

**Small or medium-scale focused research project (STREP) proposal****ICT Call 1**

FP7-ICT-2007-1

**SemaPhoto –  
Emergent content from  
personal media, context, metadata, and knowledge****Date of preparation:** May 8, 2007

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## Proposal abstract

**Personal digital media collections** are a key facet of life with digital cameras, capturing hundreds of millions of photos in Europe annually. These are being captured, collected and shared in increasing numbers amongst users. The semantic understanding of these collections with current media analysis technology, however, remains limited. The power and potential of these collections to enhance our lives and enrich our relations with others thus remains untapped.

In SemaPhoto, we will develop methods and tools for the **intelligent creation, enhancement and usage of photo collections**, exploiting an understanding of the media content and its user context as well as links to external sources, such as professional collections or the Web. The user interaction and usage of the media play a central role for this process. We take a holistic approach, where the creation, enhancement, aggregation, authoring and sharing of user content are activities that inform each other iteratively and contribute to a **continuously growing repository of semantically enriched content**.

We will achieve our aims by exploiting an innovative combination of content and context analysis (e.g., time, date, location), along with capturing user interactions with the content, and making connections with external resources. We will develop methods and tools for facilitating users to add to, manage and publish from their personal photo collections. An **emergent content framework** will provide the basis for a personal media collection to evolve with the user in the loop

We will validate our results using an **innovative digital photo album application** in a real end-user consumer application. This will be made public by our industrial partner CeWe Color and integrated both within Alinari Photo Archives' services for professional photographers and the SEraja EventWeb, a collaborative content sharing and social networking site.

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## Section 1: Scientific and/or technical quality, relevant to the topics addresses by the call

### 1.1 Concept and objectives

Personal digital media collections are now a key facet of virtually everyone's life: Digital cameras capture literally hundreds of millions of photos for the young and old alike from every walk of life every year in Europe. In SemaPhoto, we aim at intelligent creation, enhancement, and usage of photo collections exploiting the media content itself, its user context but also external sources such as professional collections or the Web, to finally achieve a comprehensive semantic understanding of personal photo collections.

#### 1.1.1 Motivation and use case

People collecting media have always been faced with the need to organize and present these media assets in an appropriate manner. People these days own huge amounts of digital media that capture their personal experiences and events. At the same time it still remains difficult to search, select, reuse, arrange, and share personal digital content. Imagine the task of creating a photo album for your daughter's 18<sup>th</sup> birthday from a large collection of images and arranging it nicely into a photo book to be presented to her at the party – a tedious and laborious task. Typically one would go through the heaps of photos taken since her birth and select a photo here and there. The photos chosen would show the important people in her life such as parents, relatives, and friends. Important steps in the child's life such as the first day in primary school or graduation from high school should be part of the photo album as well as pictures or funny, or even sad, events taken over the years that have helped shape her into an adult. Maybe family vacations to places far away should also be remembered as well as large family gatherings for grandma's 80<sup>th</sup> birthday or the 10<sup>th</sup> wedding anniversary of you and your husband. Some important photos might not necessarily have been taken by the immediate family but may belong to an aunt/uncle or a friend. Also there might be important information available with all the photos such as the names and photos of famous celebrities born on the same day, or descriptions of the locations visited during family vacations.

For a long time now, people have already created such “multimedia content” – when they selected photos, wrote explanatory texts and fondly compiled these together with tickets, maps, newspaper snippets, and other souvenirs into a paper album. The advent of digital photography and content processing technology and the availability of the Internet should in theory make this an easier, more efficient and more enjoyable activity – but this is often not the case. Clearly, there is a great potential to support processes like this with **next generation intelligent digital content creation and usage**.

The **fundamental problem** is that personal media such as photos are the attempt to capture a representation of a moment, which is important to the photographer in some way. However, the result, i.e., the digital photo dsc1295.jpg, is a poor reflection of the moment. The difference between what the person experiences and what is captured on the photo, is the contextual knowledge about the event captured, also known as the **semantic gap**.

Still **missing** is support for **sufficient understanding of personal media collections** as this is the key to searching, finding, using, and sharing of digital media collections. One would think that with advances in digital content processing, with increasingly intelligent, context-aware devices for content creation, and the availability of the Internet as a huge source of ancillary content and knowledge, that there is a great potential to improve and simplify processes like this. However, intuitive and effective management and usage of personal media has not yet been achieved. Looking at tools and systems for handling personal media content today, users are left with the piles of digital photos on their computers and not much else. Searching, se-

lecting, composing remains as task that requires much user involvement and intellectual effort to find photos from certain events, or of specific persons, funny experiences, locations and so on.

One **reason** for this is that **current research has largely considered tasks such as media capture, context and content analysis, multimedia authoring, and media enrichment in isolation, mostly assuming non-iterative, deterministic processes.** This convenient view for a long time allowed researchers to focus on just one technical task in isolation and to continue with their research undisturbed by undue consideration of links to other research fields, user roles, user needs, or the global picture of multimedia processes. Research only now is slowly starting to consider external sources and knowledge or even the user her/himself to better understand the digital photo, and most work in this direction is very limited. Indeed, no such work takes into account the fact that a personal media collection is never complete but grows and changes every day. For comprehensive understanding of digital photo collections we must reach out far beyond the raw photo and current state of the art for image processing this, to other sources that are promising to help creating and evolving a semantically rich personal media pool. Creating, evolving and enhancing content, context and metadata and knowledge relating to user's key steps that will finally allow us to better understand personal media and make and keep the collections ready for next generation digital photo services.

### *1.1.2 Scientific and Technological Approach*

#### *1.1.2.1 Overview*

For the reasons outlined above, **SemaPhoto aims at establishing a generic infrastructure for emergent content management, authoring, analysis, and enrichment of personal media collections that takes into account the tight coupling and the implicit iterative nature between these tasks into account.** Emergent content understands the user's media collection as a continuously growing pool of information in which photos are important in the same way as context such as time and location and metadata such as descriptions or names of persons and user interaction with the collection such as those arising from authoring or manual annotation. In particular, a crucial point of this emergent content infrastructure is that it considers media, context data, metadata, and multimedia compositions as first class objects that may be arbitrarily related and interwoven.

**SemaPhoto considers a media collection as continuously growing and emerging with each new content item added and with each user interaction with the collection.** Adding a new photo might add the picture of a new friend; the repeated selection of a few photos for print might increase their level of relevance for the user. Hence, creation, enhancement, aggregation, authoring, sharing can not be considered singularly but rather they interact and interfere with each other and cause new content to emerge that then flows back in the content pool.

The infrastructure we aim to develop will permit the **integration of arbitrary content creation, content analysis, context processing and inference, content enhancement, content aggregation, as well as content authoring tools and algorithms.** It will syndicate and continuously trigger the integrated tools as the personal media collection evolves. In SemaPhoto's holistic approach, the creation, enhancement, aggregating, authoring, and sharing of user content are activities that inform each other iteratively, each time enriching the semantic annotation of the content repository as a whole and potentially adding new semantically enriched content to the repository. In the following, we will develop the approach of the emergent content framework starting from the deterministic view on the tasks of media processing to date.

### 1.1.2.2 From deterministic processes to an emergent content framework

To date, given the user's media personal media collections, analyzing media collections has been considered as a sequence of processes working on the media collections (and its meta-data) as shown in Figure 1: Content analysis is followed by context analysis or the other way around; context and content might be combined in multimodal analysis. This process remains media-centric, context and metadata only play an accompanying role. Following maybe another manual annotation step the metadata-enriched media enter the personal media collection. On top of this collection search and authoring is performed later.

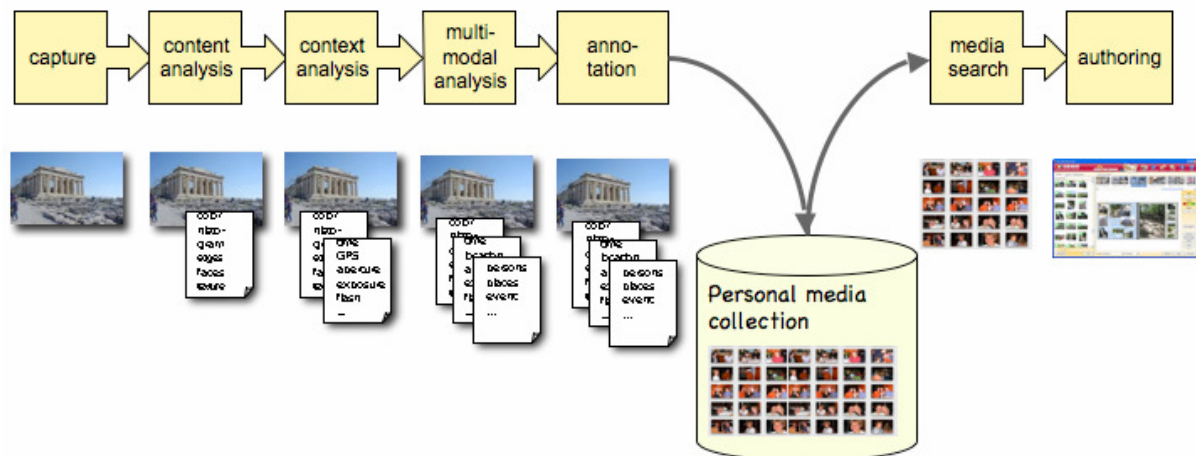


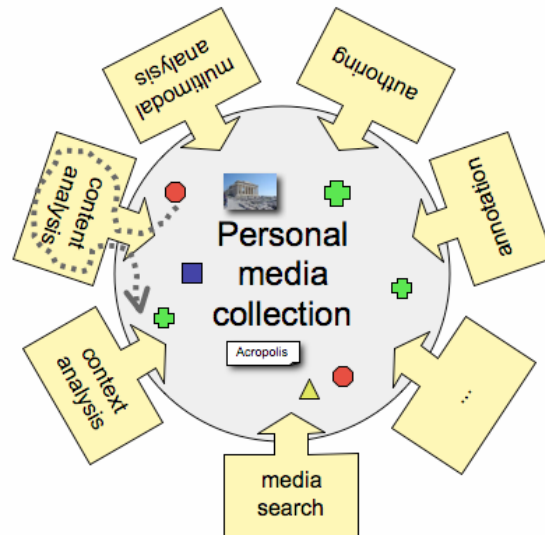
Figure 1: Linear flow of media processing tasks and personal media today

**Today, this is a linear process in which none of the steps is iterative or reflective.** The media remain in the center. Focused tools and approaches look at different tasks of content understanding without searching for interrelation between the tasks and the related research fields. Over and above, when it comes to usage such as search and authoring, the tasks start from the personal media collection only – without at all looking at the consequences of usage to analysis and content understanding. Media search looks for a set of media under given search criteria, which then are used in an authoring tool and arranged into a presentation such as a photo album.

In this view on personal media collections of today, the media content is the central unit of consideration. Context, metadata and annotations are not considered essential parts of personal media collections that need to be treated as first class objects just like the media content itself. A place where a photo was taken is also a place where the user has been, a place to which the family has traveled often over the years, a place where other great family pictures were shot.

The different information that is extracted, enhanced, learned from the personal media collection must be elevated to the level of media content itself and used for an integrated content understanding. Moreover, the information that emerges from the different tasks is not shared in any way beyond the task. For example, the selection of media from a suggested search is not communicated with other tasks for learning about preferred photos, persons, events or color styles.

Towards SemaPhoto's emergent content framework, Figure 2 illustrates the **holistic view in which the personal media collection comprises the media but also at the same time and level the different bits and pieces of information and knowledge about the personal media collections**. All different tasks are working on this personal media collection using content, context, metadata and user interaction at the same time and also generating and feeding back this into the pool.

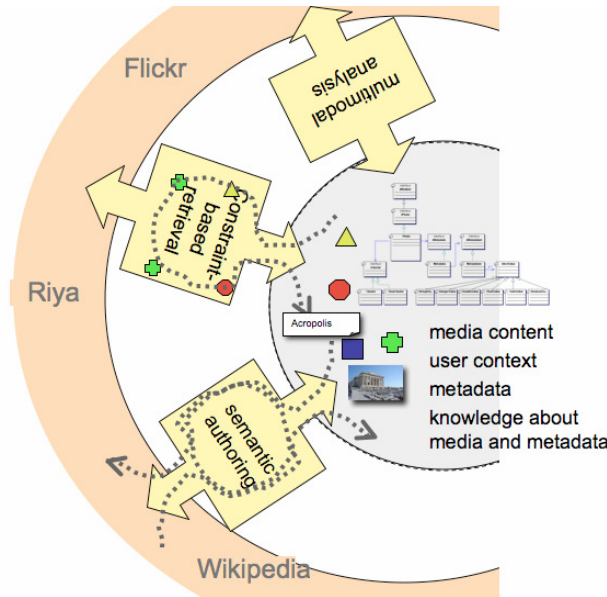


**Figure 2: Holistic view on media processing tasks and the personal media collection: all tasks of media processing take and give media, context and metadata from and to the emergent collection**

From a user's perspective, the described collection pool grows and evolves with each new content item added and with each user interaction with the collection. Adding a new photo might add the picture of a new friend, the repeated selection of a few photos for print might increase their level of relevance for the user. Hence, **creation, enhancement, aggregation, authoring, sharing** can not be considered singularly but rather they **interact and interfere with each other and cause new content to emerge that then flows back in the emergent content pool**, illustrated in Figure 3 by the arrows indicating this flow of emergent content of different type through the tasks. Furthermore, annotations that emerge from content analysis can be used for multimedia authoring but the authored entity again forms new content that already carries important information: the authoring process itself reveals new semantics that affect the annotations of single media elements. For this perspective, the different media processing tasks must be considered "around" the personal media collection. For example, placing four photos onto one album page likely indicates a close semantic correlation between those photos – they could document the same event. These correlations may again be useful annotations for the photos to be exploited for retrieval and further content analysis.

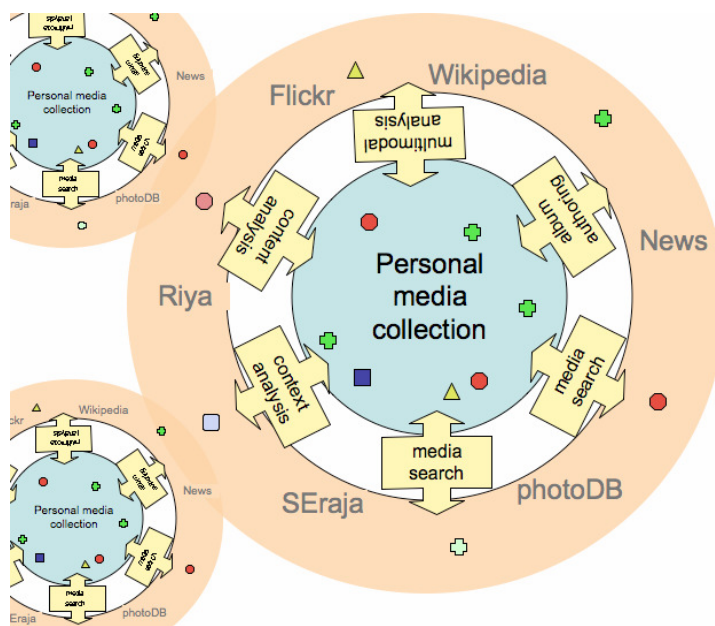
Personal media collections do not end at the user's hard drive. Rather personal media and with it personal events are related to outside content as often found on the Web. As illustrated in Figure 3, external sources can enrich the personal media collection by adding a news article to a personal photo from the birth of your child or adding a public Flickr photo from Paris to your personal vacation photos. This is, however, a mutual process as, adding a Web article from Wikipedia about the Eiffel tower to a photo helps understanding the photo content itself, searching for similar photos on Flickr can bring in the tags of these imported photos. Analysis, search, authoring on an evolving media collection are in turn continuously contributing to the media collection. In fact, going beyond the single user's media, all processes must also consider external sources to increase their effectiveness.





**Figure 3: The emerging media collection embedded into a semantic Web 2.0 world and external sources**

The project aims at establishing a generic infrastructure for emergent content management, authoring, analysis, and enrichment of personal media collections that takes the tight coupling and the iterative nature between these tasks into account. In particular, a crucial point of this emergent content infrastructure is that it considers media, context data, metadata, and multi-media compositions as first class objects that may be arbitrarily related and interwoven. The infrastructure will permit the integration of arbitrary content creation, content analysis, context processing and inference, content enhancement, content aggregation, as well as content authoring tools and algorithms. The infrastructure will syndicate and continuously trigger the integrated tools as the personal media collection evolves. This does not involve only the individual user embedded in external Web sources but involves the Web world of users that themselves capture, enhance, share, author and distribute their digital content. Therefore the personal media collection can be seen as embedded in a network of personal media collections of users world wide, as illustrated in Figure 4. With this embedding not only external content is integrated with the personal media collection but also other user's knowledge such as collaborative tagging or reports on the same concert event.



**Figure 4: The personal media collection connected with other users in the Web**

The scientific partners of SemaPhoto have complementary expertise and will contribute to multimodal content understanding spanning the processes from capturing, retrieval to content authoring. The goal is a substantial step forward in actually understanding the content and providing methods to continuously allow personal media collections to grow and evolve with every personal media asset and external (Web 2.0) content sources. Therefore, the partners will carefully develop technology in work packages for multimodal analysis, retrieval and authoring where the different sources from media, metadata, context, the user (interaction) and external Web content all contribute to enhancing and emerging the media collections. For the concrete methodology we will consider techniques from content analysis in combination with machine learning and rule based systems for content enhancement and understanding as well as a variety of data fusion approaches that are growing in popularity/importance in the literature.

Realizing the holistic view on personal media collection, an emergent content framework will provide the basis for a personal media collection to evolve with the user in the loop. Definition of an architecture both for the personal media collection and the necessary data structure as well as interfaces for processes and plug-ins will make sure that the valuable results of the different analysis, extraction and enhancement tasks can iteratively access media, context and metadata and contribute to the emerging media collections. The framework will be designed in parallel to the development of technology in the field of multimodal analysis, retrieval and authoring to assure that the objective of a personal media collection in the center is met and the processes will well be working iteratively and interwoven on and with the collection.

