

- | DSL for IP based TV: The availability of DSL in more and more households supports the delivering of TV content over IP networks. This is especially useful for video on demand (VOD) and new TV services. Microsoft TV for example has released an IPTV edition to enable an end-to-end software solution for interactive broadcasting. The main advantage is the high flexibility due to the direct bi-directional internet access. However, to achieve a scalability of an IPTV service a demanding backend is required. With the propagation of DSL technology and broadband services it is possible that this requirement will be solved during the project duration.
- | DVB-MHP: The MHP (Multi-media Home Platform) was standardised by ETSI over the past 5 years. This broadcast TV standard provides a comfortable API to build interactive TV services on a digital TV set and allows interactive access to metadata which is transported in the DVB stream. Since DVB relies on MPEG-2 Transport Streams (TS) data rates between 3 – 6 Mbits/sec are necessary to deliver interactive video content. The metadata is provided by a DSMCC object carousel. The advantage of this framework is the effective method to deliver content to many clients and consumers at the same time and with high quality. Due to the broadcast character of the transmission, no



bi-directional communication is supported. To achieve back channel functionality additional communication channels (i.e. internet, telephony) have to be used.

- | DVB-H: This emerging standard is mainly focussed for mobile devices. The transport of encoded video data is realised over IP. One advantage of DVB-H is the flexibility to use new video coding standards (e.g. H.264). Another advantage of DVB-H is the low power consumption using a burst transmission mode to extend the duration of the mobile device. Also the back channel can be directly realised over the existing telephone functionality (i.e. GPRS, UMTS) of a mobile telephone. Currently the first prototypes are available and could be used in the project.

The play out component of the overall system must be able to create flexible content. This means the intelligent media objects must be created and adapted to the distribution system. This could be either a streaming system (i.e. SMIL) or complex DVB transport streams including metadata.

The integration activity will regard also new standards from the MPEG, EBU, SMPTE and W3C standardisation organisations. MPEG-21 for example will be finalised during the LIVE project duration and concepts of the MPEG Multimedia Framework can be used. Also new multimedia transportation protocols like SIP (session initiation protocol) for interactive services and new bandwidth friendly streaming formats like H.264 (or even newer codecs) will be considered. Besides the integration and development of a broadcast distribution system also the other modules and components will be integrated in an overall system. This integration work covers the connection of the to be developed annotation tools and interfaces of the work areas Staging and Content Research – Intelligent Media Framework

with the database of the ORF containing the sports archive. Also external resources (i.e. internet, other news services) will be connected to the annotation modules.

For assuring the high practical value of the work package, the results of this work package will be tested and evaluated in experiments and the field trial Olympics 2008. In particular, ATOS' experiences in broadcasting and hosting of the European Soccer Championship 2004 in Portugal will be exploited for system integration purposes. Further ORF has the rights to use the images of the European Soccer Championship 2008 and the Olympic Games 2008 in Austria.

## Research Issues

- | Analysis of existing broadcasting distribution systems (e.g. DSL for IP based TV, DVBMHP, DVB-H) for their usability within the LIVE project. How can they provide the functionality demanded by the intelligent media framework?
- | Which of the coming interactive TV environments (e.g. MHP, IPTV, DVB-H etc.) will be available and propagated? What kind of functionality is provided by their back channel?
- | How to enable the play out component to create flexible content? How to create and adapt intelligent media objects to the distribution system?

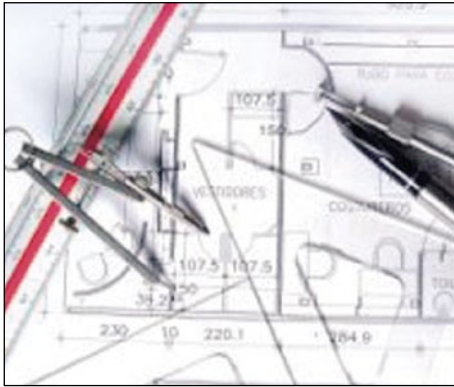
## Expected Results

- | Overall integration plan
- | Integrated overall production system prototype

## Contact Person

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# Requirements & Systems Specifications



In this work area the LIVE interdisciplinary team of researchers, developers, TV broadcasters and artists will develop new methods and tools for the live staging of media events

To do so a thorough analysis of all implicated human, technical, artistic, methodological and scientific themes of the envisioned live staging process will be carried out. Also the technical feasibility in the studio and production environment of the ORF will be defined.

