Networked Media

Current Research, Results and Future Trends

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SEVENTH FRAMEWORK PROGRAMME

European Commission
Information Society and Media

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Foreword

The Networked Media area is growing in importance and is leading the new generation of entertainment services. Creation and consumption of multimedia content is evolving at a fast pace towards new ways of media delivery, including 3D Media, Ultra HDTV and immersive On-line Games, relying on the Internet as one of the main delivery mechanisms.

The dual role of users as producers and consumers and the combination of real world with virtual and augmented reality is showing a high potential to generate innovative business models and new economic growth.

Networked media is having a strong impact on the media and entertainment market. It is estimated that **by 2015, three million new jobs will be created in many Networked Media relevant sectors** (entertainment, information, education), both directly (industry and research) and indirectly (finance, advertising).

In this context, not only the "traditional" broadcasters and telecommunication operators are extremely active in this field of research, but also new actors, such as Internet service providers and technological SMEs. The participation to the 2009 FP7 ICT R&D Call for Proposals well reflects this evolution.

This publication presents the ongoing European Networked Media research and sketches the emerging R&D trends in this area, further to the recent call for proposal.

Luis Rodríguez-Roselló
Head of Unit Networked Media Systems
DG Information Society & Media - European Commission

1 What are Networked Media?

In the old days, Internet was designed and primarily used by scientists for networking and for exchanging information between each other. Nonetheless, since then the Internet has been evolving into an open fully fledged virtual environment for media and communication services.

Networked Media encapsulate the concept of decentralized forms of mass communication, in which everyone, individuals and groups, can actively contribute to sharing and shaping a universe of media content.

Throughout the last decade, the evolution of Networked Media has essentially been driven by the extraordinary breakthrough achieved in the field of computing and electronic communication. In particular, the process of Convergence grants users ubiquitous access to media content ("anytime, anywhere"), through the integration of Information Technology (IT), telecommunications and media.

"Networked Media (sometimes referred to as Network Media) refers to media mainly used in computer networks such as the Internet."(Wikipedia)

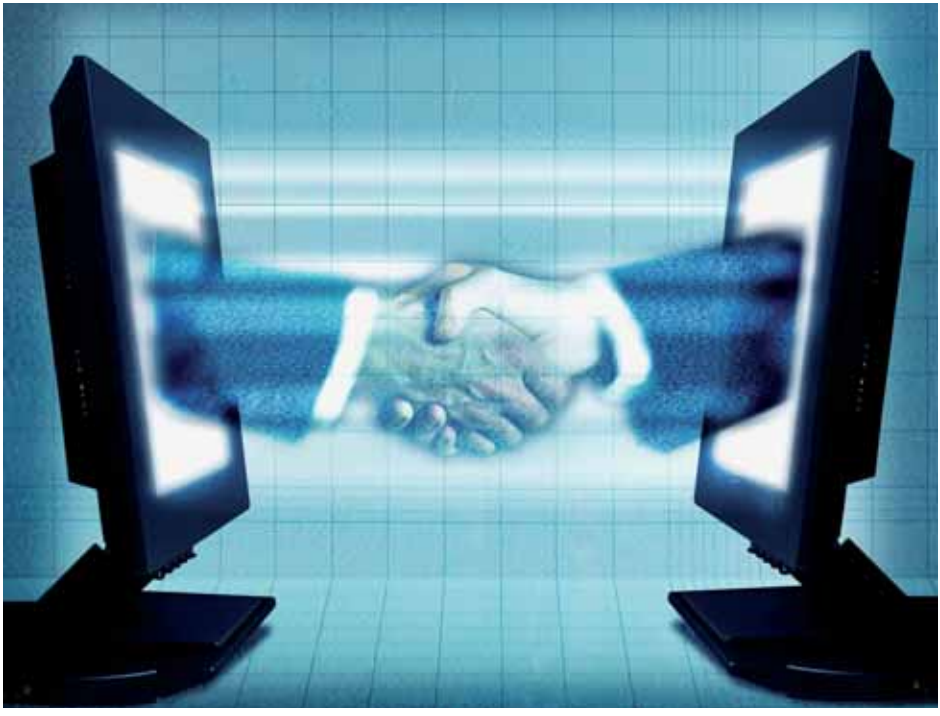
The increasing popularization of Networked Media transformed what was once considered a techie's realm into a widespread everyday life activity for the people living in our modern information society.

What makes Networked Media different from traditional media?

- Networked Media require **computers** or **input/output electronic devices connected to the network**;
- Networked Media support individuals and communities which not only **consume** but also **produce** and **actively participate**;

- Networked Media offer a **participative and collaborative** approach, allowing the **bottom up creation and sharing of contents and services**.

In essence, **Networked Media are decentralized media of mass communication, whose value chain features a network capacity for collaborative production of information and knowledge, as well as of customized services**.



2 New Consumption and Production Patterns

"The European Technology Platform on Networked Electronic Media, the NEM Initiative, foresees a future when all will be able to generate, manipulate, use, and enjoy any kind of electronic media content – wherever they are. Electronic media content will include not only the audiovisual services of today, such as telephony and television, but also a wide range of interactive services across all realms of information, education, and entertainment, offering a wide range of new business opportunities."

Strategic Research Agenda

www.nem-initiative.org

Because of the rapidly increasing amount of innovative technological solutions of networked media and of the expansion of their innovative social uses, the attention around Networked Media is getting stronger and stronger.

Internet increasingly offers immersive and engaging experiences. It is no longer only a repository of information made available for consumption by the general public.

Its current features and affordances stimulate a growing number of users and social uses, thus contributing to the shaping of the information society.

The Internet represents the stepping stone for extraordinary technological breakthroughs and societal innovation. Web 2.0 and social networks are growing exponentially, attracting more and more regular users, creating new social dynamics and new businesses. Not only is this happening in industrialized countries, but also in emerging countries. At present, the Internet traffic grows by 60% each year. We can expect an ever higher percentage growth once 3D content will be largely accessible on-line.

The major turning point represented by Networked Media is that they are not only stimulating and enhancing creativity, productivity and social relations at all levels, but also, as a result of new social uses and new consumption and production patterns, they are radically transforming the entertainment industry and information production at large.

In this context, the commercial take-up of **community networks** and the use of **Peer-to-Peer (P2P)** software are becoming the keys to the development of **new business opportunities**, increasingly based on user-centric solutions and delivered on sophisticated displays (HDTV, **3D**TV).

Internet of the Future: What policies to make it happen?