A central photo book application, driven by the market leader in the digital photo-album space, CeWe Color, will demonstrate the effectiveness of the approach and at the same time bring scientific achievements of the project close to the market in a personal photo album authoring software. In addition, by inclusion of a professional content provider, Alinari, we can ensure that the interests and opportunities for such businesses as also considered, providing them with a route to a huge and potentially very lucrative market not normally accessible to them, Inclusion of SEraja's EventWeb service will ensure the demonstration of the developed technology in the context of innovative Web 2.0 services and community-based content access portals.

The central scientific and technological challenges to be addressed in the project are:

- *Personal media collection analysis:* Combined multimodal analysis of media, context, metadata and user interaction; methods for integrating external (web) sources into the analysis process and the semantic enhancement of personal media content.
- *Constrained-based retrieval and integration of external sources:* Enabling media retrieval on the collection reflecting user's needs and requirements; semantics-driven enhancement media collections by semantically related information from external sources;
- *Intelligent content authoring:* Methods for intelligent content authoring from personal media collections learning from the user for content understanding.
- *Emergent content framework:* Development of a framework for emergent content in terms of data and process model, architecture, interfaces, and emergent content engine.
- *Intelligent content authoring application:* Validation of the approach in the domain of personal media collections; development of an intelligent photo album authoring application to be exploited by the industrial project partners.

Such a vision for personal media collections allows for innovative services and applications that allow a real and user-centric usage of one's personal media assets embedded in a world-wide multimedia Web.

### 1.1.3 Relevance to the objectives of the call

SemaPhoto particularly addresses two of the themes outlined in the work programme:

| Call Objectives   | Relevant S/T objectives of SemaPhoto  |
|---|---|
| <p>a.) Advanced <b>authoring</b> environments for the creation of <b>novel forms</b> of interactive and expressive content enabling multimodal experimentation and <b>non-linear story-telling</b>. These environments will ease <b>content sharing and remixing</b>, also by <b>non-expert users</b>, by automatically <b>tagging content with semantic meta-data</b> and by using <b>open standards</b> to store it in <b>networked repositories</b> supporting symbolic and similarity-based indexing and search capabilities, for all content types.</p>                                | <p>SemaPhoto addresses the <b>amateur photographer</b>, the private person, the European citizen who, when generating paper photo albums, is an author of “multimedia presentations”, and has been for tens of years now. The growth of <b>digital photography</b> enables new ways of handling this process. However, today’s “authoring environments” (aka photobook software tools) are mostly electronic equivalents of the paper album generation process and do not exploit the full potential of digital photography. SemaPhoto will exploit this potential by making available an integrated process that enhances and enriches photos and brings intelligence and knowledge into the digital photo collection. In particular, SemaPhoto will enable <b>semantic connections</b> to be forged <b>between personal photos and external (tagged Web 2.0) knowledge sources</b>, thus allowing for both content sharing and content (re-)mixing in a <b>novel photo book authoring application</b>.</p>  |
| <p>c.) Architectures and technologies for <b>personalised distribution, presentation and consumption of self-aware, adaptive</b> content. Detecting and exploiting emergent ambient intelligence they will use features embedded in content objects and rendering equipment to enable dynamic device adaptation, immersive multimodal experiences and contextual support of user goals and linguistic preferences. Privacy preserving learning algorithms will analyse user interactions with devices and other users so as to update and effectively serve those goals and preferences</p> | <p>The approach of SemaPhoto is to <i>enhance</i> raw photo data from a digital camera by analysing both the content and the context. The photos are thus not just collections of pixels, but are objects carrying knowledge about themselves and that gain knowledge by their usage. This enables new knowledge about the collection to be gathered automatically. Further, these composite media objects can be used as a source of information that can be analysed and used to enhance other media objects.</p> <p>SemaPhoto will augment existing applications and architectures for personal photo album authoring. Personal photos, context, presentations and knowledge will be iteratively augmented and created and will be a means to augment other personal collections as well. By creating an emergent content framework that integrates analysis, retrieval and authoring SemaPhoto captures and <b>interprets and adapts to user interaction</b> via machine learning techniques. With this, the intelligent <b>authoring of personalized photo albums</b> will be improved and brought closer to the consumer. Privacy will be assured as the results of these learning processes will not leave the personal authoring environment or will be done anonymously.</p> |

## 1.2 Progress beyond the state-of-the-art

In Section 1.2.1, we present an overview of the state-of-the-art in the related fields of semantic understanding of personal media collections. We also position SemaPhoto within the landscape of EU funded research projects in Section 1.2.2 before we present SemaPhoto's progress beyond the state-of-the-art in Section 1.2.3.

### 1.2.1 Overview over the current state-of-the-art

The problem of **semantic knowledge extraction from digital content** has been a key driver for much research in recent years. It underpins much of the **Semantic Web** research effort [Shadbolt et al, 2006]. It is referred to as the "Semantic Gap" in the content-based information retrieval (CBIR) community [Smeulders et al, 2000] in which it is already addressed that "One way to resolve the semantic gap comes from sources outside the image ...". Progress in both areas has been substantial in recent years. For example, in the content analysis community, a rich array of low-level features for content indexing and retrieval have been investigated (MPEG-7 descriptors [Salembier et al, 2002] correspond to a widely used set, for example) and significant advances have been made in applying pattern recognition strategies to infer either structure or meaning in audiovisual data [Antania et al, 2002].

The **Semantic Web and content-based information retrieval** communities are starting to work closely together, as evidenced by the establishment of the annual International Conference on Semantic and Digital Media Technologies (SAMT) [Avrithis et al, 2006] and upcoming joint special issues of the Journal of Web Semantics (Elsevier) and of Multimedia Tools and Applications (Springer) on this topic. The list of EU projects represented at the Commission's recent FP7 IST event [IST, 2006] is further evidence of this convergence.

There has been an increasing amount of related research into the area of **personal photo collection management** in recent years, from browsing collections, to searching collections using content and context analysis. One important aspect of user experience in managing digital photos is how best to support rapid browsing photo collections. For example Photomesa [Beberson, 2001] presents a zoom-able interface for image browsing. Other work looks at facilitating the annotation process, which then enables keyword-based search. These systems allow annotation retrospectively on a desktop [Schneidermann & Kang, 2000] or use audio annotations processed using ASR [Chen et al, 2003] [Mills et al, 2000] [Srihari et al, 1999].

Moving beyond photo browsing, some systems **leverage CBIR techniques to enhance the annotation process**. For example, the MiAlbum system [Wenyin et al, 2000] uses a semi-automatic approach to image annotation, and [Bissol et al, 2003] allow a user to define the indexing concepts (e.g. car, tree) that the system will then learn automatically using image classification techniques. Other work attempts to propagate labels, whether entered by humans or by automatic processes, onto multiple photos: for example [Zhang et al, 2004] propagate face labels on multiple images by formulating label propagation as an optimization problem. Also, some commercial photo management systems support photo retrieval based on colour similarity [Adobe Album, 2007]. Recently, content-based retrieval "discovered" some **contextual aspects** for improvement of content-based retrieval results: [Boutell et al, 2005] [Luo et al, 2006] discuss the use of content and context for scene classification. And [Zhao et al, 2006] describe a method to improve content-based face recognition by combining it with contextual information. Results of user studies [Rodden & Wood, 2003] suggests that for the end user, that content analysis (of whatever form) needs to provide high-quality and meaningful results in order to enhance the user experience, which SemaPhoto will help to address by means of the holistic approach that we propose.

Examining context analysis techniques, there is much existing work on using time for the organization of photo collections. Many commercial photo management systems [Picasa, 2007]

[Adobe Album, 2007] [iPhoto, 2007] use calendar based views to allow browsing of collections based on capture date, and a number of researchers have exploited the ‘bursty’ capture patterns to events such as a birthday party: In PhotoTOC [Platt, 2000] time and color histograms are used for the organization of photos in the visual user interface. Stating that "time matters" [Mulhem et al, 2003] defined hierarchical temporal events as a clustering and organizational means. Also [Graham et al, 2002] consider "Time as Essence for Photo Browsing" in a calendar-based browser, also exploiting hierarchical temporal clusters, also allowing time-based summaries. FXPAL presented an elaborated article on their temporal clustering for photo collections [Cooper et al, 2005] based on similarity of time-stamps.

Most recently, **location metadata** for indexing photograph collections has been explored. The WWMX [Toyama et al, 2003], though not exclusively concerned with personal photograph collections but rather large online archives of location stamped images, allows navigation of a large photograph collection using a map-based interface. GTWeb [Spinellis, 2003] creates web pages with map-overviews of trips along with associated photographs using GPS location information. The PhotoCampus system leverages extra contextual information from the time and location (e.g., season, weather, light status), either automatically or using external resources, and also allows browsing based on time, location, and other contextual cues like weather and light status [Naaman et al, 2004a]. They also automatically detect the notion of event, using location information in addition to the time information used by others [Naaman et al, 2004b]. Other work has looked at inferring semantic content for photos using the available context by sharing available manually created labels between photos with a similar context [Davis et al, 2004]. The ATLAS project at INRIA uses location and time for the organization of the image collections such as [Pigeau, Gelgon, 2005]. The MediAssist project, at DCU [O’Hare et al, 2007], has integrated many aspects of content and context analysis, building on much of the research mentioned above to bring location and date and time into the indexing process in an automatic manner, exploring the different ways in which this extracted and inferred data can help to organise large collections. Indeed, results from the MediAssist project suggest that utilising location as a form of contextual metadata can help to reduce the user time overhead when searching for photos by nearly 50% [Gurrin et al, 2005]. Yet, in MediAssist, and similar projects, the **holistic approach** to media processing task on personal collections has never been adequately explored, which is a key feature of this SemaPhoto project.

### *1.2.2 Related EU projects*

Within the range of related EU projects (<http://cordis.europa.eu/ist/kct/fp6-projects-alpha.htm>) funded under the Sixth Framework Programme, SemaPhoto is mainly related to projects that are clustered under the research themes “creativity and content authoring”, “content management and workflow”, and “content personalization and consumption”. The most relevant STREPS, IPs, and NoEs for SemaPhoto proposal are **aceMedia**, **BOEMIE**, **DIRECT-INFO**, **K-Space**, **MUSCLE**, and **Reveal-This**.

The **aceMedia** project aims to create a framework for combining advances in knowledge, semantics and multimedia processing technologies [aceMedia]. Although aceMedia develops tools for automatic and semi-automatic semantic content understanding, the approach adopted remains media-centric, concentrating mainly on image/video enhancement via an intelligence layer driven by content analysis. The project does not consider the entire processing chain nor does it involve complementary sources like external Web content or media usage as a means of adding semantic information. For SemaPhoto partners involved in aceMedia, this new proposal is the natural evolution of their analysis research to consider sources other than just the content itself.

The **BOEMIE** project combines semantics extraction from multimedia content and ontology evolution [BOEMIE]. The project provides new methods to link multimedia extraction with ontology evolution. It focuses on high-level semantic features and the effective combination of semantic features derived from different modalities. Unlike SemaPhoto, however, it does not address contextual information, external information sources and media usage.

The **K-Space** Network of Excellence aims at semantic inference for automatic annotation and retrieval of multimedia content by bringing together the content analysis and Semantic Web communities [K-Space]. The focus is on how best to bring existing complementary technologies from the two communities together in order to address the ‘semantic gap’. As a Network of Excellence the focus is on research resource creation via multi-partner collaborative actions, including personnel exchange. The project does not include industrial partners directly and does not address a specific application domain like SemaPhoto’s digital photo-book. Of course, since SemaPhoto partners are also in K-Space, relevant research resources developed in that project can be brought to bear in SemaPhoto as appropriate.

The **DIRECT-INFO** project aims at semi-automatic extraction of consistent and meaningful semantic information from multimedia content [DIRECT-INFO]. The specific focus of this project is on the recognition of brands in TV programs which works on the content level and has no relationship to context, metadata or media usage associated with photo collections as considered in SemaPhoto.

The **MUSCLE** Network of Excellence works in the field of content-based multimedia understanding by machine learning and derives multimedia semantics mainly from content-based analysis [MUSCLE]. It integrates the expertise of forty research groups working on image and video processing, speech and text analysis, statistics and machine learning. The goal is to explore the full potential of statistical learning and cross-modal interaction for the (semi-) automatic generation of robust meta-data with high semantic value. MUSCLE does not address personal media collections, and the integration of situational context with content-based analysis, which is our key focus in SemaPhoto.

The **Reveal-This** project addresses the development of content processing systems that will help European citizens to keep up with the explosion of digital content scattered over different platforms, different media and different languages [Reveal-This]. The system aims at developing technology to augment the content of multimedia documents with semantic information, to cross-media and cross-language information retrieval, and to categorize and summarize digital content in the domains of EU parliament sessions and of travel. The focus of the project is the exploitation of different (cross-) media to achieve a better understanding of multi-lingual digital content in targeted application domains that are significantly different from SemaPhoto’s digital photobook application.

From a high-level technical perspective, the approaches of all EU projects to date have typically focused on combining semantic ontologies and content (e.g., **aceMedia**, **K-Space**, **BOEMIE**). Whilst these have demonstrated promising results (albeit typically in very narrowly constrained content domains) none of the work reported attempts to exploit rich data capture or user context, or at best considers this as a once-off analysis of each modality with some relatively straightforward combination of analysis results thereafter. Furthermore, usually this is carried out without “a user in the loop” and with little regard/cognizance of authoring or sharing. SemaPhoto aims to move away from this rather traditional view of content processing towards a more holistic vision that includes any data source, including the user and his/her interaction that potentially carries semantic cues for media enrichment.

### 1.2.3 SemaPhoto's contribution beyond the state-of-the-art

Notwithstanding this research, searching, selecting and composing still remains a difficult and time-consuming task for users, because much of the state-of-the-art integrates either content analysis or context analysis, and in rare cases both. A key goal of SemaPhoto is the **development and evaluation of suitable fusion frameworks**, that ensure that the results of both context and content analysis can easily be integrated with each other, and reinforce the accuracy of each other. In addition, the current state-of-the-art does not involve an **analysis of usage of the content and analysis of the user him/herself**. Factoring in this rich source of hitherto unexploited contextual data, will help SemaPhoto to produce technology for combined analysis that is well beyond current state-of-the-art. To achieve SemaPhoto goals, we will develop a new and innovative framework for **managing emergent content**. Instead of sequential analysis of a collection we target an approach where the creation, enhancement, aggregating, authoring and sharing of user content are activities that inform each other iteratively, each time enriching the semantic annotation of the content repository as a whole and potentially adding new semantically enriched content to the repository.

In addition, through the inclusion of CeWe Color in the SemaPhoto consortium, the **process of authoring will be extended** well beyond the state of the art. Having access to the digital archive of CeWe will provide unique and valuable insights into the preferences of the users when constructing photo books. With the help of existing photo books and user interaction we will programmatically learn what a good selection of photos is. We will analyze this highly valuable real-world data to identify different user groups and preferences. With the help of this knowledge the process of determining a meaningful selection for a photo book will be vastly improved, and with it, the end user experience of managing digital content and producing photo books.

Existing research has rarely successfully **integrated external sources** of information and knowledge. SemaPhoto will reach beyond the user's collection as an isolated content 'island', to other sources of semantically related media information, and in this way, SemaPhoto will **create and evolve a semantically rich personal media collection**, individualised to the needs, interests and content of each user. In fact, in this way we will also **address communities of users**, by creating links between individuals with shared content requirements. The process of external integration requires the research and development of state-of-the-art automatic techniques for the **smart identification of suitable metadata which can act as a means for generating search requests** to external sources and subsequently decide what kind of additional content is needed. In our iterative approach, user context, derived from a variety of case-based reasoning, machine learning, user modelling, and personalization techniques targeting the user and his/her use of the content, will be used as another input to the content analysis, indexing and authoring processes. This will help constrain each process helping to ensure that the generally ill-posed problem of extracting and/or exploiting semantic knowledge becomes tractable. For example, knowing the location, time, date and that the user is on a family outing and usually goes to the beach, significantly aids content-based analysis of the associated content – successful image classification into relevant classes (e.g. beach views, family close-ups, etc) becomes feasible. Similarly **content authoring is aided** by providing the user with a representative sample of their own images, images from other sources (professional collections, Web 2.0 services) that capture different aspects of a day-trip and suggestions for how these might be presented.

### 1.3 S/T methodology and associated work plan

#### 1.3.1 Overall strategy of the work plan

To achieve an intelligent creation, analysis, retrieval, and authoring of and with personal photo collections we aim to utilize the media content itself, metadata, user context and the actual media usage and user interaction with the collection, but also external sources such as professional collections or the Web to achieve a comprehensive understanding of personal photo collections. For this we will develop **components for analysis, retrieval, and authoring** that take all aspects of the personal content, external sources as well as user interaction with the collection into account for an innovative content understanding and usage. Following a holistic approach, the new methods developed are seen as iterative processes that continuously emerge the users' personal media content with regard to photos, semantic descriptions and further related (Web) content. For this an **emergent content framework** will be developed, which provides the basis for the personal media collection to evolve with the user in the loop. The proof of concepts is given by a **photo book authoring application**, which illustrates how the results of SemaPhoto contribute to a much easier, intuitive and effective handling of consumer photos by everyday citizens. Figure 5 sketches the field of work for achieving the scientific and technological objectives in SemaPhoto.

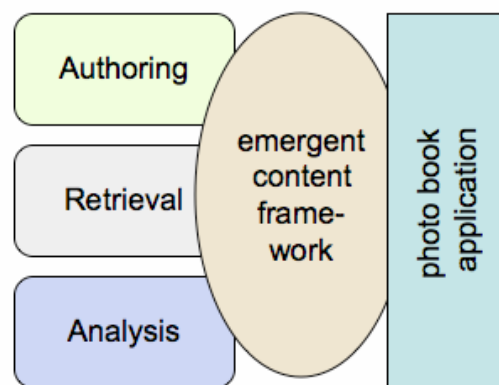


Figure 5: Overview of the strategy of the workplan to achieve the S&T objectives

The work plan for analysis, retrieval and authoring will individually look at the methodology to **advance analysis, retrieval and authoring beyond the state of the art by systematically integrating context, external information sources from Web, and the user interaction into the processes of machine learning, retrieval, and (semi-) automatic authoring processes**. The three scientific partners OFFIS, DCU, and CWI will each lead the respective work packages in the core expertise and each integrate the other two strongly in their research work. This is a promising approach as the scientific partners have already been working the adjoining fields of content analysis, content retrieval and multimedia authoring in their previous work.