The result will be the definition of the initial requirements for the work areas Staging and Content Research - Integration,

User Experiments and Field Trial. Furthermore increasing refinements of the basic architecture or the final unified system will be defined.

## Research Issues

A rigorous analysis of the entire spectrum of the involved human, technical, artistic, methodological and scientific subjects of the envisioned live staging process has to be carried out. The questions to be answered in this interdisciplinary work package include, but are by far not restricted to, the following:

- | Who is involved in the production, who is the consumer?
- | What are consumer's preferences? What kind of content and formats are conceivable / of interest?
- | What kind of information can be part of the feedback loop? How to generate this information?
- | How to personalise intelligent media objects?
- | What are the producer's needs? How to realise collaborative workflows and staging?
- | Which information is/should be encapsulated in the intelligent media objects? How do they interact within the framework? What is their behaviour?

What are the suitable metaphors for production interfaces and what are the ontologies for content categories?

- | How to utilise existing media archives?
- | What are the requirements for a unifying live staging system? How might a basic architecture of the unifying system look like?
- | How is the technical feasibility to enable this new service

## Expected Results

We expect an in depth understanding of the prerequisites for the novel live staging of media events process.

In the long run this could result in knowledge and tool kits for iTV broadcasters and content producers who want to stage live media events.

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# User Experiments & Evaluation



The user experiments and evaluations will lead to an integrated communication process. The results of these continuous activities will influence and improve the re-search activities according to the project goals.

The objectives of the experiments and evaluation work area are to:

- | Evolve new concepts and techniques through experiments that are guided by evaluation.
- | Provide a framework for validating the project outputs throughout the project life cycle.
- | Create an evaluation and validation plan.
- | Conduct trials and verification of the project outputs.
- | Provide quantitative and qualitative results that can be used to promote and disseminate the project results.

## Research Issues

New technical and conceptual methods for live iTV and new 'use' of multimedia objects demand different evaluation concept. These aspects have to be investigated concerning the views of the future consumers as well as broadcasters.

A special issue will be training affairs. A lot of new fields of work within the production workflow will be developed and established.

But of course the customer himself will need a specific introduction – explicitly by telling him and implicitly through the new iTV concept.

## Expected Results

- | A specific developed evaluation frame work.
- | Specific developed/adapted evaluation methods.
- | The results can be used as a benchmark for further developments in this area.
- | The results should be useable for promotion and dissemination issues.

## Contact Person

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## Field Trial Olympics 2008

The field trial Olympics 2008 Beijing will be the online test of LIVE. Since such an innovative concept for interactive live broadcasting needs novel technical environments, a main task will be to define the requirements for it. This includes new workflows, training, hardware and software, interfaces etc.

Within this project, a 'real' and enhanced broadcaster's environment (embedded into the existing digital setting) will be built. A real broadcast through a two-way digital (probably cable based) network will be performed. Set top boxes will be used on

the customer's side. The technical implementations will follow several broadcasters' standards (SMPTE, EBU).

In the ORF the three different head offices, the Technical, the Sports and the Archive Directorate will work together to realise this ambitious field trial Olympics 2008 in cooperation with the other partners of LIVE.

### Research Issues

The main task will be the appliance and verification of the conceptual and technical concepts. How can the broadcaster handle

and manage the tasks and how will the customer deal with the content offers? We will investigate in detail how the future digital workflows will look like, how to establish collaborative networking for iTV productions. What are the definitions of new specific working fields (e.g. content manager within complex iTV production, 'VJ'/'Video Conductor' – the new way of live directing an iTV transmission; in general: more self dependent jobs)? What are the new workflows and lifecycles of intelligent multimedia objects (reuse)? How to design specific interfaces for live and real-time operations for iTV?