Viviane Reding
Member of the European Commission responsible for Information Society and Media

Future of the Internet Conference
Prague, 11 May 2009

"Novel socio-economic trends fuelled by restless technological developments will also raise new challenges and opportunities for the Internet. Let me mention a few of these:

- *Web 2.0 and social networks are growing at viral rates. Popular social sites attract more than 120 millions regular users. This is only the beginning as web 2.0 applications will be more and more used by businesses, not only by individuals. The emergence of 'enterprise 2.0' will bring about huge benefits to European companies and SMEs in particular.*

- *Mobility and nomadic usages are becoming the norm. […] By 2012, at least 1 billion of those will use mobile as their only access to the Internet, adding to the today 1.5 billion of fixed users.*

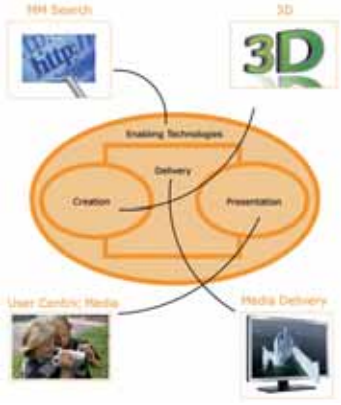
- *An ever richer content and media environment. […]. Popular social video sites add 13 hours of user video content to the Internet every minute! Search engine systems refresh the equivalent of the entire library of Congress every four hours. Every year, the Internet traffic grows by 60%. This is mainly due to video and will be further amplified with the advent of on line 3D content.*

- *The emergence of an Internet with "Things. […]. Economic prospects are significant, with an estimated market of € 30 billion by 2016 for the sole segment of RFID enabled applications."*

3 Current R&D in the Field of Networked Media

Projects in the field of Networked Media that are now funded by the **Networked Media Systems Unit** cluster around four areas:

- User Centric Media
- Multimedia Search
- 3D Media
- Media Delivery Platforms



The Networked Media Systems Unit also funds **Support Actions**.

The scope of current R&D encompasses a strategic understanding of the value chain in the networked media sector, ranging from the creation to the presentation, including the *retrieval, delivery, display and the necessary enabling technologies*.

ICT Challenge 1:
Pervasive and Trusted Network and Service Infrastructures

The overall goal is to enable the emergence of network and service technologies that open up new application scenarios and innovative business models, thus creating novel business opportunities and sustainable growth. The aim is to provide the technology for scalable networks of interconnected devices, machines, individuals and organisations, served by new, configurable, and dynamic software services. This will empower users to manage networked media content and will allow organisations to adapt to rapidly changing, networked business ecosystems."

3.1 User Centric Media

The Internet and media landscapes are undergoing a revolution driven by more active participation of users and resulting in the exponential growth of user generated content (UGC).

User Generated Content will enhance inventive and creative practices in the field of arts, science, engineering, education and leisure, based on entirely new types of creative media.

An increased user control on multimedia contents and on the Internet allows a more gratifying user experience, while imposing new challenges both related to business models and to design processes.

To meet these challenges the convergence of networking, broadcasting, consumer electronic industries and interaction designers plays a key role.

It will pave the way to a universe of new Internet multimedia services, where dynamically evolving applications are continuously adapting to users' needs, but also to which users can now contribute with their own generated content and services.

On the one hand, this higher level of interaction will enhance human creativity by unlocking the potential of a digital media-world which, while still being associated with the physical experience, is revolutionary in terms of the infinite shapes it may take. On the other hand, new solutions will have to be developed.

Along with user generated content, content produced and released by traditional media will continue to exist, but traditional media needs to evolve in order to survive this epochal turning point.

Several projects focus on new technologies and methods to enhance the user participation in the media value chain, enabling them **to consume, author and publish content on a networked audiovisual system, at any location, with any device**.

3.1.1 Overview of Research Projects in User Centric Media cluster

together anywhere, together anytime

How can technology help to nurture family-to-family relationships?

TA2 "Together Anywhere, Together Anytime" is a collaborative research project exploring a new technological solution supporting individual to group, group to individual or group to group communication, to nurture family-to-family relationships. Current media are mostly conceived for individuals: phones, computers and electronic games devices tend to be individually owned and provide individual experiences. TA2 seeks to redress this imbalance: enhancing and supporting collaborative processes among family members, enabling people to share their stories, pass digital photos and videos around, add comments, pass them back and play games together. TA2 seeks ways in which modern sensors and IT equipment can support the family to gain better awareness of each others' activities, whilst maintaining each individual's right to privacy. TA2 media and communication experiences are characterised by their naturalness; clear relaxed voice communication and intelligently edited video. Through the TA2 system, stories are automatically generated from home-related content, the personal home video or from the antics of a lively game.

Project website: http://www.ta2-project.eu

SAME

Sound And Music For Everyone Everyday Everywhere Everyway

Music making and listening are a human activity that is above all interactive and social, two big challenges for the new communication devices and applications. However, to date music making and listening is usually a passive, non–interactive and non-context sensitive experience. SAME aims at creating new end-to-end systems for mobile active, experience-centric, and context-aware active music listening. The general objectives of the SAME project are three-fold: (1) to define and develop an innovative end-to-end research platform for novel mobile music applications for participative, experience-centric, context-aware, social/shared active listening of music, for a broad target of non-expert as well as expert users; (2) to investigate and implement new communication and interaction paradigms for mobile music applications based on high-level, expressive, non-verbal multimodal interfaces, empowering the user to influence, interact, mould and shape the listened content, by intervening actively and physically into the experience; (3) to develop new mobile context-aware music applications, starting from the active listening paradigm, which will bring back the social and interactive aspects of music to our information technology age.