The unique contribution of SemaPhoto is the integration of the research on analysis, retrieval, and authoring into an **emergent content framework** will developed that provide the basis for a personal media collection to evolve with the user in the loop. The framework for emergent content **will assure the integration of the intelligent understanding, retrieval, and authoring of personal photo collections and also integrate the content** from our partners CeWe, SERaja, and Alinari into the system. The scientific partners will design the emergent content and supported by the industrial partners wrt requirements and implementation. The SemaPhoto emergent content framework will form the bridge from methods developed in the field of analysis, retrieval and authoring and provide the interfaces and methods to an integrated



management of the personal media collection and its growing and emerging with every single creation, search and authoring steps of the use in iterative and interwoven lifecycles.

The driving scenario for SemaPhoto is the **intelligent authoring of photo albums**. This will be achieved in a work area in which we define concrete requirements for this application scenarios by our industrial partners CeWe, SEraja, and Alinari. The application development will show the achieved integrated research results from content understanding, retrieval and authoring within one application and emphasize the need for an integrated and holistic view on personal photo management and the emergent content of personal media collections. The **market leadership** of CeWe opens the path to a **commercial exploitation of the results** of SemaPhoto on a large scale with the respective market knowledge and force. The application of the photo book application will also be adopted by our industrial partners to illustrate the usage of the results of SemaPhoto for the everyday Web 2.0 user, as well as the professional photographer.

The results of the project will be **disseminated** both **in the academic field** on scientific conferences but **as well in the commercial field** on fairs, public events and the Web in form of presentations and available software. A lean but **effective project management** will coordinate and accompany the course of the project. Regular meetings will foster the integration of results, the achievement of deliverables, and a good collaboration of both scientific and industrial partners.

#### *1.3.1.1 Intelligent multimodal analysis of personal photo collections*

The overriding objective of the intelligent multimodal content analysis work in SemaPhoto is to detect and infer the presence and extent of a variety of semantic entities within personal content collections. Semantic entities can correspond to time-limited temporal events (e.g., a weekend trip to Amsterdam), or specific objects (e.g. pictures of relatives, views of buildings) and activities (e.g. a cycle in the mountains). Thus, a key research activity will be to determine a suitable set of semantic entities to be detected as dictated by the projects industrial partners' informed knowledge of consumer requirements in specific application domains that are aligned with SemaPhoto demonstrators.

SemaPhoto will adopt a **multimodal approach to content-based analysis**. In this approach, both content and context will be used to extract richer semantic meaning associated with a content item than available through analysis of any single modality. The content data source corresponds to the images themselves, whilst context refers to other available complementary data sources that potentially carry important semantic cues. Examples typically used in current research include time/date/location of capture and EXIF image header data (e.g. brightness, shutter speed, flash used, subject distance, etc). Whilst this will be our starting point in this work, we will substantially extend this definition of context with user-centric output from Retrieval and Authoring coupled with user personalization, with the overall goal of developing automatic and interactive approaches to detecting a range of important semantic entities.

For both content and context, typically the 'raw' data source must undergo some low-level processing before it can be gainfully employed in more sophisticated analysis processes that seek to extract semantic meaning. In the case of the content data source, this corresponds to processing the pixel-level information, sometimes first grouped via a segmentation process into (hopefully) meaningful image regions, to extract low-level features that are useful for further processing (e.g. colour, texture, shape, face features). Similarly, the context data source can be processed to standardize and synchronize the representation of the available data and/or to infer useful ancillary metadata. SemaPhoto will not 'reinvent the wheel' in terms of the approach to be taken for this initial processing of content and context data. Rather, we will exploit the existing state-of-the-art that is available through the project partnership in

both areas. Existing approaches for low-/mid-level image feature extraction, image matching, scene classification, redundancy elimination, object segmentation (including person detection) and recognition will be brought to the project. Similarly, existing approaches for inferring new contextual information from EXIF data and external sources will also be leveraged (e.g. indoors/outdoors, weather conditions, portrait or landscape image, etc.).

These existing tools will constitute an initial set of algorithms that form the basis for a **content and context analysis toolkit** that will be developed over the lifetime of the project. The toolkit will be designed to be modular in nature facilitating ease of use by the Retrieval, Authoring and Integration WPs. Tools will be interactive whenever possible so that they are capable of being driven by the user himself/herself. Initially featuring relatively low-/mid-level analysis tools, as more sophisticated approaches to extracting semantic meaning are developed these will be added to the tool-kit, ultimately providing a useful content and context analysis resource for extracting semantic meaning at multiple levels of abstraction.

A key goal of the analysis work will be to consider suitable **fusion frameworks** that ensure that the **results of analysis in any one modality can be easily integrated with, and reinforce, analysis of the other modality**. This requires developing fusion frameworks that can handle different forms of potentially conflicting information that exhibit different levels of reliability. Thus, the key to success is a framework that handles uncertainty appropriately. Furthermore, the framework should be applicable to multiple different targeted semantic entities to be detected. Already, we have demonstrated some progress towards this goal, albeit in a very limited context, by using the Transferable Belief Model (TBM), based on well understood Dempster-Schafer theory as the fusion mechanism in a variety of image analysis and classification tasks (e.g. [Wilkens et al, 2007][Adamek et al, 2007][O’Conaire et al, 2007]). In SemaPhoto, we will expand upon this very preliminary initial work to use an extended set of contextual data sources in the fusion framework that includes feedback from the retrieval and authoring tasks, such as the nature of a content item (e.g. personal image vs. freely available Web content) and placement/layout, associated annotations, text-based analysis of related content as well as personalization outputs.

Given a suitable fusion framework for the various different forms of contextual data to be handled, a suite of **semantic entity detectors** will be developed and integrated into the analysis tool-kit. Again a modular and user centric approach will be employed ensuring smooth integration with project demonstrators so that the resulting algorithms can be called by either the user himself/herself or another content process. These detectors will facilitate user interaction so that user interaction can be captured and used effectively in updating semantic entity models based on adjusting belief masses associated with the constituent data sources used in detection. These semantic entity detectors will be integrated into the content and context analysis toolkit and the project demonstrators.

### *1.3.1.2 Constraint-based methods for retrieval from personal photo collections*

The retrieval work in the SemaPhoto project will focus on **constraint-based methods of retrieving suitable photos and additional information from the personal photo collection and external sources for a given task**. Considering the photo book scenario it is not only important to know which photos shall appear in the resulting photo book but also to consider information about this selection. This means that the result of a retrieval task will not only be a set of suitable photos, but also consists of additional, structural information. This can be clustering information according to time, location, similarity and other aspects which could result in a similar grouping in the authoring process. Also an order on the photos, perhaps designating the importance, could affect for example the size of a photo in the resulting photo book.

A central goal is to take the user interaction in retrieval and authoring into account. With the help of existing photo books and user interaction we will programmatically **learn what a good selection of photos is**. This can be highly individual and depend on the purpose of the photo selection. For this we rely on the huge amount of photo books, which are manufactured at CeWe Color everyday. We will analyze this highly valuable real-world data to identify different user groups and preferences. With the help of this knowledge the process of determining a meaningful selection for a photo book will be improved. We will also learn from the authoring process itself. If a user manually adds or deletes a photo from the photo book we can propagate this information back to the retrieval process. As a basis for learning parameter sets for the retrieval from personal collection, we will develop a **constraint-based retrieval framework**, which employs different kinds of context and metadata and define constraints on the selection criteria to provide meaningful sets to a search request. With the help of this framework each photo is given a multi-criteria score that determines its importance for the requested task. This score is not calculated on a single-media basis but other photos from the set are also taken into account. A photo could be, e.g., of very poor quality as it is underexposed or blurred. If this photo was one of a series of photos and others well, e.g., well exposed or sharper, it would probably be rated with a relatively low score. But if this photo was the only photo of an event it would probably be given a high score despite its poor quality. How the metadata is used to calculate the scores can be tuned by changing parameters, which define how and to which extend specific metadata should be taken into account for a selection. Based on this framework parameter sets will be determined by analyzing already authored photo books and information from the authoring process. If a user for example decides to delete or add a photo to a presentation or alters the set of photos, which is output of a retrieval process, this information can be used to *fine tune* the parameters for the retrieval framework and to provide a better selection next time. The goal is to determine parameters, which stand for different user groups or different purposes, and to determine a personal parameter set for the photo book user. For this we will employ state-of-the-art machine learning techniques like support vector machines and neuronal networks. With the help of these techniques the user preferences model will constantly be revised and the user will less feel the wish to alter a proposed photo set the more s/he uses the selection process.

Another important goal is the **integration of additional, external content**. This can be content from the databases of our project partners Alinari and Seraja but also the inclusion of public web sources like Flickr or Placeopedia or other personal collections. For this methods will be developed which identify suitable metadata which can act as a means for generating search request to external sources and decide, what kind of additional content is needed. To formulate if, where, how and what external content is integrated in a multimedia presentation we follow a rule-based approach. A simple example for such a rule is: *“If there are at least 4 pictures in a cluster where at least one consist of a location information and if there is enough space on the page integrate a map of the place where these photos were taken.”* How this map is retrieved is defined by formulating specifications for data sources. These data sources guarantee to provide a specific output if specific inputs are given. One example for this is Google Maps: to be able to provide such a map, one or more locations are needed as input. Another scenario is the user’s wish to add additional photos from the same event to his photo book. The Seraja EventWeb site can then act as a data source which provides pictures if the according event is given as input but could also provide a textual description of the event. A framework implementing this **rule-based approach** will be developed **within the retrieval work**. Throughout the project and with user feedback from user studies at CeWe Color suitable rules will be found, formulated and evaluated. One method to formulate such rules is by automatically analyzing user designed photo books and monitoring the authoring process such as *“The user always puts a describing text on the first page of a new chapter → For the next chapters he can automatically be offered a describing text from Wikipedia”*.

### 1.3.1.3 *Intelligent semantic authoring of personal photo collections*

**User-centred semantic authoring of photo collections** makes use of and contributes to a growing collection of semantically annotated images and presentations. Annotations will be produced as a result of the analysis step, but are not restricted to annotations from this step. They will include, in addition: context information about how and when an image was captured or created; the query used for retrieval; annotations added by users. These different sources of annotations will be used for steering the process of determining the structure and layout of the final presentation.

The authoring process can be divided into different stages. These may be addressed by the author in any order, thus the environment will provide support for the different stages in any order, [Falkovych et al., 2006]. We will provide support for the following stages: genre selection, content selection, presentation structure specification, style selection.

The author will be able to select the genre of the presentation from a pre-defined set. The genre captures the overall structure of the presentation the author wishes to create. Example genres applicable to image collections are biography, where photographs of a particular person can be assembled, or event description, such as a birthday party. The genre encapsulates relationships between the semantics available in the content, for example, a person, and the role of the content in the presentation. For example, for a biography there is a main character, with potential family and professional relationships. This changes the status of the different images which all contain “person” corresponding to the selected genre. Initial example **genres will be created and the collection will develop during the course of the project**, [Geurts et al., 2003]. Later in the project, advanced support for the creation of longer presentations, with (interactive) narrative structure, will be provided. Guidance will be provided through the different stages that need to be completed. This can be seen as a genre-dependent narrative template supported by semantic background processes.

For the authoring of a photo collection set such as a photo book will be provided with a selection of content from different sources, such as the own personal media collection, commercial edited content, free Web (2.0) sources. Through the emergent content framework, smooth access to these different sources will be enabled. This will require close cooperation of the authoring with the retrieval part of the project so that the author is presented with an integrated interface. The integration of the external sources can be pre-suggested in an extended retrieval task in which the collection of interested is enriched but also interactively suggested during the authoring process. For example, photos from a visit to Paris can be automatically augmented by the retrieval with additional descriptions of Wikipedia and “handed over” to the authoring which carries out a structuring and styling of the collection. But search and inclusion of external sources can take place interactively. For example, once an image has been identified of “the main character”, the retrieval process can search for more, potentially better, images of that person, or in a different location, setting or continuity constraint (such as close up or long shot). The author will be able to select images for preferential inclusion and indicate images that should not be included.

What is unique to the SemaPhoto, is that we **retain all these interaction and changes for future interactive analysis and retrieval**. For this, a **rule-based approach** will be developed to capture the relevant user interaction and feed it back to the emergent content pool for iterative refinement of analysis and retrieval. For example, if a retrieval operation is repeated, for example looking for similar objects in a different location, then previous manual changes will be reapplied automatically, for example, excluding images with more than 4 faces or that are out of focus. Also, if a photo is annotated with a name, this annotation is collected for a face detection that might benefit from this.

The author will be presented with suggestions for the **presentation structure** depending on the chosen genre and selected content. The suggested structure will be **derived from patterns found in the emergent content such as photos, context, or metadata**. This can be, for example, pictures of an event by the same photographer, photographs of a person in the same year, collections of “interesting events” in lifelogs [Smeaton et al., 2006]. In the biography example, the main character will play the most important role, with collections of images for each of the other prominent characters. The structure will be based on the semantic structures in the genre, e.g. the connections between the different characters, and the available content, e.g. the number of images available for each character. It is up to the author to make decisions on how to include groups that contain too few or too many images.

Perhaps the most striking part of the authoring process is the visual style. This determines to a great extent the impact the presentation has on its viewers. Visual style includes layout, both temporal and spatial, and colour schemes. The **layout process** will take into account visual features in the images, provided by the analysis stage, for examples, allowing alignment of the design to potential lines or colour changes within the images. Automatic scaling, cropping and tinting is another example where feature analysis can play an essential role in making individual images appear as part of a group, e.g. individual portraits brought together. Alignment of textual descriptions about an image can be made with features within an image. While images form the predominant media type, textual descriptions associated with the images will be taken into account in the layout process.

At any stage during the authoring process, the author can add annotations about either the content of the image, or the role it plays in the presentation. These are recorded by the system and can be used at different stages of authoring. Part of the research is to determine which annotations developed at which stage are useful during other authoring stages. In addition, within the project, **feedback from different stages of the authoring process** can be given to **steer the types of content analysis and retrieval processes** addressed in the project. This includes recording the current genre when the user is selecting content to place in the presentation. Once an image has been incorporated in a presentation, the fact that it has been selected for use by a user is an important piece of information to retain in the system. The image has been implicitly annotated as more interesting than other (discarded) images. Such information from the authoring process will be fed back into the emergent content pool.

#### *1.3.1.4 Emergent content framework*

The holistic approach of SemaPhoto is realized by the emergent content that provides the basis for the emergent personal media collection which integrates the processes of analysis, retrieval, and authoring.. For this we will design and implement an architecture both for the emergent personal media collection as well as interfaces for the processes and applications of SemaPhoto. In detail, the emergent content framework, as illustrated in Figure 6, consists of a conceptual data and process model and an engine implementing that conceptual model and providing an execution environment for the emergent content processes.

The **conceptual emergent content framework** is based on a content metamodel that comprises content, context, metadata, as well as the user interaction and media usage. The meta model is an abstract content model that defines meta classes for the different content types as first class objects. This metamodel has then to be instantiated for the domain of SemaPhoto to create the concrete SemaPhoto emergent content model. The differentiation between the metamodel and its concrete instantiation in the domain of personal photo collection allows for a later usage of the emergent content framework in another domain and contributes to the genericity of the results of SemaPhoto. Based on this content metamodel, a task capability description language will be developed that allows for the formal specification of the input

and output data of the media processing components attached to the media collection in form of pre- and post conditions.

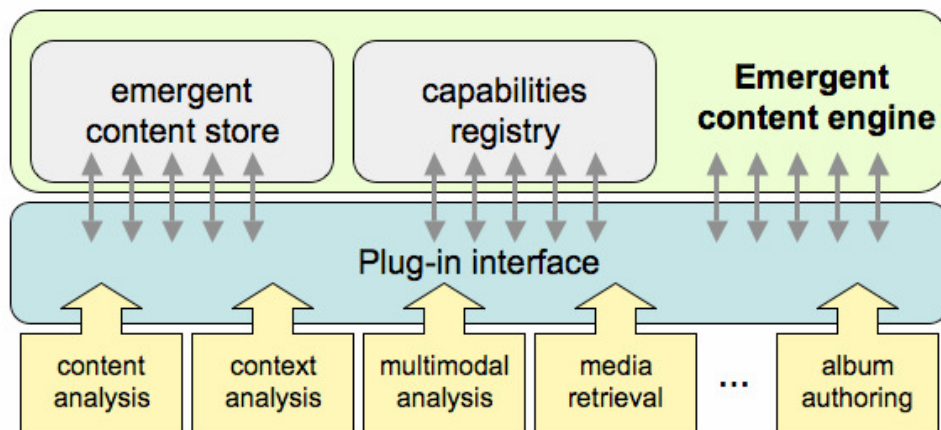


Figure 6: Overview of the emergent content framework

This conceptual emergent content framework will be implemented in form of an emergent content pool and an emergent content engine operating on that pool.

The **emergent content pool** implements a store conforming to the conceptual emergent content metamodel and the SemaPhoto instantiation of the metamodel. The pool persistently manages and provides access to all first class objects of personal media collections. This involves the access to the actual media content as well as context information such as time, date or position as well as metadata such as manual description of a photo or a derived event description from the multimodal analysis. A notification interface will allow listening components to be notified in case some content has been added to pool or changed.

The **emergent content engine** provides a registry and execution environment for task capability descriptions. It allows the registration capability descriptions of content processing components such as a photo book image page cluster analyzer. The engine hooks into emergent content pool and asynchronously triggers components according to their capability descriptions. The components controlled by the engine connect via a plug-in interface.