### Expected Results

- | Set up a specific but sustainable production environment.
- | Trained broadcast staff who can deal with test beds.
- | Feedback on hard and software developers.
- | Positive feedback of customers (amount/quality of access).
- | Feedback of customer that can be interpreted and evaluated with relevance.
- | Project as an impulse for further live iTV developments.
- | Sustainability of changes/developments.

One special task will be, to ensure the rights clearing of the used material. Since the ORF holds a big amount of archive material, the specific use of it will require extra efforts for rights clearing. But also the 'live' material has to be cleared for the use at the field trial.

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We are proud at LIVE to have a well balanced group of R&D institutions, universities and industry players - which bring together a healthy blend of solid technical expertise, strong user side know-how and hard nosed industry and business sense. Just the right mix for the ambitious goals of LIVE.

The LIVE Consortium consists of nine partners from five European Member States. Representing two RTD institutions, three industry players including a major national broadcaster and four Universities highly acknowledged in their area of speciality.



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Informationssysteme

FhG/IAIS is active in the research and development of advanced broadcast solutions over more than 10 years. The recent developments in Fraunhofer IAIS comprise the interactive MHP solution JAME including an interactive authoring framework for interactive TV applications and a solution for media indexing called iFinder.  
[www.iais.fraunhofer.de](http://www.iais.fraunhofer.de)



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[www.atosorigin.com](http://www.atosorigin.com)



Fachhochschule Köln  
Cologne University of Applied Sciences

The University of Applied Sciences Cologne (UASC) is the largest university of applied sciences in Germany. The responsible Institute for Media and Imaging Technology (IMP) belongs to the Faculty of Information, Media and Electrical Engineering at the UASC.  
[www.fh-koeln.de](http://www.fh-koeln.de)



Kunsthochschule für Medien Köln  
Academy of Media Arts  
École Supérieure des Arts et Médias

In Germany, the Academy of Media Art, Cologne is the only art academy for all audiovisual media. The art and media sciences offered combine various courses, not to be found at any other art academy in this constellation. Experimental computer science no longer considers the computer only as a tool, but also as a means of personal and subjective expression. On this basis, analysis is done in experiments which take into account computer science consideration, its history and actual relationship with art.  
[www.khm.de](http://www.khm.de)



The School of Informatics at the University of Bradford (Brad) is a focus of multi-disciplinary research and education; combining areas of digital media, parallel computing for image processing, image coding, video processing, computer graphics, modelling, computer animation, visualization, virtual reality, solar imaging, HCI, video transmission, design, and media production.  
[www.bradford.ac.uk/external](http://www.bradford.ac.uk/external)



Salzburg Research conducts applied research in the areas of information and communication technologies with a focus on creating and managing digital content. We presently employ 55 researchers across our application areas of Digital Media, eCulture, eTourism and EduMedia.  
[www.salzburgresearch.at](http://www.salzburgresearch.at)

Univerza v Ljubljani



University of Ljubljana (UoL) is cooperating in EU projects in the fields of multimedia and interactive TV since 1996. UoL is an expert in the design and development of collaborative-networked applications, such as peer-to-peer networks as well as client-server based applications.  
[www.uni-lj.si/English/english.asp](http://www.uni-lj.si/English/english.asp)



The ORF is an independent public media corporation. It is the largest television and radio broadcasting company in Austria, with its headquarters in Vienna. The ORF has nine regional offices in each Austrian province and another one in South Tyrol.  
[www.orf.at](http://www.orf.at)



Sony NetServices creates, develops and operates innovative content services for various media platforms such as mobile phones, home entertainment equipment and PCs. Sony NetServices supports the Sony Corporate Goal of generating growth through device and content convergence.  
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## Administrative Details

LIVE is an integrated project of the European Union's 6th Framework Programme - Call 4.  
Project duration 45 months, begin January 2006.

## Project Management

Technical Coordinator: Dr. J. Köhler  
Project Manager: M. Borowski