Project website: http://www.sameproject.eu

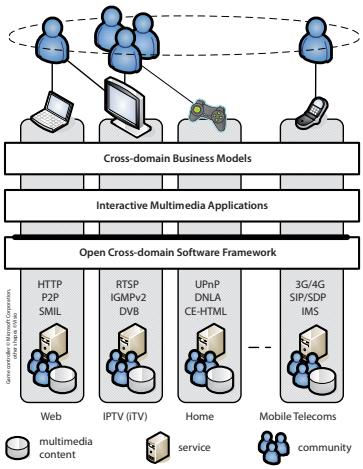
PlayMancer: An European Serious Gaming 3D Environment

PlayMancer implements a new Serious Game environment, by augmenting existing 3D gaming engines with new possibilities. The objectives of the project are four-fold: (1) to construct a next generation networked gaming environment, mainly augmenting the gaming experience with innovative ICT modes of interaction between the player and the game world; (2) to allow for a shorter and more cost-effective game production chain, by enabling techniques for procedural content creation based on generative modelling, and thus reduce the cost of offering a full-fledged pre-designed gaming world; (3) to evolve the principles of "Universally Accessible Games" (UAG) for application into 3D-based games, following a "design for all" philosophy, with the ultimate goal of designing games to be equally challenging to players of different abilities; (4) to evaluate the proposed framework and gaming infrastructure by developing and testing a series of serious games modules as applied to two application domains: physical rehabilitation, and therapeutic support and lifestyle management programs for behavioural and addictive disorders. User requirements from the application domains will drive development of the platform. Specifically, the focus on physical rehabilitation will drive platform requirements for supporting the development of UAG) and the integration of low cost player motion tracking and bio-feedback devices. Games scenarios from the lifestyle related disorder could implicate platform requirements for emotion recognition of states such as boredom, depression, anxiety and associated cognitive responses. Due to the modular nature of the envisioned PlayMancer gaming platform architecture and the commitment to Design-for-All philosophy, the project results could be generalised to other serious games applications and user communities.

Project website: http://www.playmancer.eu

INEM4U: Sharing interactive multimedia experiences in a converged world

iNEM4U aims at designing, prototyping and evaluating a distributed service infrastructure that supports the following goals: • Delivery of interactive multimedia content and services across technology domains • Seamless integration of professional and user-generated multimedia content across devices and locations • Personalised interaction with multimedia services and content • Synchronous community-based content and experience sharing • Open (collaborative) business models. To accomplish this, the project extends and combines existing services from different technology domains, such as Web 2.0, IMS, peer-to-peer and IPTV services. In particular, iNEM4U investigates innovative solutions in thre areas: new generic services that facilitate cross-domain interoperability (identity management, media synchronisation and metadata integration), user-centric services for enhanced shared media experiences (context-dependent cross-domain recommendation system, community management), and business models that provide benefits for the entire content distribution value chain.



Project website: http://www.inem4u.eu/

Secure, Trusted and Legally Ruled Collaboration Environment in Virtual Life

Virtual Life aims to combine a high quality immersive 3D virtual experience with the trustworthiness of a secure communication infrastructure, focusing on the creation of secure and ruled places within the virtual world where important transactions can occur.

The proposed system provides users with the possibility to create and share contents, media, data in a very intuitive way, since all the user action will be performed in a virtual reality environment by sending the commands of an avatar representing the user in a world defined and created by the user himself.

Project website: http://www.ict-virtuallife.eu

Real-Time Context-Aware and Personalized Media Streaming Environments for Large Scale Broadcasting Applications

My-e-Director builds a prototype context-aware broadcasting platform, offering personalized streaming experiences to individual users or whole user communities. Based on this platform fixed and/or mobile users can enjoy a diverse range of personalized media services, which is seamlessly supported by the underlying fixed, broadcasting and mobile telecommunication networks.

The service resembles an automated ambient intelligent director that operates with minimal or even without human intervention. Contrary to state-of-the art services of similar nature that focus on few targets and low-level activity scenes, My-e-Director is implemented in the scope of large scale multi-actor, multi-target environments and high-activity scenes. The key innovative feature of the My-e-Director broadcasting service is the personalised selection of "targets" via semantic search, and accordingly the delivery of a personalized video stream to end-users. The personalized selection and assembly of the target streams is based on a context-aware multi-camera selection algorithm. End users of the platform will be able to select specific cameras in order to focus on precise places and scenes or even in order to "follow" individuals or groups. The consortium aims to develop and deploy a technology showcase for the coming 2012 Olympic Games in London.

Project website: http://www.myedirector2012.eu

Dynamic Personalization of Multimedia

MyMedia addresses the key social problem of ever growing information overload, aiming at increasing the level of relevant content over the "noise". The project addresses this problem by creating an open source software framework to dynamically personalize the delivery and consumption of multimedia. MyMedia tames growing volume of content streams by combining them and allow users to sip from a single manageable stream of the most personally relevant content. The project delivers an open source software framework which allows researchers and potential commercial exploiters outside of the consortium to easily plug-in and experiment with new recommender algorithms and content sources. This simplifies take-up outside the consortium and creates an even wider impact. Field trials will be conducted in multiple countries and languages to understand cultural differences.

Project website: http://www.mymediaproject.org

Games at large: Meeting the demandof highly interactive multimedia systems

Games@Large aims at providing new system architecture for Interactive Multimedia which will enhance existing CE devices such as, Set Top Boxes and other Devices which are lacking both the CPU power and the graphical performance to provide a rich user experience. Games@Large further aims to provide the solutions based on the above architecture in a low-cost fashion, in order to make it attractive for both business and consumers to implement the various solutions. Games@Large optimises the sharing of CPU power and Storage while using Wi-Fi methods for wireless communication. Games at Large intends to research, develop and implement a new architecture to provide users with a richer variety of entertainment experience, diversifying from dedicated appliances and a single corner of the house, to any place at home such as the TV in the living room, the hand-held device or any other device with a relevant screen, controls and connectivity. The technological challenges in the Games@Large projects are:

- Distributed computing and storage,
- Video/Image/Graphics delivery with very low latency through a wired/wireless home network,
- Adaptation of PC screen images to TV screen and hand-held devices, Integration of wireless users' game control devices,
- Translation of user ergonomics to different devices and form factors, Research of new class of Media Extenders for games
- Enhancement of STBs to support video games,

Project website: http://www.gamesatlarge.eu

Enabling non-professional users to co-create networked applications and experiences with user-generated content.

"Based on user-generated media, recorded by different users at different times, an open and flexible architecture will create a novel networked application or experience each time a user uploads new content."

Citizen-Media developed a platform enabling non-professional users to co-create networked applications based on their own generated content. Users can consume, author and publish their own content through a networked audio visual system at any location with any device. Based on user-generated media recorded by different users at different times, an open and flexible architecture is proposed that creates a novel networked application each time a user uploads new content. The underlying infrastructure hides the complexity of content handling for the end user by supporting transcoding of formats, customisation and mixing of personal and private content. The audio visual system is able to handle a massive amount of user-generated content in different formats in real time, annotate and store this content into huge databases, search, retrieve, process and render all these pieces of user-generated content to create a new experience.