Thus, the emergent content framework will be the “docking station” for the different tasks of media processing developed in this project: multimodal content analysis, semantic enhanced and constrained-based retrieval, and intelligent collection authoring. Its **plug-in infrastructure** is also well prepared to transparently integrate future content processing components tasks and let them contribute to a user’s media collection. For example, a future sensor evaluation and inference task might exploit a user’s sensor data such as heartbeat and movement as well as surrounding noise to derive a level of excitement for the photo taken.

Applications – such as the photo book authoring application to be developed in this project – are considered as yet another kind of content processing components that connect to the emergent content framework via the plug-in interface. Thus, applications also benefit from the asynchronous notification and triggering functionality of the emergent content engine.

#### 1.3.1.5 Photo book authoring application

In addition to the novelty of SemaPhoto’s holistic emergent content approach, the results will be **exploited in a personal photo book authoring application**. This application will illustrate and demonstrate the advances in analysis, retrieval and authoring integrated in SemaPhoto’s emergent content framework approach. Driven by our industrial partner CeWe Color,

the results will be integrated into their existing photo book application to show the applicability and potential of the emergent content approach in a **commercially relevant end-consumer application**. The CeWe Photo Book is one of CeWe's latest developments and marks the transformation from analogue photography to sophisticated digital services for personal media collections. It is particularly designed for digital photographs and therefore is one answer to the change in the photo market from analogue to digital. The photo book is a printed book that aims at the user who not only wants his digital photos to be finished in a professional way, but also demands for a decent way for these photos to be presented. In order to achieve such kind of neat presentation the usual way is to let the digital photos be printed and to organize and annotate the prints by putting them in a conventional photo book. In order to simplify and expedite this CeWe Color aims at shifting this design process to the home computer. Therefore, CeWe has developed an application which enables the customer to create his personal photo album with his PC and let the result be printed by CeWe Color in a high quality manner. The final product is a professionally manufactured photo book as shown in Figure 7.



**Figure 7: Example of a printed photo book from CeWe from a personal photo collection**

Currently, in the photo book application the user basically finds the same functionalities when authoring a photo the conventional way: the user can rotate, resize, and crop photos and place them anywhere on an album page; s/he can also choose between different kinds of backgrounds or a custom cover page; additionally, the pages can be annotated with text blocks that can be placed anywhere on a page. CeWe also has done first steps in automating the authoring process. For example, if there are several photos, perhaps several hundred from a holiday trip, doing the selection and design process in a manual fashion becomes a complex and tedious task. That is why the photo book software already offers the user options such as pre-defined templates for placing the photos on a page. For photo selection and grouping content-analysis and context-analysis techniques are already used to for example group the photos in a certain way or to be able to ensure photos belonging to one event are not split over several pages or mixed with other events. However, currently this analysis, retrieval and automatic authoring functionalities are at a very early stage can well be improved. The SemaPhoto project results will be used to improve the automatic selection of photos from the personal photo collection and to **advance the authoring into intelligent, intuitive photo book software for the end consumer**. This will provide the photo book application user with a personalized suggestion for a photo book content structure and layout and relieve her/him from a tedious authoring task but make content creation easy and fun. This is getting even better over time by iteratively learning from the personal photo collection and by observing the authoring process.



Currently, there are also no options to enhance the photo album with content besides the personal photo collection, although the computer as a tool with its connection to the internet and therefore a channel to external content offers a great opportunity for this. By integrating the SemaPhoto research results it will be possible to gain access to other shared personal photo collections. With this it will be possible to, e.g., create a meaningful photo album of a holiday trip where several people attended and the photos taken by several people and cameras have to be merged. The SemaPhoto project will also enable the CeWe photo software to (semi)-automatically include additional content from the Web like matching photos from community photo web sites or to enrich the photo book with texts and photos from a event database like EventWeb provided by SEraja.

The photo book application already integrates a billing system as the production of a photo book has to be paid by the customer. Obviously the billing of external content that is not free can smoothly be integrated into this system as shown in already existing integrations. At the end of the design process, the user is then presented with a bill containing the overall costs of the photo book, with the costs for the external content already being integrated. This will also be an easy way for commercial content providers like Alinari to sell their content. Users probably won't bother to pay the extra 0,10 € for a neat picture if the overall costs for the photo book are 7.95 € and more.

With CeWe Color as a partner, being one of the biggest photo finisher in the world, we have the opportunity to directly integrate technology developed in SemaPhoto into a product that is used by a huge and ever growing amount of end users all over Europe.

#### *1.3.1.6 Transfer of the results into further applications and domains*

In addition to the photo book authoring application, the project partners SEraja and Alinari will adopt the emergent content approach and integrate photo boot authoring software in the field of a Web 2.0 application as well an application as a content provider, e.g., for professional photographers.

**SEraja EventWeb Integration:** The integration between the CeWe Color photo book application and SEraja Event Web is going to be bidirectional. Not only will the CeWe photobook software use EventWeb as an external content and knowledge source as described above.

- SEraja will **integrate** with the **CeWe photo book authoring tool** to create a prototypical event book authoring service that will enable EventWeb users **to** quickly and **semi-automatically author CeWe photo books about SEraja events online** right from their Web browser. Furthermore, SEraja will make use of the external content enrichment facilities to be developed in SemaPhoto. Using these facilities, events on EventWeb will be automatically augmented with media documents from external content source in addition to those media explicitly uploaded to EventWeb.
- SemaPhoto thus teams up a physical media printing and production company with a Web 2.0 generation online content sharing and community build service provider. This will **provide a valuable case study** offering new insights on two fundamental questions raised by the Web 2.0 development: how to position traditional, analogue media printing and production business in the **Web 2.0** age as well as how to support Web 2.0 **virtual social networking and content sharing** business with established and very real business models from **traditional media printing and production services**.



**Alinari Professional Photo Album:** Alinari will channel the created photo books through its SemaPhoto-service and create photo albums for professional contexts. The integration of SemaPhoto emergent content approach and a profession search interface in photo archives will demonstrate that the developed analysis and retrieval results also support constraint-based retrieval application for content-providers on an emergent photo archive and professional photo book application.

- Alinari will offer an **adopted photo book authoring** in a Web portal, which will be **specialized for professional photographers and act as a service provider**. It will also consider the use of SemaPhoto technology in order to improve some of the services offered in one of Alinari's dedicated business portal, for example to enhance the information in the business sites by using SemaPhoto's retrieval system. In the long term, Alinari will also experiment the offer of services based on SemaPhoto on mobile devices, in order to offer to **professional content brokers or photographers** the SemaPhoto services.

### 1.3.2 Risk management

The highly innovative approach of SemaPhoto bears the risk that the project results cannot be reached as planned. The consortium is aware of this risk, and is pro-actively addressing it. We will define a state-of-the-art change management process in order to deal with technical difficulties that may occur during the project. All partners will be involved in the discussion and implementation of changes. By that, we guarantee that all partners are always synchronized with the technical focus and state of the project. The risk management will be part of WP 6 "Project Management".

A preliminary risk assessment has already been made and shows that the risks of SemaPhoto do not exceed the normal level that could be expected from such a kind of project.

**Operationality of the system:** The main risk of SemaPhoto is that the resulting system does not work as expected. The most important measure against this risk is that the project goes for an iterative approach with versions of the systems and methods developed in the work packages and with several prototype versions, both within the research work and within the application development. This allows for early evaluations and for early identification of problems arising, thus allowing the implementation of measures to resolve or at least reduce the problems. In more detail, some of the scientific and technological risks that might arise during the development and evaluation of the emergent content framework, analysis, retrieval and authoring as well as the photo book application, and potential measures against are:

- Rapidly decreasing confidence scores might lead to search results becoming ambiguous → more rigid parameterisation
- Performance problems in modality extraction and merging → replace complex modalities by simpler ones, e.g. in colour information.
- Difficulties in learning parameter sets for photo retrieval → limit number of training data to smaller test cases and start with smaller parameters sets.
- Problems with integration of the results in the emergent content frame → early start with prototyping the emergent content framework, plan a less sophisticated architecture with simpler content model and process definition for first prototypes.
- Problems with providing the plug-in and interfaces of the emergent content framework for the application → Strong connection of scientific partners and industrial partners in one WP; early implementation of abstract interfaces to allow partners to start working and developing against these.

**Project consortium:** The risk here is that the consortium is not working together as good as expected. To mitigate this risk, the consortium has been carefully established and each partner is experienced with multiple similar references in his field. Moreover, most of the partners of the project are experienced leaders in their field of research and industrial sector and have been working together before on EC and/or national projects. This will allow reducing considerably possible misunderstandings (the partners already share the same background and language) while speeding the necessary synergies. The project management is based on a strong project organisation that has been used successfully in many comparable projects before and is based on

- OFFIS as project coordinator, closely and transparently interfacing with the Project Officer,
- Partners in charge of WPs,
- Partners in charge of clearly identified tasks.

**Uptake of results.** Research projects always bear the risk that the results of the project are not accepted by “the (research and development) community”. SemaPhoto to a large extent mitigates this risk by the inclusion of strong industrial exploitation partners – SERaja, Alinari and particularly CeWe. CeWe not only has a high strategic interest in the project and its results, but it also has the market position to push the project results into the market. So this risk is low in SemaPhoto.

**Focusing on technical challenges instead of addressing real user needs.** Related to the aforementioned risk on uptake of results, researchers tend to focus on the most scientifically or technically challenging tasks, at the risk of ignoring the cost/benefit relation for final users. The combination of technical and user-oriented partners in SemaPhoto, and their close collaboration in this work package, should be sufficient to avoid this risk. In SemaPhoto we establish a close loop of the resulting applications to test users. CeWe Color has access to a large number of test users as well as Alinari and SERaja which will be included in the loop for early and continuous feedback.

**Legal and IPR issues.** SemaPhoto must ensure the on-time delivery of a meaningful collection of digitized content and accompanying metadata. A possible risk lies in the use of copyrighted material (professional photographers do not adhere and do not provide contents). Intellectual Property Rights are respected by using material owned by the institutes in the consortium and by making arrangements with rights owners whenever necessary. Alinari has extensive experience in rights clearing. Digitization itself will not be a risk, as the photographic archives already have significant amounts of digitized material available. Please also refer to section 0 for a more detailed discussion on IPR issues and how SemaPhoto will handle them.

### *1.3.3 Structuring and timing of work packages*

The break down of the overall strategy into six work packages (WP) follows a clear and easy strategy. The concept behind this break down is the following and the relationship of the workpackages is also illustrated in Figure 8.

There are three work packages **WP1**, **WP2**, and **WP3** dealing with the core research questions – **Analysis**, **Retrieval**, **Authoring**. Each of these work packages is lead by the one of the three research partners with the relevant expertise, the other two research partners contribute to a lesser extent. The industry partners are not directly involved in research but will stimulate the research with requirements from the integration and exploitation WP 5.

There is one work package – **WP4, Integration and Application** – that acts as a hinge between research and industry. In the beginning of the project, it defines the requirements for

the future work. In the later course of the project, the results of the research work are transferred into practical use by implementing a software framework and a set of applications in the contexts of the industry partners. This work package opens the door for the usage of the project results. Consequently, it is lead by an industry partner, CeWe Color, and the other two industry partners contribute massively. The research partners are active only to a lesser extent, to ensure a smooth transition between research and application. Being our central point of knowledge exchange, WP4 is fairly large with respect to efforts and scope. We do believe, however, that this helps the project to intensify collaboration between the partners. With the consortium being only medium sized, we think that this is a pragmatic and practical solution.

**Dissemination and Exploitation** of results are bundled in **WP5**. This ensures coordinated activities of all the partners. The main path here is the commercial exploitation of the project results; therefore this WP is lead by an industry partner, with major contributions by the other two industry partners. The scientific partners obviously concentrate on the dissemination of the research results, e.g. through publications, presentations at conferences etc.

**Project Management** is handled exclusively by OFFIS in a single work package **WP6**. This again is pragmatic and, given the rather medium overall size of the project, feasible.

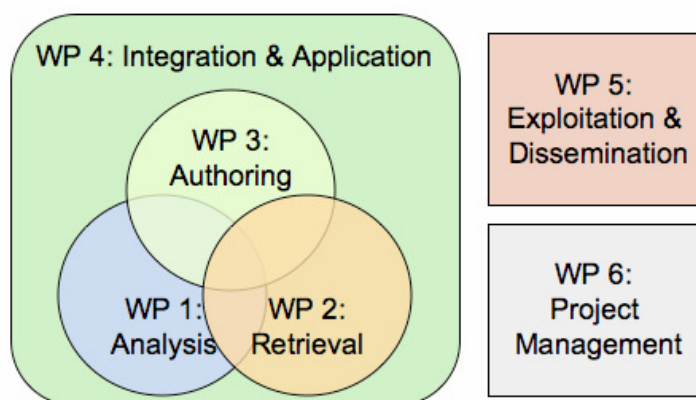


Figure 8: Overall work package structure

The timing of the work packages as well as the list of deliverables (Table 1.3b) show a strong temporal and work relationship of the WP1, WP2, WP3 with the Integration and Application work package WP4. Exploitation and Dissemination (WP5) as well as Project Management (WP6) are running in parallel during the project fulfilling the respective tasks in the different phases of the project.

| WP No | Work package title        | Type of activity | Lead partic. No | Lead partic. short name | Person months | Start month | End month |
|-------|---------------------------|------------------|-----------------|-------------------------|---------------|-------------|-----------|
| WP 1  | Analysis                  | RTD              | 2               | DCU                     | 73            | 2           | 30        |
| WP 2  | Retrieval                 | RTD              | 1               | OFFIS                   | 87            | 4           | 30        |
| WP 3  | Authoring                 | RTD              | 3               | CWI                     | 87            | 4           | 30        |
| WP 4  | Integration & Application | RTD              | 4               | CeWe                    | 169           | 1           | 36        |
| WP 5  | Exploitation & Dissem.    | RTD              | 6               | Alinari                 | 70            | 1           | 36        |
| WP 6  | Project Management        | MGT              | 1               | OFFIS                   | 20            | 1           | 36        |
|       | TOTAL                     |                  |                 |                         | 506           |             |           |

Table 1.3 a: Work package list

The overall timing of the work packages is documented in the Gantt chart below. Project Management (WP6) of course is a process from the first to the last project month. Dissemination and Exploitation activities start in the first month with preparatory actions and continue in parallel to the other WPs throughout most of the project. WPs 1, 2, 3 and 4 are strongly inter-linked, following the following logic:

- WP4 starts in the month 1, developing requirements needed as input for WPs 1, 2, 3.
- WP1 starts a bit later, developing an "early prototype" needed as input to WPs 2 and 3
- When the requirements and the early prototype are available, WPs 2 and 3 start
- WPs 1, 2, 3 have first results after project month 9, documented in deliverables D1.2, D2.1 and D3.1. These are handed over to WP4 for integration into the emergent content framework.
- The first application prototypes are handed back to the research WPs after month 20, allowing for rating and evaluation of the success of the work.
- A second, preliminary hand-over of the research results happens after the second project year and a final and official one after 30 months which finally results in the final application prototypes at the project end.