Project website: http://www.ist-citizenmedia.org

3.2 Multimedia Search

Search engines are one of the most popular 21st century technology inventions. For the vast majority of users, a good web search engine is an essential entry point to find out what's on the World Wide Web.

Free search engines have become the end-user's on-line media knowledge brokers.

Once upon a time, IP veterans would have had to invoke an exact item to FTP. Today surfing and fetching the web with a vague keyword query has become so popular that even six-year-olds who spell poorly can do it.

An essential and interactive technology to match questions with answers, search engines allow for entry or for expansion of commercial viability for any networked media service. As such they play a key role for both scalability and growth of future Internet services.

Gigabytes of data flow into the web daily, increasingly due to user-generated and image-based content. For anyone to access, find, or navigate the visible portion of the Internet, requires smarter, faster and more powerful audio-visual search engines. Yet the visible web is but the tip of the iceberg when compared to the data that is collected and that could one day be mined or reused.

Media search of broadcasted material involves database access, storage and smart indexing & retrieval solutions. Search engines must understand better the user's query. The best search engines are both multimedia and metadata savvy. Multimedia search engines don't just handle text-based documents, as commercially done today, but also process natural language, music recordings, photo archives, streamed video sequences, live theatre recordings and possibly also multi-avatar virtual performances.

One day soon n-dimensional digital data objects of any kind will be easily modelled, captured, transferred and retrieved by multimedia search platforms; not to mention multimodal and multilingual search.

Going beyond the visible internet search domain, the multimedia search technology finds equally important usage within enterprise networks (*Enterprise search*), or as embedded service component within media rich applications (content enrichment).

Enterprise search engines allow search of unstructured information wich as phone call logs, emails, photos… allowing use of materials that are not already organized in a specific database.

Indexing programs enable networked pcs to organize knowledge, to understand multimedia as words, images, sounds… Thus analysis patterns or relations.

CHORUS AUDIO-VISUAL SEARCH

"Advancing search technology for audio-visual content"

CHORUS** is a co-ordinated action to facilitate mutual information exchange and cross fertilisation between the projects that run in the field of advanced search technologies for digital audio-visual content.* ***Its task is to provide a roadmap for the realisation of Audio-visual search engines in the EU.

http://www.ist-chorus.org

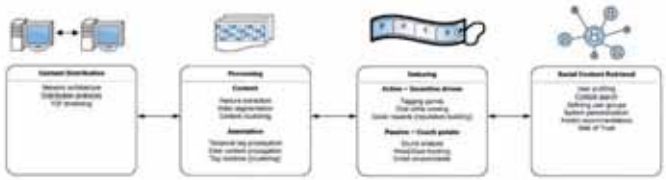
Since the internet economy relates to the global economy, and because the ICT sector is fundamental for Europe's growth, research in this domain has been prominent. In addition to the collaborative EU funded R&D projects, specific national initiatives have been launched to focus on the discovery of new algorithms techniques and interoperability standards able to handle new search needs (eg QUAERO, THESEUS, iAD, MC2).

The big research challenge is how to progress from today's commercial text and language-based search engines to multimedia search engines. How to achieve this technological breakthrough remains a fundamental and open question. The outcome of the ongoing projects' results will tell us more over the next years of experimentation and discovery.

3.2.1 Overview of Projects in Multimedia Search Cluster

Peer-to-peer Tagged Media

The Network of Excellence PetaMedia brings four strong national networks together (Netherlands, Switzerland, UK, and Germany) in the areas of multimedia content analysis (MCA) and social and peer-to-peer (SP2P) networks., at first to form a European network of national networks, and eventually to establish a sustainable European virtual centre of excellence to which research groups throughout Europe can connect. The collective research effort that thus comes available will be directed towards integration of existing MCA and SP2P technologies, and towards identification and exploration of potentials and limitations of MCA/SP2P combinations. A particular scientific challenge that binds the partners is the synergetic combination of user-based collaborative tagging, peer-to-peer networks and multimedia content analysis.



Project website: http://www.petamedia.eu

Lighting the way for European audiovisual search

PHAROS aims to be the **P**latform for searc**H**ing **A**udiovisual **R**esources across **O**nline **S**paces, providing the means to search and explore contextually-relevant multimedia content, which could be audiovisual, structured or unstructured in origin.

PHAROS' goal is to distinguish itself from other audiovisual search systems, by improving the trustworthiness of multimedia search, and increasing the robustness of content against malicious manipulation and by detection of viral spam.

"PHAROS moves search engines right into the 21st century, providing automatic annotation and full multi-media searching on audiovisual content whatever its nature and structure."

The research targets state-of-the-art of audiovisual search, focusing on areas such as automated semantic annotation, retrieval techniques for audiovisual content, heterogeneous data fusion, and mixed-media queries. Its system adds semantic meaning to audiovisual content in a way that prepares it for information retrieval and helps to overcome the growing heterogeneity of video, music, images, and TV stream collections.

Project website: http://www.pharos-audiovisual-search.eu/

SAPIR
Search in Audio-Visual

A Picture is Worth a Thousand Words

SAPIR's main objective is to research and develop large scale P2P solutions for the indexing and search of audiovisual content:

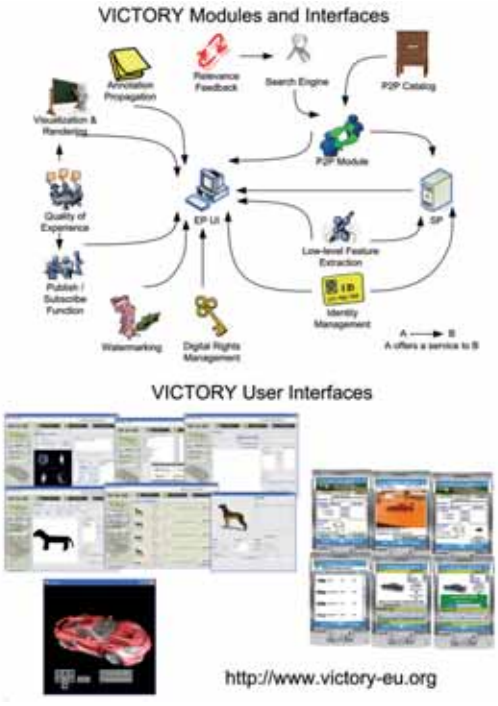
"Our vision is to conduct innovative research that will lead to a technology where end-users are peers that can produce audio-visual content from their mobile devices. This content will be indexed by super-peers across a scalable P2P network to enable content searches in real-time, while respecting IPR and protecting against spam."