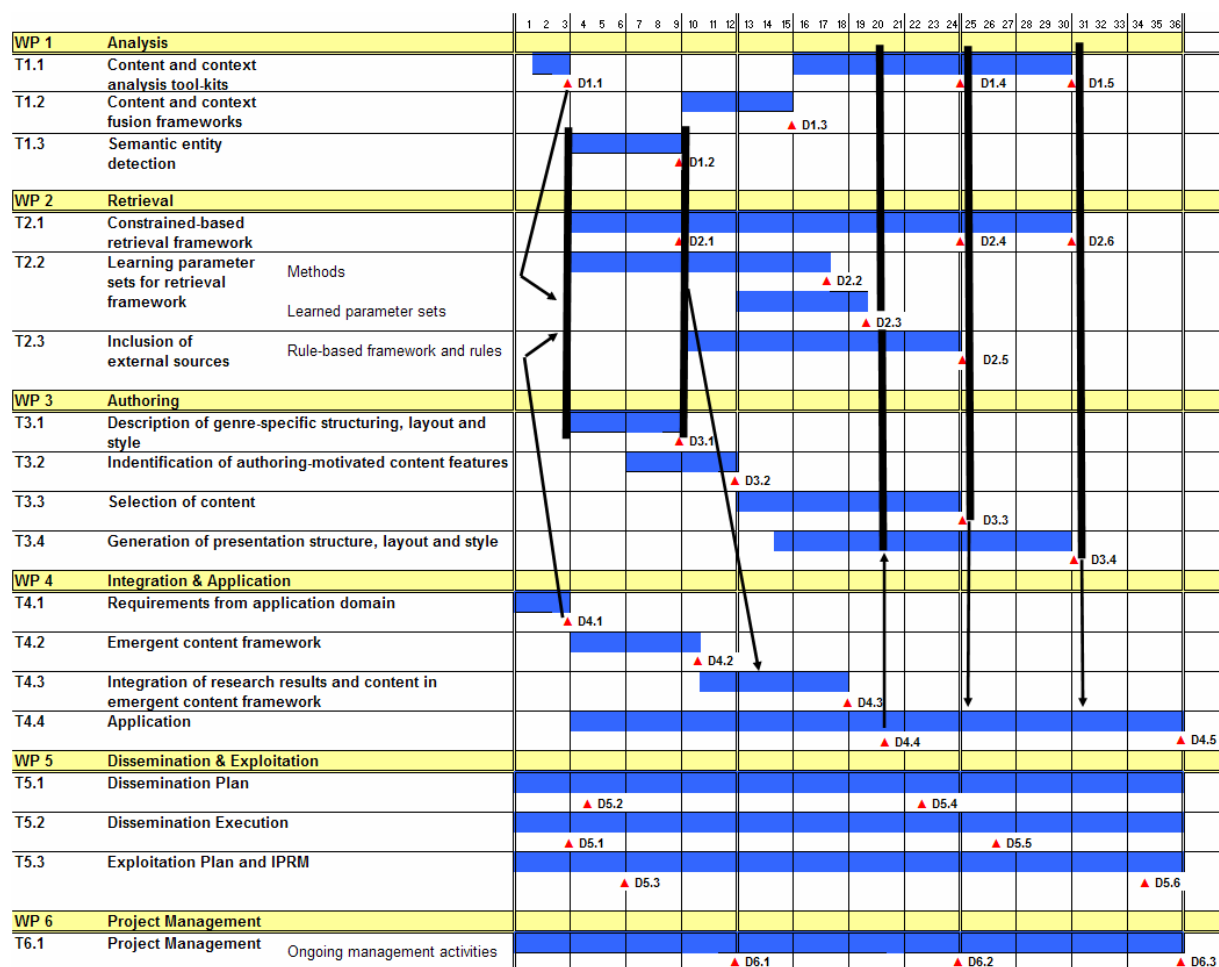


Figure 9 Individual timing of workpackages

| <b>Del. No.</b> | <b>Deliverable name</b>   | <b>WP no.</b> | <b>Nature</b> | <b>Dissemination level</b> | <b>Delivery date (proj. month)</b> |
|-----------------|---|---------------|---------------|----------------------------|------------------------------------|
| D1.1            | Early prototype of content and context processing toolkit                                   | 1             | P             | PU                         | 3                                  |
| D1.2            | Definition of semantic entities in Sema-Photo demonstrators                                 | 1             | RP            | PU                         | 9                                  |
| D1.3            | Content and context fusion frameworks for knowledge discovery in personal image collections | 1             | P             | PU                         | 15                                 |
| D1.4            | Content and context processing toolkit v1.0   | 1             | P             | PU                         | 24                                 |
| D1.5            | Content and context processing toolkit v2.0   | 1             | P             | PU                         | 30                                 |
| D2.1            | Constraint-based retrieval framework v1.0   | 2             | P             | PU                         | 9                                  |
| D2.2            | Methods for learning retrieval parameter sets from authoring                                | 2             | P             | PU                         | 17                                 |
| D2.3            | Learned parameter sets for personalized collection retrieval for the photo book application | 2             | RP            | PU                         | 19                                 |
| D2.4            | Constraint-based retrieval framework v2.0   | 2             | P             | PU                         | 24                                 |
| D2.5            | Rule-based integration of external sources into retrieval                                   | 2             | P             | PU                         | 24                                 |
| D2.6            | Constraint-based retrieval framework with integration of external sources                   | 2             | P             | PU                         | 30                                 |
| D3.1            | Description of genre-specific structuring, layout and style use cases                       | 3             | RP            | PU                         | 9                                  |
| D3.2            | List of content/context features specific to authoring requirements                         | 3             | RP            | PU                         | 12                                 |
| D3.3            | Description of content selection methods  | 3             | RP            | PU                         | 24                                 |
| D3.4            | Description of presentation structure generation methods                                    | 3             | RP            | PU                         | 30                                 |
| D4.1            | Initial requirements from the application domain  | 4             | RP            | PU                         | 3                                  |
| D4.2            | Emergent content framework v1.0   | 4             | P             | PU                         | 10                                 |
| D4.3            | Integration of research results and content in emergent content framework                   | 4             | P             | PU                         | 18                                 |
| D4.4            | First application prototypes  | 4             | P             | RE                         | 20                                 |
| D4.5            | Final application prototypes  | 4             | P             | PU                         | 36                                 |

| <b>Del. No.</b> | <b>Deliverable name</b>   | <b>WP no.</b> | <b>Nature</b> | <b>Dissemination level</b> | <b>Delivery date (proj. month)</b> |
|-----------------|---|---------------|---------------|----------------------------|------------------------------------|
| D5.1            | Production of promotion material including project website portal | 5             | O             | PU                         | 3                                  |
| D5.2            | Initial dissemination planning                                    | 5             | RP            | PU                         | 4                                  |
| D5.3            | Initial exploitation planning report and market survey            | 5             | RP            | PU                         | 6                                  |
| D5.4            | Revision of dissemination planning                                | 5             | RP            | PU                         | 22                                 |
| D5.5            | Finalization promotion material including project website portal  | 5             | O             | PU                         | 26                                 |
| D5.6            | Revision of exploitation planning report and market survey        | 5             | RP            | PU                         | 34                                 |
| D6.1            | First annual management report                                    | 6             | RP            | CO                         | 12                                 |
| D6.2            | Second annual management report                                   | 6             | RP            | CO                         | 24                                 |
| D6.3            | Final annual management report                                    | 6             | RP            | CO                         | 36                                 |

**Table 1.3b: List of deliverables**

|                                       |                 |     |                                     |           |        |         |
|---------------------------------------|-----------------|-----|-------------------------------------|-----------|--------|---------|
| <b>Work package number</b>            | <b>1</b>        |     | <b>Start date or starting event</b> | <b>M2</b> |        |         |
| <b>Work package title</b>             | <b>Analysis</b> |     |                                     |           |        |         |
| <b>Activity type</b>                  | <b>RTD</b>      |     |                                     |           |        |         |
| <b>Participant number</b>             | 1               | 2   | 3                                   | 4         | 5      | 6       |
| <b>Participant short name</b>         | OFFIS           | DCU | CWI                                 | CeWe      | SEraja | Alinari |
| <b>Person-months per participant:</b> | 15              | 47  | 11                                  | 0         | 0      | 0       |

### Objectives

The objectives of this WP are to:

- Develop a suite of contextual and content analysis techniques leveraging state-of-art analysis in each modality;
- Develop efficient data fusion frameworks for combining context and context analysis results given a semantic entity to be detected;
- Develop analysis algorithms for detecting a variety of semantic entities in personal content collections for event detection, photo organization and selection;
- To ensure that all algorithms are developed in a modular fashion facilitating straight-forward integration into the project demonstrators.

### Description of work (possibly broken down into tasks) and role of partners

#### T1.1 Content and context analysis tool-kits

Initially in this task, existing content and context analysis techniques will be brought to the project. These techniques will be developed into a modular framework with content/context processing interfaces that can be either called directly by the user or alternatively by another link in the processing chain. Subsequent releases will incrementally include the semantic entity detectors developed in T1.3. The benefits of these tool-kits to the project within WP3 and WP4 will be facilitated by ensuring that DCU works closely with OFFIS and CWI during the specification phase of the analysis tools so that they can be easily used with WP3 (Retrieval) and WP4 (Authoring).

#### T1.2 Content and context fusion frameworks

In this task we will develop frameworks based on Dempster-Shafer theory that can handle measures of “belief” associated with multiple input data sources, be it belief associated with the results of image processing/segmentation, inferred metadata or user preferences. Potential frameworks will be considered and developed from the perspective of their ability to generalize to multiple different semantic entities depicted in the content and the ease with which the user can potentially interact either in the training or feedback stages. This will be harmonized with the fusion work to be carried out in WP3 (Retrieval) where possible via close cooperation between OFFIS, CWI and DCU.

**T1.3 Semantic entity detection**

In this task we will identify a core set of semantic entities and develop automatic detectors for each. Semantic entities will be selected and modeled using input from the projects industrial partners (CeWe, SEraja and Alinari) based on their knowledge of their end consumers and their requirements. DCU will coordinate with OFFIS and CWI to ensure that the outputs of WP3 (Retrieval) and WP4 (Authoring) smoothly transition into this task. Work will focus on using processed content and context data sources in the identified fusion frameworks tailored to specific semantic entities depicted in the content.

**Deliverables** (brief description) and month of delivery

**D1.1 Early prototype of content and context processing toolkit (M3)**

This is a first version of the content and context processing tools that can be used for an initial analysis of the content collection. It will facilitate an initial non-ideal partitioning and organization of the collection, but will allow WP2 and WP3 to begin work immediately.

**D1.2 Definition of semantic entities in SemaPhoto demonstrators (M9)**

This is a description of the core set of semantic entities for which detectors are to be built. It will be a prioritized list of concepts and their characteristics intended to delimit the scope and assist in the modeling phase. A timeline will be provided outlining the delivery of each to the project.

**D1.3 Content and context fusion frameworks for knowledge discovery in personal image collections (M15)**

An initial specification of the fusion framework to be used for combining data sources for semantic entity detection and an initial set of prototype algorithms for a subset of the concepts in D1.2 (intended as initial early delivery of D1.4 to facilitate work in the other WPs).

**D1.4 Content and context processing toolkit v1.0 (M24)**

Complete implementations of a subset of the identified semantic entity detectors in a framework suitable for integration into project demonstrators.

**D1.5 Content and context processing toolkit v2.0 (M30)**

Complete implementations of the remaining detectors not covered by D1.4 and required for the project final demonstrator.



|                                       |                  |     |                                     |           |        |         |
|---------------------------------------|------------------|-----|-------------------------------------|-----------|--------|---------|
| <b>Work package number</b>            | <b>2</b>         |     | <b>Start date or starting event</b> | <b>M4</b> |        |         |
| <b>Work package title</b>             | <b>Retrieval</b> |     |                                     |           |        |         |
| <b>Activity type</b>                  | <b>RTD</b>       |     |                                     |           |        |         |
| <b>Participant number</b>             | 1                | 2   | 3                                   | 4         | 5      | 6       |
| <b>Participant short name</b>         | OFFIS            | DCU | CWI                                 | CeWe      | SEraja | Alinari |
| <b>Person-months per participant:</b> | 52               | 15  | 20                                  | 0         | 0      | 0       |

### Objectives

The objectives of this WP are to:

- develop a constraint-based retrieval framework based on emergent content in the analysis WP that is tunable by different selection parameters;
- develop methods for learning parameter sets for the retrieval framework with machine learning techniques and identify relevant parameter sets in a learning phase from user interaction;
- develop a framework for a rule-based integration of external content and define and evaluate suitable rules;

### Description of work (possibly broken down into tasks) and role of partners

#### T2.1 Constraint-based retrieval framework

In this task, a constraint-based retrieval framework will be developed by OFFIS. This involves the definition of a fusion framework for utilising the different content, context and metadata to retrieve a structured set of photos according to a set of constraints. Close cooperation with DCU and CWI wrt to analysis and authoring aspects. A framework will be developed to define weighted functions for iteratively fusing different metadata constraints into an overall best match as well as the ranking and structuring methods for the retrieved set.

#### T2.2 Learning parameter sets for photo retrieval framework

The retrieval process is tunable by specifying different parameter sets, which represent different user preferences, different user groups, and differing purposes for the resulting photo selection. To achieve meaningful personalized retrieval, we aim at determining and learning these parameters, which stand for different user groups or different purposes and to determine an individual parameter set for the photo book user. These parameter sets will be chosen by machine-learning techniques based on input from authoring process in WP3. With the help of these techniques and by observing the authoring and user interaction with the retrieval process, these different parameter sets will be determined.

#### T 2.2 Rule-based inclusion of external sources into photo retrieval

In this task we aim at the integration of external content from external sources such as Web 2.0 content sites or other photo collections. For this we allow define rules for accessing and including content from external sources into the retrieval results, in coordination with DCU

and CWI. The rule definition language will describe the preconditions under which content from an external source is requested and how the results are integrated into the selected collection and also merged back into the personal media collection. The rule-evaluation can be triggered within the retrieval process as well as interactively from an authoring process.

**Deliverables** (brief description) and month of delivery

**D2.1 Constraint-based retrieval framework v1.0 (M9)**

Specification of the retrieval framework that is extended in D2.4 (intended as initial early delivery to facilitate work in the other WPs). This comprises the definition and implementation of basic framework functionality, constraint description and retrieval result structuring.

**D2.2 Methods for learning retrieval parameter sets from authoring (M17)**

This deliverable will describe the methods developed for learning retrieval parameters. The input parameters from authoring, the machine learning techniques (SVM) and the integration of the different parameters into the classifier and the results of the parameter set clustering.

**D2.3 Learned parameter sets for personalized collection retrieval for the photo book application (M19)**

Based on the methods for learning parameters sets developed in T2.2 in this deliverable those parameter sets that are obtained from training data from authoring

**D2.4 Constraint-based retrieval framework v2.0 (M24)**

Refined and extended specification of the retrieval framework with regard to more advanced constraint definition, multi-criteria structuring of retrieval results and interactive retrieval of subsets during authoring.

**D2.5 Rule-based integration of external sources into retrieval (M24)**

Description of the rules for the search and integration of content from external sources. Formal description of rule-format, preconditions for external content queries and content integration into the personal collection; formulation of concrete rules for the photo book application.

**D2.6 Constraint-based retrieval framework with integration of external sources (M30)**

Finalized retrieval framework fully integrated with the emergent content framework and exploited by the photo book application.

|                                       |                  |     |                                     |           |        |         |
|---------------------------------------|------------------|-----|-------------------------------------|-----------|--------|---------|
| <b>Work package number</b>            | <b>3</b>         |     | <b>Start date or starting event</b> | <b>M4</b> |        |         |
| <b>Work package title</b>             | <b>Authoring</b> |     |                                     |           |        |         |
| <b>Activity type</b>                  | <b>RTD</b>       |     |                                     |           |        |         |
| <b>Participant number</b>             | 1                | 2   | 3                                   | 4         | 5      | 6       |
| <b>Participant short name</b>         | OFFIS            | DCU | CWI                                 | CeWe      | SEraja | Alinari |
| <b>Person-months per participant:</b> | 20               | 10  | 57                                  | 0         | 0      | 0       |

### Objectives

The objectives of this WP are to develop a user-centered semantic authoring environment for predominantly image presentations which

- supports genre-specific structuring, layout and style selection processes;
- makes use of results from the retrieval process for selecting content;
- makes use of all annotations (including from contextual and content analysis processes) in determining presentation structure, layout and style.
- provides feedback from authoring process to analysis and retrieval processes.

### Description of work (possibly broken down into tasks) and role of partners

#### T3.1 Description of genre-specific structuring, layout and style

Descriptions of genre-specific structuring, layout and styling processes, for example for biography or holiday album, will be created. This will include information on the information expected to be incorporated in the presentation, for example main character or location of holiday. CWI will coordinate with CeWe and DCU on usage scenarios.

#### T3.2 Identification of authoring-motivated content features

CWI will give feedback to analysis and retrieval partners on specific features that are useful in one or more of the authoring processes, e.g. close-up or long shot of people in the images. CWI will coordinate with OFFIS and DCU on ensuring transfer of annotations from analysis and retrieval processes to the authoring process. Partners will ensure that annotations derived during the authoring process, will be passed back to the repository of annotated images.

#### T3.3 Selection of content

Content will be selected based on the role in the presentation (known from the genre), description of content in image, continuity constraints (e.g. location, setting, lighting, focal length) and quality of the image (e.g. in focus, shaken). This will be carried out in close cooperation with T2.1.

#### T3.4 Generation of presentation structure, layout and style

Output from the retrieval process will be taken and preliminary structures and layouts for a presentation proposed, from which a user can select and apply editing actions. This will use annotations, including content and context, for determining presentation structure, for example, based on location, creator, topic and/or uniqueness. The images will be laid out and styled according to genre-specific layout and style descriptions established in T3.1.

**Deliverables** (brief description) and month of delivery

**D3.1 Description of genre-specific structuring, layout and style use cases (M9)**

Requirements collection for genre-specific adaptation of structure, layout and style.

**D3.2 List of content/context features specific to authoring requirements. (M12)**

Compilation of content and context features that are relevant for authoring photo collections to provide feedback to analysis and retrieval WPs

**D3.3 Description of content selection methods (M24)**

Report on implemented content selection methods

**D3.4 Description of presentation structure generation methods (M30)**

Report on implemented presentation generation methods, including structuring, layout and style

|                                       |                                      |     |                                     |      |        |         |
|---------------------------------------|--------------------------------------|-----|-------------------------------------|------|--------|---------|
| <b>Work package number</b>            | <b>4</b>                             |     | <b>Start date or starting event</b> | M1   |        |         |
| <b>Work package title</b>             | <b>Integration &amp; Application</b> |     |                                     |      |        |         |
| <b>Activity type</b>                  | <b>RTD</b>                           |     |                                     |      |        |         |
| <b>Participant number</b>             | 1                                    | 2   | 3                                   | 4    | 5      | 6       |
| <b>Participant short name</b>         | OFFIS                                | DCU | CWI                                 | CeWe | SEraja | Alinari |
| <b>Person-months per participant:</b> | 10                                   | 10  | 10                                  | 60   | 44     | 35      |

### Objectives

The objectives of this WP are to:

- acquire requirements from the application domain with regard to the content, context and metadata as well as the functionality for photo authoring services;
- design the bridging emergent content engine with the emergent content store and capabilities descriptions;
- integrate the results from the scientific partners from analysis, retrieval and authoring into the emergent content framework;
- integrate the content from the industrial partners Alinari and SEraja;
- develop the intelligent photo book application and with it the adopted application for search and authoring within the Web 2.0 application and a professional search tool

### Description of work (possibly broken down into tasks) and role of partners

#### T4.1 Requirements from application domain

Within this task, the industrial partners will acquire the requirements for SemaPhoto wrt to content, context, metadata as well as the intended functionality for media retrieval and authoring. These requirements will be fed into the WP1-WP3 as well as the emergent content framework in WP4. This task will be driven by CeWe, together with Alinari and SEraja.

#### T4.2 Emergent content framework

This workpackage comprises, the conceptual design and development of the emergent content framework for SemaPhoto, driven by CeWe. This task will strongly be interrelated with the workpackage WP1, WP2 and WP3 (and the responsible WP leaders) to seamlessly integrate the results from this workpackages into the emergent content framework for early prototypes as well to receive requirements from these work packages in addition to the requirements from the application domain from T4.1.

#### T4.3 Integration

Integration of analysis, retrieval and authoring with the emergent content framework: In this task the results from work packages WP1, WP2, WP3 will be integrated with the emergent content framework. For this the results the scientific partners (OFFIS, DCU, CWI) will be integrated, who will implement the emergent content plug-in-interface and integrate their developed methods with the personal media collection.

Integration of content from the partners Alinari and SEraja: For the emergent personal media collection, the industrial partners will integrate their content into the personal media collection

and/or make it available for the integration of external sources into the emergent personal media collection. CeWe will provide the needed interfaces for this. SEraja will expose the event database of its EventWeb service to the research partners and CeWe via a Web Service API. Alinari will develop and make available its contents through Web Services.