To this end, SAPIR brings top level experts in the field of audio-visual content together so as to produce a 360° solution covering the areas of text, audio, image and online videos search, to allow the extraction of information from all forms of online media content.

To further improve audio-visual retrieval and navigation SAPIR's consortium combines experts in Mobile devices technology with experts in Social networking and in IPR to enable a secure and trusted environment. Having such a technology can provide significant advantage to the European community over existing centralized text only search engines and can be applied in various fields of applications such as tourism, government services, healthcare and more.

Project website: http://www.sapir.eu/

Audio-Visual Content search and retrieval in a distributed P2P repository



VICTORY aims at the creation of a search engine for 3D and multimedia distributed content into P2P and mobile P2P networks for three dimensional object retrieval evolving from text annotation to content-based, and from stand-alone applications to web-based search engines. Driven by the very successful concept of Wikipedia, the first goal of VICTORY is to create the first distributed Visual Object Repository in which any peer can contribute to. The main feature of VICTORY repository is its distributed nature and the fact that any visual information will be described as MultiPedia object (3D object along with its accompanied information -2D views, text, audio, video).

The user will be able to use any Multipedia object or a combination of them, as input. The retrieved content will contain 3D objects and their accompanied mixed-media and it will be accessible from both mobile devices and standard PCs. The search engine will be based on a combination of novel algorithms able to extract 3D low- level geometric features and high-level semantic features using relevance feedback and annotation techniques which are expected to improve significantly the retrieved results. Furthermore, the search engine will be enriched by multimodal personalized interfaces so as to take into account the users' interests and to offer capabilities of matching between 2D/3D objects, sketches and text.

Project website: http://www.victory-eu.org

3.3 3D Media

In the recent past, many companies have set up storefronts and show rooms in Second Life, even though commercial profits are evasive. Rather than selling goods and services to avatars, companies are now turning to closed proprietary virtual environments (e.g. in-house virtual workspaces and simulated 3D rooms) as effective work tools for employees and business partners geographically separated.

To go beyond the current level of immersion (be it at home or at the cinema, via high definition and 3D visualization), scalable rendering on immersive and glasses-free 3D displays is the key for the enhancements that are expected in spatial resolution and in the development of portable devices allowing reproduction of 3D content for users on the move.

Likewise the production of linear and non-linear interactive video content (e.g. games, virtual training and applications) requires more and more that reality is augmented, refined or even substituted by synthetic models.

Realistic virtual characters (avatars) represent another key element for enhanced 3D virtual environments, as avatars can be used to represent humans for inter-personal and collaborative online applications, ranging from professional applications (e.g. e-training, e-learning and simulation) to massive multiplayer games. Thus avatars must be capable of conveying information through dialogue and non-verbal behaviour, and must be believable both in situations of human-machine multimodal interaction and in relation with other virtual characters.

3.3.1. Overview of Projects in 3D Media Cluster

Mobile 3DTV content delivery optimization over DVB-H system

The MOBILE3DTV project aims at developing core elements of the next generation of mobile 3D television (3DTV). Stereoscopic video is captured and converted to a proper content format, then compressed, encapsulated, and broadcast to a large audience of mobile users, whose terminal devices receive, decode, and display the 3D content. Building upon two established technologies, namely the European DVB-H standard and auto-stereoscopic displays, the consortium will develop optimal mobile 3DTV data format and the associated content creation methods. The mobile 3DTV technology will have the potential to become widely available to consumers for 3D-content delivery. This is expected to strengthen the leading role of Europe in introducing novel media technologies and to generate new and sustainable market opportunities for European hardware manufacturers, software developers and content producers.

Project website: http://sp.cs.tut.fi/mobile3dtv

Content generation and delivery for 3DTV

The 3D4YOU project aims at developing a practical and efficient 3DTV system independent of display technology, and backward compatible with 2D broadcasting and conventional stereo.

The 3D4YOU project aims to pave the way for the introduction a 3D TV system. The project will build on previous European research on 3D, such as the FP5 project ATTEST, which has enabled European organisations to become world leaders in this field. The 3D4YOU consortium covers all important aspects of the 3D broadcast chain. Its objective is to deliver an end-to-end system for 3D high quality media.

Project website: http://www.3d4you.eu

Three-Dimensional Phone....

The 3DPHONE project aims at developing technologies and core applications enabling a new level of mobile 3D experience, by developing an all-3D imaging mobile phone. The aim of the project is to realise all fundamental functions of the phone i.e. media display, user interface (UI), and personal information management (PIM) applications in 3D but usable without any stereo glasses. Users will be able to:

- Capture memories in 3D and communicate with others in 3D virtual spaces
- Interact with their device and applications in 3D
- Manage their personal media content in 3D. The expected outcome will be simpler use and a more personalized look and feel. The project will advance the state-of-the-art in mobile 3D technologies by:
- Implement a mobile hardware and software platform with both 3D image capture and 3D display capability, featuring both 3D displays and multiple cameras.
- Develop user interfaces and applications that will capitalize on the 3D auto-stereoscopic illusion in the mobile handheld environment.

- Investigate and implementing end-to-end 3D video algorithms and 3D data representation formats, targeted for 3D recording, 3D playback and real-time 3D video communication.
- Perform ergonomics and experience testing to measure any possible negative symptoms, such as eye strain, created by stereoscopic content.

Project website: http://www.the3dphone.eu

2020 3D Media: Spatial Sound and Vision

2020 3D Media is a project aiming at developing novel forms of compelling entertainment experiences based on new 3D technologies.

The innovation which 2020 3DMedia will bring consists of new and engaging 3D media forms, creating the technology for the production of viable 3D surround audiovisual media.

2020 3D Media researches, develops, and demonstrates novel forms of compelling entertainment experience based on technologies for capture, production, networked distribution and display of sounds and images in three-dimensions. 2020 3D Media adds extra dimensions to Digital Cinema and creates new forms of stereoscopic and immersive networked media for the home and public spaces. The goal is to research and develop technologies to support the acquisition, coding, editing, networked distribution, and display of stereoscopic and immersive audiovisual content to provide novel forms of compelling entertainment experience in

"We would like to bring more the immediacy and excitement to media, in public and at home, by presenting sounds and images in three dimensions"

the home or public spaces. The users of the resulting technologies will be media industry professionals across the current film, TV and 'new media' sectors to make programme material addressing the general public. The key will be the creation of technologies for creating and presenting 'surround video' as a viable system, based on recognised standards. This will require innovations and new knowledge in:

- Technologies and formats for 3D sound and image capture and coding, including novel high-resolution cameras
- Technologies and methods for 3-D postproduction of sound and images
- Technologies for the distribution and display of spatial media
- The creative application of spatial media technologies

Project website: http://www.20203dmedia.eu

Transmitting the feeling of physical presence

The 3D Presence project rationale is that effective communication and collaboration with geographically dispersed co-workers, partners, and customers requires a natural, comfortable, and easy-to-use experience that utilizes the full bandwidth of non-verbal communication. With this goal in mind, the 3D Presence project implements a multi-party, high-end 3D videoconferencing concept that will tackle the problem of transmitting the feeling of physical presence in real-time to multiple remote locations in a transparent and natural way. To attain this objective, 3D Presence will go beyond the current state of the art by emphasizing the transmission, efficient coding and accurate representation of physical presence user (auto)stereopsis, multi-party eye contact and multi-party gesture-based interaction.

Project website: http://3dpresence.tid.es

3.4 Media Delivery Platforms

The term "Networked Media" implies that all kinds of media including text, image, 3D graphics, audio and video produced can be distributed, shared, managed and consumed through various networks, like the Internet, be it via Fiber, WiFi, WiMAX, GPRS, 3G and so on, in a convergent manner.

In this evolving environment, new transport protocols, new multimedia encoding schemes, cross-layer network adaptation, machine-to-machine communication (including RFIDs), rich 3D content as well as community networks and the use of peer-to-peer (P2P) overlays are expected to generate new models of distribution, interaction and cooperation. Thus Content Aware and 3D represent the new frontiers for the Media Delivery platforms of the future.

The emerging networked media landscape will be able to support enhanced perceived quality-of-experience (PQoE) and innovative applications both for traditional fruition modes such as TV and Cinema and for the growing "on the move" consumption.

3.4.1. Overview of Projects in Media Delivery Platforms and Electronic Cinema

Next Generation Peer-to-Peer Content Delivery Platform

P2P-Next develops an open source, efficient, trusted, personalized, user-centric, and participatory television and media delivery system with social and collaborative connotation using the emerging Peer-to-Peer (P2P) paradigm, which takes into account the existing EU legal framework.

P2P-Next Project presented world's first video end-to-end streaming distribution of professional content to low-cost STB hardware at IBC 2008 in Amsterdam.

The current infrastructure of the Internet is not suited to simultaneous transmission of live events to millions of people (i.e. broadcasting). With millions of potential users, this will easily congest the Internet. P2P-based technology is considered an essential ingredient for future efficient and low-cost delivery of professional and user created content. This development will have important consequences for the existing business models and institutions, as well as for content production, content distribution, and end user experience. In response to these challenges, the objective of P2P-Next is to move forward the technical enablers to facilitate new business scenarios for the complete value chain in the content domain, i.e. from a linear uni-directional push mode to a user centric, time and place independent platform paradigm. P2P-Next will develop a platform that takes

open source development, open standards, and future proof iterative integration as key design principles.

Project website: http://www.p2p-next.org

Seamless Content Delivery

SEA aims at offering a new experience of seamless video delivery, maintaining the integrity and adapting and enriching the quality of the media across the whole distribution chain.

SEA introduces novel services by innovating three key-content delivery pillars:

A) **Multi-layered/Multi-viewed content coding.** SEA considers the evolving H.264 SVC and MVC, as the major foreseen content delivery technologies over heterogeneous networks, multiple terminals and large audiences.

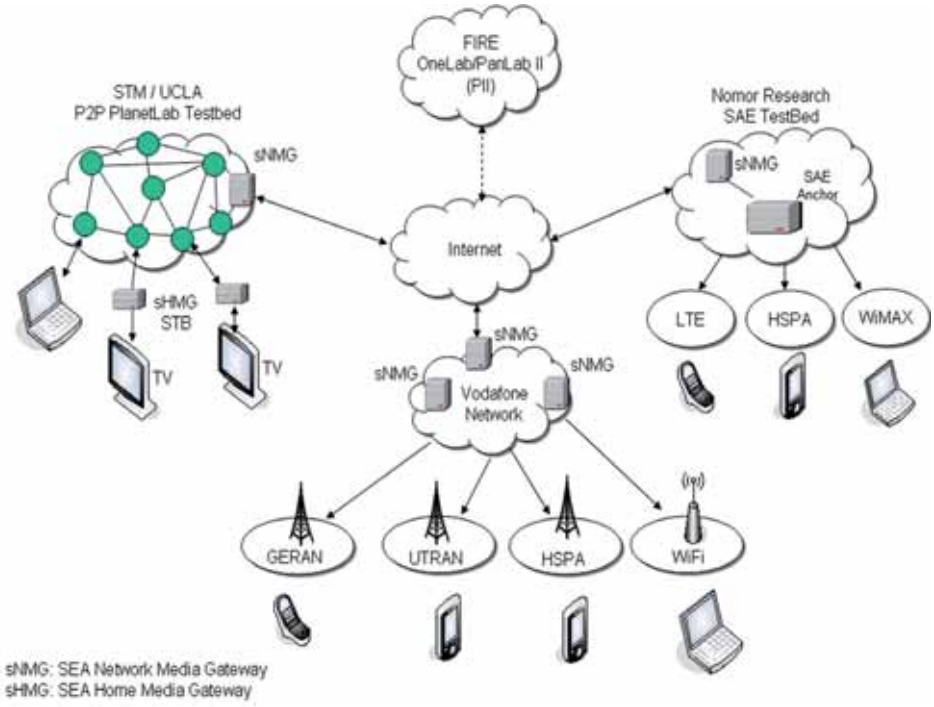
B) **Multi-source/multi-network streaming & adaptation.** SEA offers on-the fly content adaptation, inherited resiliency and enriched PQoS by dynamically combining different content layers, views and representations of the same video stream transmitted from multiple sources (different servers or peers in case of P2P streaming) and/or received over multiple diverse paths or networks. Moreover, SEA implements dynamic-adaptable multi-description coding (MDC) schemes, compatible with SVC/MVC, allowing tuning of the redundancy according to the network conditions.

C) **Content Protection and lightweight asset management.** Lightweight content protection is offered in the extended delivery environment.

SEA will test and validate the developed technologies over real-time emulators (3G/4G, WiMAX, ADSL and WLAN IEEE 802.11b/g/a) along with a large state-of-the art P2P testbed and a real 3G/4G network. Over this heterogeneous architecture, P2P IPTV-like application will efficiently combine and utilise all SEA networking and multimedia technological advances.