#### **T4.4 Application**

Under the leadership of CeWe, SemaPhoto will develop an authoring tool for intuitive authoring of photo books. The functionality of the photo book authoring software will integrate the advancement of the analysis, retrieval, and authoring functionality developed in SemaPhoto to bring the research results towards the user for an intelligent and intuitive authoring of personal media content.

SEraja will develop a connector to CeWe's photo book authoring application. This will enable users to create an event book, pre-populated with photos, maps, directions, and text about the event available in EventWeb that can be authored afterwards using CeWe Color's photo book authoring tool. SEraja will also implement a plug-in for discovering external media related to events managed by EventWeb.

Alinari will adopt the photo book and collections for the professional and semi-professional users providing B2B services of searching contents, user profiling, and photo book creation form an emergent professional photo content pool.

**Deliverables** (brief description) and month of delivery

#### **D4.1: Initial requirements from the application domain (M3)**

The description of the initial requirements in the form of use cases, description of the relevant content, context and metadata as well as applications functionality will be input to WP1-WP3.

#### **D4.2: Emergent content framework v1.0 (M10)**

This deliverable is a first implementation of the design of the emergent content framework and its interfaces, which is part of T4.2. This implementation serves as the basis for the integration of the research results in the emergent content framework in T4.3 and the application development in T4.4.

#### **D4.3: Integration of research results and content in emergent content framework (M18)**

This deliverable is a first instance of the emergent content framework with the results from Analysis, Retrieval and Authoring (WP1-WP3) integrated via the plug-ins interface and functional with regard to the basic component functionality and application interface.

#### **D4.4: First application prototypes (M20)**

This deliverable is the first application prototype of the photo book application. Lead by CeWe a functional application using all basic aspects from the emergent content framework wrt analysis, retrieval, authoring for an intelligent selection and creation of personalized photo book will be developed. SEraja will develop an EventWeb first version as well as the Alinari will develop a first professional photo book based on the emergent content framework

#### **D4.5: Final application prototypes (M36)**

For the final prototypes a fully functional emergent content framework, the components from analysis, authoring and retrieval and will include access and usage of external sources. The application prototypes will meet the initial requirements and show the innovative results of SemaPhoto's holistic approach to personal media collection management and usage.

|                                       |   |     |                                     |      |        |         |
|---------------------------------------|---|-----|-------------------------------------|------|--------|---------|
| <b>Work package number</b>            | <b>5</b>                                |     | <b>Start date or starting event</b> | M1   |        |         |
| <b>Work package title</b>             | <b>Exploitation &amp; Dissemination</b> |     |                                     |      |        |         |
| <b>Activity type</b>                  | <b>RTD</b>                              |     |                                     |      |        |         |
| <b>Participant number</b>             | 1                                       | 2   | 3                                   | 4    | 5      | 6       |
| <b>Participant short name</b>         | OFFIS                                   | DCU | CWI                                 | CeWe | SEraja | Alinari |
| <b>Person-months per participant:</b> | 5                                       | 5   | 5                                   | 13   | 10     | 32      |

### Objectives

The objective of this WP is to

- promote the results (scientific and technological) to the European research community and
- to prepare the post-project exploitation of the commercial results on the European market, extended to the global market as far as possible.

IPR and DRM aspects will be addressed during the exploitation planning both for consumer photographers and for the professional photographers.

### Description of work (possibly broken down into tasks) and role of partners

#### Task 5.1 Dissemination plan

This task aims at planning the dissemination activity both for the consortium and for single partners, driven by Alinari. This plan will be reported in the Dissemination Plan, the first release of which will be maintained and updated throughout the entire project period to reflect possible refocusing of the scientific, technical, users' oriented and business work.

#### Task 5.2 Dissemination execution

Project dissemination will entail production of promotional material such as the creation of a Project Web site and information portal, a web- forum, ad-hoc mailing list, project leaflet, brochures, and posters. This activity will begin at the beginning of the project and will be updated during the project lifetime. Dissemination will also be carried-out by publishing research results of the project in international journals and conferences, and through a Newsletter produced periodically and delivered via e-mail and RSS.

#### T5.3 Exploitation Plan and IPRM

A market survey will be undertaken and a project exploitation plan will be defined. This plan will be reported in the Exploitation Plan, whose first release will be then maintained and updated throughout the entire project period to reflect possible refocusing of user-oriented and industrial work. IPRM issues will be planned and draft agreements will be generated. A Market Agreement of the Consortium. IPRM will be set up with particular attention to the SemaPhoto user groups (consumers and professionals).

**Deliverables** (brief description) and month of delivery

**D5.1 Production of promotion material including project website portal (M3)**

This deliverable will report about brochures, posters, public web site implementation and other promotional material which will be created during the project lifetime.

**D5.2 Initial dissemination planning (M4)**

This deliverable identifies the dissemination strategy. It will be updated and will measure the success of the project and the awareness generated. The dissemination plan will be developed to drive partners towards exploitation of the project results.

**D5.3 Initial exploitation planning report and market survey (M6)**

The deliverable will tailor on the basis of the consortium partner's profiles (business and academic or research) a possible exploitation scenario. It will identify the competitors of SemaPhoto, the market context and the possible channels to generate product or knowledge exploitation. The deliverable will also address the IPRM models and solutions.

**D5.4 Revision of dissemination planning (M22)**

The deliverable updates the dissemination strategy refocusing the goals on the basis of the advanced state of the SemaPhoto prototype.

**D5.5 Finalization promotion material including project website portal (M26)**

This deliverable will report about final brochures, demo-video, posters, public web site implementation, services offered and other promotional material which will be created during the project lifetime.

**D5.6 Revision of exploitation planning report and market survey (M34)**

This deliverable will identify final exploitation scenarios, channels, models and the IPRM statements.



|                                       |                           |     |                                     |           |        |         |
|---------------------------------------|---------------------------|-----|-------------------------------------|-----------|--------|---------|
| <b>Work package number</b>            | <b>6</b>                  |     | <b>Start date or starting event</b> | <b>M1</b> |        |         |
| <b>Work package title</b>             | <b>Project Management</b> |     |                                     |           |        |         |
| <b>Activity type</b>                  | <b>MGT</b>                |     |                                     |           |        |         |
| <b>Participant number</b>             | 1                         | 2   | 3                                   | 4         | 5      | 6       |
| <b>Participant short name</b>         | OFFIS                     | DCU | CWI                                 | CeWe      | SEraja | Alinari |
| <b>Person-months per participant:</b> | 20                        | 0   | 0                                   | 0         | 0      | 0       |

### Objectives

The objective this WP is to

- deal with the day to day project management issues (Strategic, Financial & Legal, Innovation, Co-ordination of WPs, Quality etc) by the project's coordinator, according to the project management structure described in Section 2.1.

### Description of work (possibly broken down into tasks) and role of partners

#### Task 1.1: Project Management

- Project strategy
  - Manage the relationship with the EC.
  - Convene, organise, and report on meetings of PCC and PTC
- Financial and legal
  - Manage the Consortium Agreement and the IPR
  - Manage the distribution of funding and financial reporting.
- Innovation
  - Coordinate the knowledge management.
- Project co-ordination and decision
  - Manage & validate the overall project work plan.
  - Help to solve any conflicts arising at WP level
- Quality
  - Check and approve the deliverables
  - Check the efficiency of allocated resources.

### Deliverables (brief description) and month of delivery

#### D6.1 First annual management report (M12)

This deliverable summarizes the project's progress within the first project year from a management point of view: Progress achieved, possibly deviations from the work plan, risks dealt with, IPR issues identified, etc.

**D6.2 Second annual management report (M24)**

In updating the first report, this second annual management report summarizes the project's progress within the second project year from a management point of view.

**D6.3 Final annual management report (M36)**

In updating the second report, this third annual management report summarizes the project's progress within the third project year from a management point of view.

| <b>Partic no.</b> | <b>Partic. Short name</b> | <b>WP 1</b> | <b>WP 2</b> | <b>WP 3</b> | <b>WP 4</b> | <b>WP 5</b> | <b>WP 6</b> | <b>Total person months</b> |
|-------------------|---------------------------|-------------|-------------|-------------|-------------|-------------|-------------|----------------------------|
| <b>1</b>          | <b>OFFIS</b>              | 15          | <b>52</b>   | 20          | 10          | 5           | <b>20</b>   | 122                        |
| <b>2</b>          | <b>DCU</b>                | <b>47</b>   | 15          | 10          | 10          | 5           | 0           | 87                         |
| <b>3</b>          | <b>CWI</b>                | 11          | 20          | <b>57</b>   | 10          | 5           | 0           | 103                        |
| <b>4</b>          | <b>CeWe</b>               | 0           | 0           | 0           | <b>60</b>   | 13          | 0           | 73                         |
| <b>5</b>          | <b>SEraja</b>             | 0           | 0           | 0           | 44          | 10          | 0           | 54                         |
| <b>6</b>          | <b>Alinari</b>            | 0           | 0           | 0           | 35          | <b>32</b>   | 0           | 67                         |
| <b>Total</b>      |                           | 73          | 87          | 87          | 169         | 70          | 20          | 506                        |

Table 1.3d Summary of staff effort

## Section 2: Implementation

### 2.1 Management structure and procedure

The management approach for SemaPhoto builds upon the management structures and procedures of former EU-funded projects coordinated by OFFIS (e.g., ICODES, POET, ROBOSEM). The management structure of these projects has proven to be adequate, efficient and able to quickly respond to any changes and threats to the project. It is therefore reasonable to apply it to SemaPhoto, too.

OFFIS, as a research institute, has extensive experiences in coordinating European projects in FP6 and dating back to FP5 and even FP4. It has coordinated not just, STREPs, but, IPs as well and will thus bring this considerable background and all its experience into SemaPhoto coordination to ensure a smoothest possible acting project.

#### 2.1.1 Management structure in brief

The project management will consist of the following structures and roles, whose interaction is shown in the figure below:

- Project Coordination Committee (PCC)
  - Project Technical Committee (PTC)
  - Workpackage Leaders
  - Project Manager
    1. Administrative Project Manager
    2. Scientific Project Manager
- Project Office

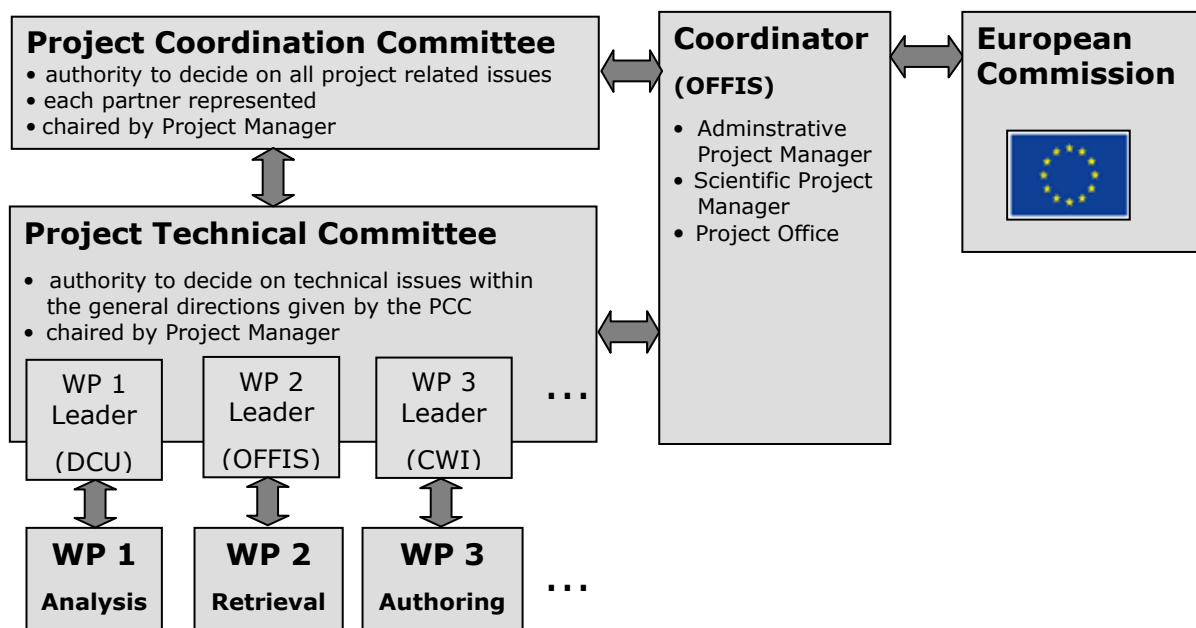


Figure 10: SemaPhoto management structure

SemaPhoto will be coordinated jointly by an *Administrative Project Manager* and a *Scientific Project Manager*, together referred to as *Project Managers*. The Administrative Project Manager will keep the direct contact to the Commission. The PCC, PTC and the Project Managers will be assisted by the *Project Office* that is located at the coordinator, OFFIS. Each workpackage is managed by one of the partners who will appoint a *Workpackage Leader*. The PTC consists of the Workpackage Leaders, including the Administrative Project Manager, who is also the Workpackage Leader of the Management Workpackage and the Scientific Project Manager. The Workpackage Leaders represented in the PTC will be able to make decisions as to the partner's particular technical interests and how to use the resources allocated for the project. The management representatives in the PCC will have the authority to make decisions on behalf of his or her company in terms of overall strategy and resources allocated to SemaPhoto. Each project partner is represented with one person in the PCC.

### 2.1.2 Project Manager

The project will be coordinated jointly by the Administrative Project Manager, for general and administrative issues, and the Scientific Project Manager, for scientific issues. Both managers will work closely together and can substitute for each other when needed. The function and responsibilities of the Project Managers can be summarized as:

- Act as reference and unique interface to the European Commission.
- Management of the Consortium in the wide sense on a continuous basis (i.e. monitor project progress and workload consumption, anticipate corrective actions when/if necessary, resolve conflicts within the Consortium as early as possible, serve as project secretary and archive, collect the partner's financial statements and audit certificates, etc.).
- Distribution of the funding budget.
- Transmission of project deliverables to the Commission.
- Prepare and follow-up Review, PCC and PTC meetings.
- Chairing of the PCC and PTC.
- Workpackage Leader of the Management Workpackage.
- Acting as a liaison between the Consortium and the European Community offices in Brussels.
- Negotiate on contract, budget, Consortium Agreement.
- Representation of the Consortium to the outside world.

The Administrative Project Manager is *Jochen Meyer* who is the director of the Multimedia and Internet Information Services Division of OFFIS. He will also head the project office. Jochen Meyer has co-ordinated for several years a variety of industry driven as well as publicly funded R&D projects and has participated in several EU funded projects in IST and Galileo (ENABLED, POPEYE, Loccata). He will also be the workpackage leader of the Management Workpackage.

The Scientific Manager is *Prof. Dr. Susanne Boll* who is Professor for Multimedia and Internet Technologies at the Carl von Ossietzky University of Oldenburg and Member of the Scientific Board of OFFIS. Susanne Boll has a well known scientific reputation in the thematic field of SemaPhoto and extensive experiences in the management of scientific projects.

### 2.1.3 Project Coordination Committee (PCC)

The SemaPhoto PCC is composed of one representative from each partner in the Consortium, plus the Project Manager. The representatives will have the authority to make decisions on behalf of his or her organization in terms of overall strategy and resources allocated to SemaPhoto. The Project Manager will chair the PCC. The PCC is responsible for the overall direction of the project and has a final decision authority. The PCC will meet at least two times per year and more often as required for administrative and scientific management. The decisions will be taken by consensus or by simple majority in the case where consensus is not possible. Changes to the work-plan will require consensus or an absolute majority. Each member of the PCC will have one vote. The Project Manager will resolve any tie in the vote. The voting procedure as well as the responsibilities of the PCC will be laid down in the Consortium Agreement. The main responsibilities are summarized as:

- The management of the project.
- Deciding on adaptations of the work-plan.
- Agreeing on the (re) allocation of the project's budget if required.
- Making proposals for review/amend the EU contract, if the case.
- Taking measures to cope with defaulting partners.
- Deciding on issues like: Technical roadmaps, joint publications and press releases, IP rights, exploitation and dissemination plans, control and auditing procedures.
- Maintaining the Consortium Agreement.

### 2.1.4 Project Technical Committee (PTC)

The SemaPhoto PTC is composed of the Workpackage Leaders. With SEraja being the only non-WP-leading partner and originating from a non-EC-member, it is given a special "guest" role in the PTC where its opinions are heard but it is not given the right to vote. This ensures highest efficiency of the PTC, at the same time keeping the structures clear. Members of the PTC may differ from the members of the PCC for their scientific and technical focus. The representative in the PTC shall be able to make proposals and decisions as to the particular technical interests and how to use the resources allocated to achieve the project's goals. The Project Manager will chair the PTC. The PTC is responsible for the monitoring of the project progress and the preparation, review and updating of the detailed work-plan. The decisions will be taken by consensus or by an absolute majority in the case where consensus is not possible. Each member of the PTC will have one vote. If no decision can be achieved, the PCC will be called to settle the dispute. The PTC will meet every month in a phone or video conference and face-to-face meetings will be held at least 2 times per year (in conjunction with the PCC meetings) and more often as required to fulfil the tasks of the PTC. The voting procedure as well as the responsibilities of the PTC will be laid down in the Consortium Agreement. The main responsibilities are summarized as:

- Co-ordinating the overall technical work on a continuous basis.
- Co-ordinate the interaction and collaboration across Partners and Workpackages.
- Preparing proposals for the PCC on issues like the (re)allocation of budget, the adaptation of the work-plan, when and if needed.

### *2.1.5 Workpackage Leader*

The Workpackage Leaders will be appointed by the lead participant for the corresponding workpackage, as already agreed upon (WP1 (Analysis): DCU, WP2 (Retrieval): OFFIS, WP3 (Authoring): CWI, WP4 (Integration): CeWe, WP5 (Dissemination&Exploitation): Alinari, WP6 (Management): OFFIS). The Administrative Project Manager is the Workpackage Leader of the Management Workpackage. The main responsibilities of the Workpackage Leaders are summarized as:

- Co-ordinate the work in the Workpackage.
- Ensure a close communication among the workpackage participants.
- Convene workpackage internal meetings if necessary.
- Ensure the on-time availability of workpackage deliverables.
- Participate to the meetings of the PTC.
- Report progress and deviations from the work-plan to the Project Manager and the PTC.

### *2.1.6 Project Office*

Administrative management is the prime responsibility of the Project Office, assisted by an administrator/secretary from the coordinator's staff. The Project Office is located at the Coordinator's site, OFFIS. The main responsibilities of the Project Office are:

- Organizing meetings of members of the Consortium.
- Taking care of payment delivery to the partners.
- Collecting documentation for monitoring the activities within the workpackages and for the preparation of the Annual Report.
- Coordination of the preparation of the Annual Report.
- Controlling the financial reports from the individual groups.
- Obtaining audit certificates from each participant.
- Collecting deliverables for submission to the Commission.
- Preparing a detailed list of deliverables, partner contact information, preparing and updating of the project calendar, establishing mailing lists, setting up a secure internet platform for the exchange of project data and information.

## 2.2 Individual participants

### 2.2.1 OFFIS e.V., Germany

OFFIS, founded in 1991, is an application-oriented non-profit research and development institute related to the Computer Science department of the University of Oldenburg, Germany. Its primary mission is to adopt the findings from university basic research in computer science and other relevant disciplines, stay in touch with new market demands through its many years of experience in co-operation projects with the industry and bridge the gap between “basic research” and “application demands” through application-oriented research. The institute has a wide spectrum of projects covered, including numerous projects funded by the European Commission. About two hundred people are employed in OFFIS.

The SemaPhoto project is located at the **OFFIS R&D Division “Multimedia and Internet Information Services”**. This division places its focus on research and development in the areas of mobile services and environments, delivery of information on demand and virtual spaces. Other keywords to describe the areas of expertise are auditory user interfaces and multimodal environments, usability engineering, mobile applications, location-based services, distributed software architectures. Regarding the SemaPhoto project the division also has expertise in the areas of personalization, adaptive and context aware applications, smart (multimedia) authoring for smart (multimedia) content and context-aware multimedia retrieval.

The division is currently engaged in the Integrated Project “ENABLED – Enhanced Network Access for the Blind and Visually Impaired” (in e-Inclusion) and “POPEYE – Professional Peer Environment Beyond Edge Computing” (in Collaborative Working Environments).

OFFIS will act both as **coordinator and an expert in multimedia retrieval** in the SemaPhoto project and will be leading WP2 “Retrieval”. OFFIS will also be involved in WP1 (Analysis) and WP3 (Authoring) as well as the Integration (WP4) in order to ensure that the outputs of WP2 are smoothly transferred to the other research WPs. As project leader OFFIS will be responsible for project management in WP6.

#### Key Persons:

**Prof. Dr. Susanne Boll** is Professor for Media Informatics and Multimedia Systems, Department of Computing Science at the University of Oldenburg. She is also member of the scientific board of OFFIS. In 2001, she received her doctorate with distinction at the Technical University of Vienna, Austria. She is an active member of SIGMM of the ACM and German Informatics Society.

**Jochen Meyer** studied Computer Science at the University of Oldenburg from 1989 to 1994. From 1994 to 1995, he worked as a software developer for a software house. Since 1995, he works at OFFIS. Since its foundation in 1998, he is director of the division “Multimedia and Internet Information Services”, where he now is responsible for the coordination of the activities of about 20 scientists.

**Philipp Sandhaus** received his diploma degree in computer science at the University of Oldenburg in 2005. Since then he is working as scientific assistant at OFFIS on a project together with CeWe Color to find new and innovative ways of digital photo services.

**Dr. Ansgar Scherp** received his PhD in 2006 at the University of Oldenburg. From 2001 he has worked at the University of Oldenburg where he developed methods and tools for virtual laboratories. Since 2003 he has worked as scientific assistant at OFFIS and is presently spending a research year at the UC Irvine with the help of a Marie Curie International Fellowship. His research interests are in the area of emergent semantics from personal, multimodal authoring.



### 2.2.2 Dublin City University (DCU), Ireland

The Centre for Digital Video Processing (CDVP) at Dublin City University (DCU) performs basic and applied research into the technologies necessary to support efficient management of large collections of multimedia information. The Centre is a founding partner of the Adaptive Information Cluster (AIC), a Strategic Research Cluster, funded by Science Foundation Ireland. The expertise of AIC/CDVP's researchers covers A/V analysis, information management and personalisation. The centre also conducts research into browsing and search interfaces, content access from mobile platforms, media navigation for safety and security applications, 3-D and multi-modal imaging and design of low-power hardware architectures for media processing.

The AIC/CDVP will bring its existing expertise to SemaPhoto via an innovative research programme directly aligned with the project's objectives. Specifically, the AIC/CDVP will be directly responsible for WP1 "Analysis" that will develop new algorithms for semantically enriching personal media collections based on analysis of both content and context data sources. The AIC/CDVP will also be involved in WP2 (Retrieval) and WP3 (Authoring) in order to ensure that the outputs of WP1 are smoothly transferred to the other research WPs and conversely so that WP1 can avail of the outputs of these WPs. The AIC/CDVP's role in WP4 (Integration) will be to ensure that the algorithms developed are integrated into the project demonstrators. Finally, in WP5 (Exploitation and Dissemination), the AIC will ensure wide dissemination of project results via publications in a variety of high-profile academic journals and conferences.

#### Key Persons

**Prof. Alan Smeaton** is a Professor of Computing at DCU. His research work addresses analysis and content-based retrieval of all kinds of multimedia information. Since 2001 he has coordinated the annual TRECVID activity, which benchmarks the effectiveness of video search and retrieval and coordinates submissions from almost 70 research groups worldwide.

**Prof. Barry Smyth** is an Adjunct Professor in the Faculty of Engineering and Computing DCU. He holds the Digital Chair of Computer Science at University College Dublin (UCD) and is head of the School of Computer Science and Informatics at UCD. His research focuses on adaptive information technologies and personalization. In 1999 he co-founded Changing-Worlds that today employs more than 70 staff and works with more than 30 leading mobile operators.

**Dr. Noel E. O'Connor** is a Senior Lecturer in the School of Electronic Engineering at DCU. His research interests include content analysis in context, image/video compression, and efficient media processing hardware architectures. Since 1999, he has filed 5 patents and spun off a campus company, Aliope Ltd, with Prof Smeaton. He is the Irish national representative to the ISO/IEC MPEG standards group.

**Dr. Gareth Jones** is a Senior Lecturer in the School of Computing at DCU. He holds B.Eng (hons) and PhD degrees (PhD in 1994), from the University of Bristol, UK. Prior to his present appointment he was a Lecturer in the Department of Computer Science, University of Exeter, UK for 7 years, a Toshiba Fellow at Toshiba Corporation R&D Laboratories in Kawasaki, Japan, and a Research Associate in the University of Cambridge, UK.

**Dr. Cathal Gurrin** is a senior postdoctoral researcher in the School of Computing, DCU and holds a position as a Research Fellow in the Department of Computer Science, University of Tromsø, Norway. In the late 1990s he was founder and MD of Oberon Digital Media, a Dublin-based software company.

### 2.2.3 *Centrum voor Wiskunde en Informatica (CWI), Netherlands*

The Semantic Media Interfaces group (<http://db.cwi.nl/projecten/thema.php4?themanr=6>) at the Centre for Mathematics and Computer science (CWI) carries out research on improving models and tools for presenting multimedia information to end-users on a variety of platforms. CWI is the research institute for mathematics and computer science research in the Netherlands. CWI's mission is twofold: to perform frontier research in mathematics and computer science, and to transfer new knowledge in these fields to society in general and trade and industry in particular. CWI has always been very successful in securing considerable participation in European research programs and has extensive experience in managing these international collaborative research efforts. CWI is also strongly embedded in Dutch university research: about twenty of its senior researchers hold part-time positions as university professors and several projects are carried out in cooperation with university research groups. In addition, CWI has strong links to the World Wide Web consortium, and houses the Benelux office.

CWI has a staff of 210 fte (full time equivalent), 160 of whom are scientific staff. CWI operates on an annual budget of EURO 13M. CWI's research is organized in research themes, including: Datamining and Knowledge Discovery, Semantic Media Interfaces and Visualization and 3D Interfaces.

In SemaPhoto, the group will lead the WP3 – "Authoring" work package and contribute to WP1 and WP2.

#### **Key Persons**

**Prof. Dr. Lynda Hardman** is the head of the Semantic Media Interfaces group and part-time full professor at the Technical University of Eindhoven. She obtained her PhD from the University of Amsterdam in 1998, having graduated in Mathematics and Physics from Glasgow University in 1982. During her time in the software industry she was the development manager for Guide, the first hypertext authoring system for personal computers (1986). Her favourite chocolates are from Puccini, Amsterdam.

**Dr. Jacco van Ossenbruggen** is a senior researcher, having obtained his PhD from the Vrije Universiteit Amsterdam in 2001. He was a member of the W3C working group that developed the SMIL recommendation. He is currently active in the MultimediaN E-culture Project, which won the first prize at the Semantic Web Challenge at ISWC '06. He also serves as the project manager of the Dutch BSIK BRICKS project. His current research interests include multimedia on the Semantic Web and the exploration of heterogeneous media repositories.

**Dr. Raphaël Troncy** is a post-doctoral researcher, having obtained his PhD from the University of Grenoble (INRIA/INA) in 2004. He selected as an ERCIM Post-Doctorate Research Associate 2004-2006. Raphaël Troncy is co-chair of the W3C Incubator Group on Multimedia Semantics. He is an expert in audio visual metadata and in combining existing metadata standards (such as MPEG-7) with current Semantic Web technologies. He works closely with the IPTC standardization body on the relationship between the NewsML language and Semantic Web technologies.

**Dr. Zeljko Obrenovic** is a post-doctoral researcher, having obtained his PhD from the University of Belgrade in 2004. His current research interests include design of interactive systems, universal accessibility, software engineering, service-oriented computing and semantic web. He is a member of the W3C Incubator Group on Multimedia Semantics and a guest lecturer at the Vrije Universiteit Amsterdam

### 2.2.4 CeWe Color, Germany

CeWe Color is the leading European photo services company supplying photo dealers, mass merchandisers and Internet trading companies with personalized photographic products. These products range from ordinary photo prints over photo gifts such as photo-printed mugs or t-shirts to advanced photographic products like printed personal photo books.

60,000 trade partners, both stores and Internet retailers, in 19 European countries are supplied with photographic products. In 20 production plants throughout Europe 3,000 employees run a highly-automated industrial mass production system. Operating is done on state-of-the-art machines, which are partly self developed in order to achieve a high degree of efficiency, permanently enhance productivity, and to guarantee an excellent quality standard.

In 2007 CeWe Color targets at generating a turnover of 380 million EUR and at producing 2.6 billion color prints. Currently CeWe Color is faced with a transition from traditional analogue to digital products. At the end of 2007 already more than two-thirds of turnover is expected to be generated with digital products.

The most prominent example is the “CeWe Photo Book”<sup>1</sup>: Consumers design their individual photo album using CeWe’s Home Photo Service on their home PC and send the result to be printed and manufactured by CeWe in a high quality manner. Together with OFFIS as a research partner CeWe Color constantly improves and extends the Home Photo Service to make the photo authoring process easier and to provide additional services. This is done by automating several authoring tasks such as photo selection and automatic background selection according to photos placed on a page.

In the SemaPhoto project CeWe Color will act as a partner for the exploitation of the project results by integrating them into the photo book application and therefore making them available to a big audience all over Europe. Having access to a considerable amount of customers, CeWe will also be responsible for the development of the demonstrator application and the evaluation of the projects results.

#### Key Persons:

**Dr. Reiner Fageth** is Member of the Board of CeWe Color Holding AG and responsible for Research and Development. He received his PhD from the University of Nothumbria at Newcastle.

**Wulf-D. Schmidt-Sacht**, Management Consultant, has been Member of the Board of CeWe Color Holding AG until 2006. He has a degree in engineering. He was responsible for several innovations and developments at CeWe Color.

**Sabine Thieme** is project manager, responsible for desktop software and new software technologies since 2005. She studied Computer Science at the University of Hildesheim. After three years of software development in the car industry she worked as a research assistant at OFFIS in Oldenburg.

**Dr. Ralf Wieting** is Head of Software Development and System Operation for Desktop, Internet, and Mobile Applications. He received his PhD from the University of Oldenburg, Germany.

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<sup>1</sup> <http://www.cewe-photobook.com>

### 2.2.5 SERaja Technologies Pvt. Ltd., Bangalore, India

SERaja Technologies develops and hosts EventWeb (<http://www.seraja.com>) – a unique multimedia event sharing and social networking service on the World-Wide Web. EventWeb addresses the need of people to organize, share, and explore the events of their lives and their memories and views on these events. EventWeb differs from the usual event calendar and content sharing sites in that it covers the whole event life-cycle: event planning, event discovery, live and post event experience. It organizes rich community interaction around events allowing the sharing of memories and impressions using any type of media – and not one type such as photos. EventWeb captures relationships between events enabling the discovery and exploration of related events provides context-sensitive mobile content creation tools for live capturing of events as they happen. Since its launch in 2006, EventWeb has been growing continuously to one of the largest event index world-wide with more than 200,000 future, current, and past events and associated media documents from all over the world. These include personal events, cultural events, news and sports events, and conference events. SERaja employs a team of about 15 event editors continuously looking for and creating events.

In SemaPhoto SERaja fulfils two major roles:

*External media and data source provider:* EventWeb provides a rich source of event-related media content, context data, and metadata as well as knowledge about events. This unique data source is contributed to the project as real-world live data for the research partners.

*Commercial exploitation partner:* SERaja is one of the drivers of the commercial exploitation of SemaPhoto research results. The automatic media collection enrichment facilities developed by the research partners will be adapted for the enrichment of events on EventWeb with external media documents. Moreover, the photo book authoring tools to be developed will be prototypically connected to EventWeb to permit users easy creation of event books.

#### Key Persons

**Prof. Dr. Ramesh Jain**, *Chairman SERaja Technologies / UC Irvine:* Ramesh Jain is a pioneer of computer vision and multimedia research and a successful entrepreneur. He is a fellow of the ACM, IEEE, AAAI, IAPR, and SPIE. He has published more than 300 research papers in well-respected journals, workshops, and conference proceedings and is the (co-)author of several books. He has been the driving force behind establishing event-centric, experiential computing as a new multimedia research direction.

**Rajesh Jain**, *Vice-Chairman SERaja Technologies:* Rajesh Jain is a prominent entrepreneur in India. 1995, he already had launched the IndiaWorld Web portal, which he later sold in one of Asia's biggest Internet acquisitions. Recently he made it onto the cover page of the Feb. 12th Newsweek issue.

**Arun Katiyar**, *CEO SERaja Technologies:* Arun Katiyar has a diverse media industry background. Among other things he was magazine editor and COO for online business in the India Today publishing group, worked as station director for Radio City 91 FM, produced a rock album for CBS, and led the technical support of business of Microland Ltd.

**Dr. Utz Westermann**, *Head – Event-Based Multimedia Systems, SERaja Technologies:* Utz Westermann leads the engineering efforts for EventWeb's event indexing backend and mobile tool development. Living in Germany, he will coordinate SERaja's work in SemaPhoto. He has worked as a researcher in multimedia content management at the University of Vienna, at VTT Electronics in Oulu, Finland, and at UC Irvine. He has published 28 articles in/on/for renowned international journals, workshops, conferences, and book projects. He holds a doctoral degree in computer science from the Technical University of Vienna.

### *2.2.6 Fratelli Alinari Istituto Di Edizioni Artistiche (Alinari IDEA), Italy*

The history of Alinari coincides with the very history of photography: the activity of the dynasty of Alinari photographers is at the heart of the huge photographic heritage housed in the present Alinari Archives. Alinari is today the leader in traditional and multimedia photographic publishing and is a synonym for the highest quality in the production of artistic prints. Alinari represents an irreplaceable landmark for preserving, cataloguing, making known and handing down, through photography, Italian and European history, society, art and culture. The unique heritage of the Alinari collections gives life to one of the biggest international centres of photographic and iconographic documentation with over 3.5 million vintage images from the 19th and 20th century from all over the world. Alinari has taken part of several EC projects like: Aquarelle, Victor, Rama, Imprimatur, and today 2KAN, SCHEMA, MINERVA, TNT, ORPHEUS and aceMedia, MultiMatch, EURIDICE, TRIPOD. Alinari main focus on EC projects has been watermarking and IP rights, cultural heritage matters, content provider, high speed communication, security and user authentication, ecommerce solution, data compression, picture retrieval/pattern recognition, creation of multilingual datasets, building of domain ontologies and the developing of professional interfaces for web and PDA applications for the creation of new accesses to the cultural heritage repository that it owns.

In SemaPhoto Alinari will act as content provider in WP 4 and will provide the support for the project leading the dissemination and exploitation and evaluation tasks in WP5. It will also partly responsible for the software prototypes in WP4.

#### **Key Persons**

**Emanuela Sesti** is Head of Alinari On-line. She has a degree in art history, specialized in History of Middle Age and Modern Art. She has been involved in important studies for the Italian National Research Council and for the University of Firenze. She has been funded by the Tuscan Region for the indexing and retrieval of content for Art Picture libraries. She has published several papers on the history of art, history of miniatures, minor arts and history of photography. She has been employed at Alinari since 1985 as a leading scientific expert in the iconographic research department.

**Andrea de Polo** is Head of the Digital Imaging Department and manages a staff of 8 including a Multimedia Development Manager and 7 support personnel for electronic photographic indexing. He is responsible for assessing hardware/software requirements and coordinating and supervising multimedia and digital projects. He leads the "Alinari 2000" Consortium responsible for cataloguing and digitization of image archive for online retrieval for Finsiel (second largest European Software Company).