SEA results have already been contributed to relevant standardization bodies (MPEG, IETF AVG, IETF MMUSIC) and SEA signalling has been submitted to IETF and is currently under IESG evaluation (close to RFC).

Project website: http://www.ist-sea.eu

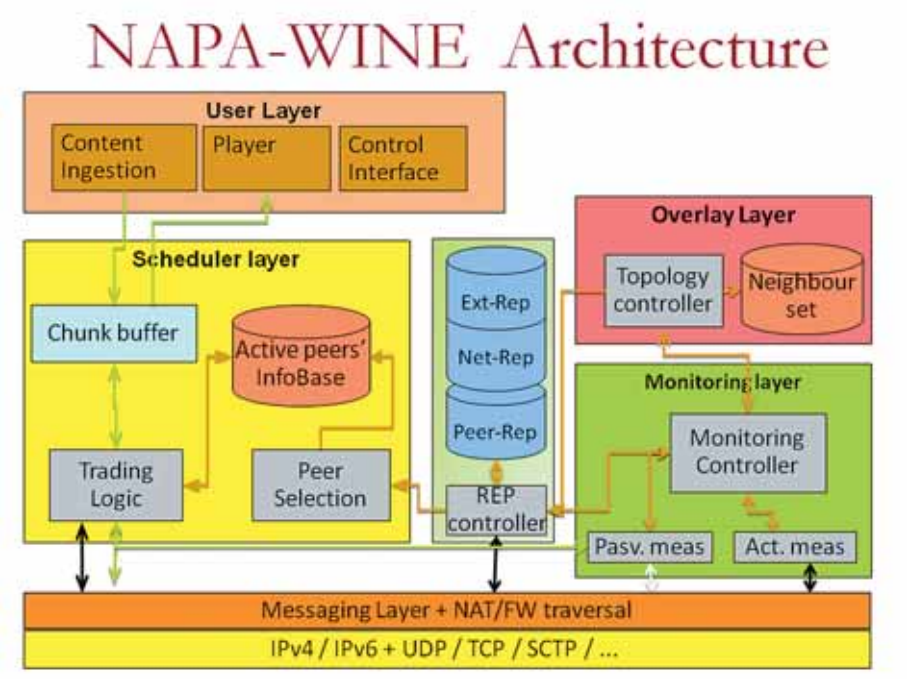


NAPA WINE

Network-Aware P2P-TV Application over Wise Networks

NAPA-WINE (Network Aware Peer-to-peer Application over WIse NEtwork) is a three years long STREP whose main goal is the study of a future system suitable for High Quality TV live streaming over the Internet based on Peer-to-Peer technology, or P2P-HQTV system.

The major focus is on the overcoming of today pure layered design approach, envisioning a cooperative paradigm in which the application and network layers cooperate in order to optimize the quality of services offered to end users



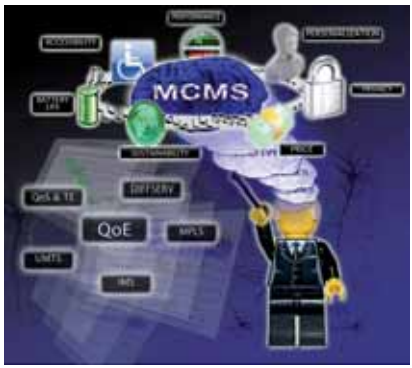
In particular, NAPA-WINE brings substantial and significant steps toward a deep understanding of the interactions between the transport network and P2P-HQTV systems, providing answers to fundamental questions raised by operators, such as:

- Can the current Internet infrastructure survive to a massive deployment of large scale high definition video streaming distribution systems?
- How can an operator predict/control what happens in its transport infrastructure?
- Which are the costs in terms of the backbone bandwidth needed to successfully support such applications?
- How can the above costs be minimized?
- Will P2P video traffic be harmful to other applications? How can this be avoided?
- Can the users' satisfaction be improved by providing a better service? Can cooperation be fairly defined and what kind of forms of cooperation are at our disposal?

Project website: http://www.napa-wine.eu

Enhancing IPTV and VOIP delivery over IMS with PQOS-aware and user –centric cross layer adaptation

The predominant candidate for the current trend of multimedia services convergence with mobile/fixed networks and broadcast-interactive applications is the IP Multimedia Subsystem (IMS). IMS entails novel business opportunities for pioneering and emerging multimedia services, such as IPTV and VoIP video call applications. However, this strong commercial interest is balanced by the lack of efficient user/customer-centric network management mechanisms.



ADAMANTIUM proposes a user-aware MCMS, an IMS-compatible Multimedia Content Management System, focused on performing dynamic cross layer adaptations for optimization of the user experience in terms of perceptual quality for IPTV and VoIP services. The MCMS acts as the orchestrator element focused on enhancing users Quality of Experience (QoE) by applying adaptation actions along all the network layers and nodes of the media-delivery chain. Then, ADAMANTIUM is based on a user/customer-centric approach rather than a typical engineering one. In this framework, the MCMS utilizes advanced machine learning decision algorithms, considering various constraints in the decision process, such as the content characteristics, the network condition and the encoding type, aiming at the optimization of the user satisfaction.

Project website: www.ict-adamantium.eu

Optimisation of Multimedia over wireless IP links via X-layer design

OPTIMIX is a collaborative project focusing on the study of innovative solutions for enhanced video streaming on wireless heterogeneous systems.

OPTIMIX goal is to optimize the video quality perceived by wireless users of point-to-multipoint video diffusion, to allow an enjoyable experience of video applications on 3G or 4G wireless devices.

OPTIMIX project involves three main axes of research. First it aims at improving the efficiency of scalable video codecs for wireless multi-user scenarios. Then, OPTIMIX aims at developing cross-la schemes to enable the communication between the application world and the wireless transmission world. Finally, it designs novel controlling strategies for point-to-multipoint video diffusion.

Project website: http://www.ict-optimix.eu

3.5 Support Actions

4NEM: Support Action for the NEM European Technology Platform

In 2004, the Networked and Electronic Media (NEM) industrial sector launched the NEM European Technology Platform. The NEM platform intends to sustain the birth of the NEM industry sector, developing its influence on European organisations, and to improve its presence on the international scene. 4NEM includes the following activities:

- NEM secretariat,
- Strategy Development, with the extension of the NEM Vision 2020, development of NEM Strategic Research Agenda and production of position papers
- European collaboration, in particular, with the European Commission and Parliament, other European Technology Platforms and European Initiatives, such as Eureka-Celtic, as well as relevant national initiatives,
- Publication and dissemination of achievements made by NEM community, briefing standards and regulatory bodies,
- Organisation of an annual conference, "NEM Summit", attracting 400 to 500 delegates from the NEM community and from the worldwide community of the NEM sector,
- Strategic analysis on coverage by running projects of the FP7 networked media objectives and NEM Strategic research Agenda, including a wide consultation within and outside the NEM community, launching an open forum.

Project website: http://www.nem-initiative.org

Coordinated approach to the European effort on audiovisual Search engines

CHORUS is a coordination action on audiovisual search engines. It has set up an information exchange platform for the EU projects, national initiatives and links key players in the domain of multimedia search engines (MSE). CHORUS activities aim to bridge the gap between *researchers view* (academia and industry) and the *new services* for end-user (addressing the needs of technology consumers: professional and large public content owners) within a market prospective. Chorus organizes different events: working groups, Think-Tank, "A-V Search" cluster and workshops, CHORUS tackles the interdisciplinary problem of identifying and deriving *critical issues* through technological aspects together with socio-economic and legal aspects. The CHORUS coordination action focuses on the categories of information access-based activities and spotlights trends and new challenges for future development in the search engine domain.

Project website: www.ist-chorus.org

SALA+: SUPPORT ACTION for a European and Latin American Strategic cooperation on Networked Media RandD

SALA+ is a Support Action (SA) intended to foster International Cooperation in the area of Networked Electronic Media (NEM) between Europe and Latin America. The global aim is to prepare for future concrete partnerships between Europe and Latin American countries. SALA+ provides support to the implementation of the FP7 ICT Work Programme. In this context, the SALA+ project encourages entities from Europe and Latin America to cooperate in the Networked Media field through collaborative R&D projects. SALA+ identifies specific areas for Scientific & Technological cooperation within the Networked Electronic Media field.

Project website: http://www.salamas.eu

4 The future of media in a networked world

European R&D is significantly contributing to the evolution of Networked Media.

The 2009 **Networked Media Call for Proposals** received the highest subscription of the ICT call, with 139 proposals submitted, confirming the growing importance of this research area. Only 23 proposals could be retained for negotiation (1 out of 8 STREPs and less than 1 out of 6 Integrated Projects), leaving very good proposals unfunded.

Altogether, the new set of projects about to be launched are set to make a **major contribution to the European endeavours towards a Future Internet, where Networked Media is going to be the main driver**.

Projects address innovative technologies and services based on more intelligent, adaptable and personalised media in the following areas:

- **Content-aware Networks and Network-aware Applications**
- **3D Media Internet and Immersive experiences**
- **Multimedia Networked Search**

In the area of **Content-aware Networks**, the key objective is to investigate how networks and content interact and adapt intelligently to each other so as to optimise **quality of experience**.

Projects to be launched within this area proposes solutions, such as:

- the creation of a networked 'Media Ecosystem' based on a flexible cooperation between providers, operators, and end-users enabling users to access the offered multimedia services in various contexts, and to share and deliver audiovisual content dynamically, seamlessly, and transparently
- a content-centric network architecture able to offer network-wide Service Level Agreements in service discovery and content consumption
- a P2P architecture for the distribution of User Generated Content
- the optimisation of the overall quality of experience for end-users on the basis of improved content caching and deploying network-controlled scalable and adaptive content delivery techniques
- the test of smart data drop algorithms technology for bandwidth optimization of multiple HD, SD IPTV and internet TV video streams

- collaborative, social, context-aware and scalable media distribution development
- novel algorithms, mechanisms and protocols for a cross-layer network solution
- optimisation of content source selection and distribution by mapping the content to the appropriate network resources based on transmission requirements, user preferences and network state
- new methods for delivery and compression of multi-view video and multi-channel audio.

All the above projects represent a major step towards the replacement of **the old Content Delivery Network paradigm** and will have a **key impact on the Future Internet**.

In the area of **3D Media Internet and Immersive experiences**, selected proposals address highly innovative technologies and services, such as:

- Instantaneous virtually transporting people (visitors) from one physical place in the world to another destination, so that they can interact with the local people there. This is to be achieved by creating a unified virtual environment representing the physical space of the destination in real-time.
- Future immersive and interactive TV services enabling the users to navigate around an ultra-high resolution video panorama, showing a live or recorded event and providing immersive media experiences to audiences during live events.
- Technology independent adaptation to any 3D display and transmission of multi-view signals, including robust transmission schemes for 3DTV over all existing and future broadcast channels.

- New forms for the creation and delivery of live media content, including also the automatic capturing of the events in 3D and the delivery thereof for realistic, interactive and immersive playback.

Altogether projects in these areas will represent a major step forward towards the **new forms of creation and access to novel media experiences much beyond current state of the art**.

Courtesy of Future Media Internet Task Force

In the area of **Multimedia Networked Search**, projects address innovations, such as:

- An open platform for multimedia and multimodal content indexing, sharing, search and retrieval.

- Using events as the primary means to organize and index media, e.g., photos, videos, journal articles, thus providing their experiential and subjective personalisation dimension. Here the local experience-driven contextual information can be shared, enabling the creation of new social networking of event-based communities. This will eventually build social intelligence to

automate media search and content retrieval. This research on Networked Media holds the promise to one day replace the Future Internet today's reliance on text.

The call also resulted in **Support actions** contributing to:

- The consolidation of the NEM European Technology Platform
- International cooperation, particularly with Latin America
- The follow-up of the strategic activities on Multimedia Search Engines
- Future Media Internet R&D roadmap
- The contribution to and the promotion of open Web standards by the Networked Media community.

The **European Technology Platforms on Network and Electronic Media (NEM)** is helping to strengthen the commitment of European industry to joint R&D. The definition of a **NEM Strategic Research Agenda** provides a very valuable contribution to the definition of the new research priorities to be called in the new Work Programme from 2011 onwards.

(http://www.nem-initiative.org/Documents/NEM-SRA-060.pdf).

We are at a crucial moment where new generation of research projects leading to future media systems are about to be launched, whilst actual services and applications based on convergence start finding its way in European markets and throughout the world.

The new research about to be started will have a key impact in shaping future Networked Media systems and markets world-wide. Success in this endeavour will certainly allow European stakeholders to play a major role in this global undertaking.

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