**Leonardo Lemmi** is Head Engineer at Fratelli Alinari SpA. He graduated in Electronic Engineering at the University of Florence, July 2000, He works on analogue electronic and digital electronics. He is Head of Alinari online technical team and leader of a team of 6 software programmers, working on activities which include managing the Alinari online picture database (over 150,000 images currently online), and web site optimisation.

**Sam H. Minelli** is Head of R&D and Systems Manager at Fratelli Alinari SpA. He graduated in Electronic Engineering at the University of Padua (IT) and has experience as project management and project implementation in the 5th and 6th European Framework Programmes for Research and Development. In particular, he has been responsible for the methodological framework set up to test image compression software; system and network management. He has taken part in JPEG2000 testing activities and is contributing to the JPSEARCH standardization activities and to the IPTC white papers contributions. He is in charge of the management of R&D projects related to semantic web and ontology building.

## 2.3 Consortium as a whole

### 2.3.1 Consortium Setup

The SemaPhoto Consortium has been set up in a clear mixture of research (two institutes, one university) and industry (two SMEs, one of them from India, and one large company with industry leading position). This blend ensures both a concentration of the required know-how with regard to research and application demands and the best-possible options for uptake of the results throughout Europe.

The scientific partners OFFIS, Dublin City University and a semantic Web partner we bring in their experience in multimedia content analysis, multimedia authoring and semantic Web. Each of the partners is known internationally for outstanding and recognized work in their fields and can be considered among the top experts for such a research proposal. For the proposed objectives the partners bring in the complementary scientific expertise from content understanding, content retrieval, multimedia authoring and the semantic Web. For many years the three partners have been working in this field and also have touched the research areas of each other. This gives the consortium very good grounds in a focused and integrated work, which is needed for the holistic approach of emergent content in SemaPhoto. The three scientific partners have successfully been already been mutually working together on formal and informal grounds for many years now such that a very successful and synergetic cooperation in the project can be expected.

In addition to the scientific partners strong industrial partners assure that the scientific objects meet the real future market demand of personal media collections not only from a user but also a commercial perspective. With the industrial partner CeWe Color we have a market leader in the consortium, who is bringing in access to large data collections and with its digital services an important market for exploitation of the project results. With the transition to digital photo services CeWe Color, Europe's largest photo finisher, brings in access to large sets of consumer photos and plays a central role for the requirements and the application development and exploitation of the project results in the European market. The scientific partner OFFIS has already good research exchange with CeWe Color' research and development, which with SemaPhoto can now be brought to an international.

With the industrial partner SERaja Technologies, the SemaPhoto consortium features a Web 2.0 start-up company that develops and hosts a collaborative platform for finding and sharing interesting events and content about these events. SERaja brings in one of the world's largest event databases into the project as a valuable real-world source of event-related media content, metadata, and context data for use by the scientific partners.

In addition to serving as a data source, SERaja will prototypically integrate the content authoring and content enrichment services developed in SemaPhoto with its event sharing platform and expose these to its user community. SERaja thus drives requirements and commercial exploitation from its perspective of a Web 2.0 content sharing business. The resulting interplay between SERaja and CeWe Color for commercial exploitation in SemaPhoto is expected to yield novel bridges between the traditional physical print and content production and Web 2.0-generation virtual content sharing business – with services and business models that offer an elixir for the first and economic viability for the latter.

Alinari is not only a necessary partner as being developing interfaces for professional consumption of photographic contents but also as final user of SemaPhoto. Alinari is provider of a photographic archive managing 20M picture copyright (sum of owned and managed contents). This implies a considerable involvement in the implementation of the professional interface and also a fundamental commitment in the exploitation of the system. Moreover, Alinari attends to some of the most relevant events in the photographic domain (photo fairs, con-

ferences, workshops) in Europe and in trans-European countries. Alinari has had past collaborations with SemaPhoto partner DCU through the projects: SCHEMA, aceMedia and Multi-Match. These partnership enforced Alinari's research experience.

### *2.3.2 Sub-contracting*

All partners (except for SERaja who is using lump sum calculation) foresee an amount of 3.000 to 5.000 Euros for subcontracting in the management costs. This is simply for the required audit certificates and obviously fully inline with common practice. Alinari's subcontractors perform not-core tasks in SemaPhoto but which are necessary for the achievement of project objectives. An independent consulting company is needed to perform interviews with the users (supporting Alinari's user requirement definition) and execute distribution activities among photographers. Alinari's subcontractors are necessary for SemaPhoto due to the fact that some components of Alinari's system have been developed by these selected subcontractors. Transferring the knowledge about these systems to other partners in the consortium would lead to additional, unneeded costs.

Apart from that, no sub-contracting is foreseen in SemaPhoto.

### *2.3.3 Involvement of other Countries*

As an Indian company, SERaja qualifies as a partner from a FP-7 International Cooperation Partner Country (ICPC). On a political level, SERaja's involvement in SemaPhoto thus directly serves the EU's goal to build up scientific and economic ties to the rapidly growing information technology markets in Asia.

Despite its base in India, SERaja's cooperation with the partners in SemaPhoto is going to be efficient. Key person Utz Westermann, who is head of SERaja engineering and coordinates SERaja's work in SemaPhoto, is located in Oldenburg, Germany. Moreover, Utz Westermann as well as SERaja chairman Ramesh Jain have both a strong multimedia research background, which will support and ease interaction with the research partners in the project. Finally, SERaja is in the process of starting a cooperation with CeWe Color for offering photo print services for SERaja's European users.

The partners of the SemaPhoto consortium have carefully been chosen to cover all required expertise needed for a successful work in the project.

## *2.4 Resources to be committed*

The SemaPhoto project will be accomplished by partners that are highly interested in both the ongoing research and development work and the results of the project. Naturally, the project will be embedded in existing organizational and technical structures that ensure a high-quality working environment, simplifying the work of the SemaPhoto team, allowing synergies between existing work and enabling the use of existing technological infrastructure.

**OFFIS** has a high-quality equipment of computing machinery and network infrastructure that is professionally managed by a central system administration, thus ensuring highest reliability of the required hardware. A considerable amount of multimedia hardware including various digital cameras and other photographic equipment, servers, multimedia software etc is already available and can readily be used within SemaPhoto. Moreover, and probably more important the know-how of the R&D division "Multimedia and Internet Information Services" with all in all 16 researchers will form an important background for the professional and high-quality accomplishment of SemaPhoto. Finally, OFFIS will complement the EC contribution with scientific mentoring and support for the project of approximately 6 person months effort performed by Prof. Susanne Boll (member of the scientific board of the R&D division MI) and Jochen Meyer (director of the division MI), as described in the management procedures.

The AIC/CDVP at DCU has access to state of the art computing laboratories (refurbished in 2007 with Gigabit networking points at each desk) that comfortably house all 45 postgrads and postdoctoral research fellows in the AIC/CDVP, with ample hot desking space for visiting SemaPhoto researchers. A range of imaging facilities ranging from location enabled low-cost mass produced consumer cameras and digital video cameras to high-end professional capture devices (e.g. stereo and trinocular cameras) are available for use in SemaPhoto if required. Capturing data, however requires a significant investment in supporting infrastructure in order to be able to index and process the data. Consequently, AIC/CDVP also bring to SemaPhoto a specially developed and significant computing resource corresponding to specially purposed multi-processor media servers (over ten), large multi-terabyte storage servers for multimedia data (20TB), high speed interconnecting network hardware and a significant code-base of both home-grown and commercial software tools. In addition, over fifty typical desktop workstations are contained within the group, many of which are dedicated content processing workstations. As one of the largest research centres in the University, the AIC/CDVP has dedicated technical and administrative support. Technical support extends to expertise on building and supporting large media repositories. For example AIC/CDVP have generated a collection of 20,000 personal photos, all GPS stamped and most manually annotated with groundtruth data for many typical automatic content analysis tools. In addition, we host a collection of 60 million WWW images downloaded in 2005 for content-based retrieval experimentation and host a collection of almost 100 million HTML web pages, also to support experimentation. All such media repositories, and associated software, are made available to the SemaPhoto project and consortium members.

The Semantic Media Interfaces (SMI) group has access to the excellent library and infrastructure facilities provided by CWI. CWI is part of the national broadband high speed network, allowing effortless transfer of huge quantities of media. Support is also provided for financial management of projects. The group itself is part of two national projects on exposing cultural heritage assets to a wider audience. Collaboration with 2 other Amsterdam-based research groups led to the winning of the coveted Semantic Web Challenge award at ISWC 2006. The experience and insights gained, as well as the exploratory interfaces developed, apply directly to the goals of the project. SMI is an active partner in the EU NoE K-Space, where researchers from both the content analysis side (including DCU) and semantics side are working together on bringing media and metadata closer together. Knowledge on experience gained as well as access to the knowledge and experiences of other partners will complement the knowledge of direct partners in SemaPhoto. The group has also set up a special issue on canonical processes of media production, to facilitate different players in the semantic multimedia community to understand the inter-relation of creation, annotation and media usage processes. This will play a vital role in the development of SemaPhoto, as both media and corresponding metadata need to be passed amongst components of the system. Members of the group are actively involved with the W3C Multimedia Semantics incubator group, of which Raphael Troncy is co-chair, and Susanne Boll from OFFIS an active member. Participation in the incubator will allow dissemination of project results to the international community, and at the same time guide the direction of research approaches within the project.

CeWe owns about 20 labs all over Europe, where we produce photos, photo individualized presents and photo books. Head quarter is situated in Oldenburg, Germany. Most innovations are tested and managed from Oldenburg. New products are guided by the product management team. New technology is initiated by D&R group. About 70 employees plus many freelancers care for the digital systems, grouped into teams for desktop software, online services, kiosk systems team, back end teams and production teams. CeWe would like to integrate the projects results into their order systems. It provides the knowledge about online, kiosk and



desktop software for photo order purpose. CeWe also supplies a huge and always available backend to set up the orders.

**Alinari** will use during the SemaPhoto project its professional machinery for collecting, managing, cataloguing the pictures and delivering them to partners and business clients such as editors, universities, etc. The users will access to the web service through Alinari's Hiperway bandwidth. Alinari's internal expert team (Content Managers, IPR Experts, Quality Managers) will contribute to the success of the project. Alinari manages a photographic museum in the centre of Florence (National Photographic Museum of Alinari) and project brochures and information will be made available through this unique opportunity to consumers and to professional photographer visiting the museum. Alinari is also going to establish a new high tech museum in Trieste to enhance the experience of the visitors and their interactivity with photography. This place too will be (if the opening will have place during the project lifetime) used to provide to the visitors the means to access the SemaPhoto services

In addition to the efforts and resources explicitly funded by this proposal, **SEraja** contributes further infrastructural and content resources. At its main office in Bangalore, SEraja employs a development team of about 8 developers and a content authoring team of about 20 editors. These will assist the integration of SemaPhoto project results concerning automatic enrichment of events with external media and photo book authoring with EventWeb. SEraja will also host the SEraja-related software components developed in this project close its production infrastructure on a dedicated server. SEraja will make the developed components available to a selected group of its users and perform a user study. With regard to project coordination, SEraja contributes the services of its head of event-based multimedia systems engineering, Dr. Utz Westermann who is based in Oldenburg, Germany. Furthermore, the expertise of SEraja's chairman, Dr. Ramesh Jain of UC Irvine will be available to the project consortium. Finally, SEraja contributes its large event database consisting of more than 200,000 world-wide, past, present, and future events and 300,000 media reports to the project. SEraja will setup and maintain a dedicated server next to its production environment that is going to host the SemaPhoto-related developments.

The overall financing of the project has been calculated with these important individual commitments in mind. The project aims to be a "fat STREP", where a carefully chosen, merely medium-sized consortium works together in an effective and powerful way, clearly aiming for high-quality results that are optimally prepared for uptake and exploitation through industry. Thus, the individual contributions of the partners are chosen high enough to ensure that powerful teams can work effectively on SemaPhoto at the individual partner organizations.

## Section 3: Impact

### 3.1 Expected impacts listed in the work programme

Consumer photographic habits that remained unchanged for nearly a century have been thrown into chaos by recently emerging digital technology. It is estimated [Lyra, 2006] that in 2009 close to half a trillion digital images will be captured by digital cameras and in 2010 it is expected that (not including cameraphones) 89 million digital cameras will be produced. The trend is clearly that consumers are 'going digital' and embracing digital technologies. Since consumers are now capturing many billions of digital photos every year, and this brings with it the requirement for organizing and printing these photos. SemaPhoto, and the novel research proposed, is aimed at preparing European research and industry in preparing for this inevitable future.

The modern digital imaging industry, comprised of imaging companies (Kodak, Canon, Ce-We Color, etc...), information technology companies, retailers and service providers are struggling with the requirements to handle this torrent of personal digital media. Our aim in this project is to develop technologies (software tools and real-world deployments) that will allow European-based industry to be at the forefront of Info-imaging technology and become a significant player in this area. We will give industry in Europe the opportunity to provide added-value to the global digital industry in the area of enabling richer and more intuitive user experiences of organizing, browsing, searching and printing from vast libraries of personal digital content that an individual will amass over a lifetime.

Exploitation and Dissemination will be promoted via a project Web site. SemaPhoto research will be highly visible: appearing in refereed academic publications, professional journals and in submissions to relevant standards bodies. Several of SemaPhoto's consortium partners have strong experience in past European projects and they are in a position to contact and get involved many valuable end-users and potential new partners. Exploitation and Dissemination is discussed in detail in section 3.2.

#### 3.1.1 Detailed Work Programme Impacts

The next table gives an overview of the *impact* expected in the work programme and how SemaPhoto will contribute to it:

| <i>Expected impact</i>   | <i>Contribution in SemaPhoto</i>  |
|--|---|
| General: These activities will make digital resources that embody creativity and semantics easier and more cost-effective to produce, organize, search, personalise, distribute and (re)use, across the value chain. | SemaPhoto goes through a full value chain from the creation of content (by taking digital photos) through the organisation in personal collections, the selection for a given photo album, the enhancement with additional information and semantics and the usage in a paper album or a multimedia presentation. The main goal is to simplify this process for the user, thus truly boosting creativity. |

| <i>Expected impact</i>  | <i>Contribution in SemaPhoto</i>  |
|---|---|
| Creators will be able to design more participative and communicative forms of content.  | SemaPhoto directly focuses creators of personal digital photo albums. One focus is to enhance the way such photo albums are generated, from today's rather manual to a future semi-automatic and multimedia supported way. Another focus is the innovative usage of such "multimedia-improved" content: The inclusion of the Web2.0-startup SEraja is a major example of how the SemaPhoto-enhanced content may be used in a participative and user-community form. |
| Publishers in creative industries, enterprises and professional sectors will increase their productivity with innovative content of greater complexity and ease of repurposing. | Creative industries basically face the same problem as the private user: Handling data, metadata and knowledge. It will be possible to transfer the SemaPhoto approach to such industries as well. This is not a direct focus of SemaPhoto, but by dissemination of scientific results and by the industrial exploitation of the project outcomes, we believe that such a transfer will be stimulated and will happen after the project.                            |
| Scientists will operate more efficiently by automating the link between data analysis, theory and experimental validation.  | SemaPhoto does not primarily focus on scientific usage.   |

### 3.1.2 Work Programme Impacts from a European Perspective

The move towards a knowledge-based economy is both a major threat and a great opportunity for those industries that deal with digital media content. With the advent of digital cameras the photo industry is in a turning phase from handling chemicals and prints to digital services. Currently, in the European market, there are an estimated 20 billion digital photos taken per year, however, from all digital images only about 20 percent are actually printed. At the same time the number of analogue prints has already decreased by 30% [GfK, 2006]. Companies that do not very actively handle this shift in the market are likely to lose their market position, as has happened to Kodak's large-scale photo finishing branch that had to be abandoned completely. SemaPhoto will develop a major building block for innovate services that interconnect the traditional paper-based products with the new possibilities and requirements of digital photos, thus considerably **increasing the competitiveness of the European photo industry** and helping it in the **transition to a knowledge-based economy** that is well-founded on the traditions of long-lasting enterprises.

SemaPhoto will also have a strong impact on the **European citizens**: The user partners in this consortium see a clear change in customer behaviour towards new technology and web-based services which could not be offered previously. However, the use of advanced Internet services still requires technological knowledge that only a percentage of our citizens have – the digital divide is a major threat to Europe's vision of a knowledge-based society. SemaPhoto will deliver a new, advanced search service to the fingertips of the user, in a manner that the user will find easy to use and will offer state-of-the-art technology in an intuitive

fashion. By bundling the SemaPhoto technology with CeWe's photo album application, virtually tens of millions of consumers in Europe can be reached. Thus SemaPhoto helps to further the **non-discriminatory access to the world's largest knowledge stock in Europe**.

Locating such a diverse range of expertise and research skills at a national level in Europe would be very challenging indeed. With these consortium partners, we enable SemaPhoto to work on a broad foundation with specialized and excellent know-how. This bundling of know-how can only be achieved by **crossing national borders and working on a true European level**. The outcomes of the project can on the other hand be **disseminated throughout Europa**. A particular strength of is that with CeWe Color there is an exploitation partner who will use the project results in more than a dozen European and international countries. This European exploitation requires that the research and development already takes place with partners in Europe in order to respect cultural differences and ensure multi-national concepts. This also is a reason why multi-linguality is of high importance in SemaPhoto.

SemaPhoto is consistent to the Big Challenges of the Strategic Research Agenda of the **NEM European Technology Platform**: It directly addresses Challenge 2 "to empower end-users by putting the user first", and obviously particularly sub-challenge 2.2 "Supporting end-users with content creation processes and personal content management". The approach of enhancing photos from "collections of pixels" to "knowing media objects" also contributes to challenge 4 "accelerating the convergence of various media and content formats" by providing basic work for the "Produce once, Use everywhere" methodology. (sub-challenge 4.1).

### *3.1.3 SemaPhoto's European Consortium*

SemaPhoto is a perfect project specifically tailored for a European Dimension. The project is a consortium of world leading research groups, content providers and SMEs, each acknowledged experts in their fields and each being well-integrated in national and international networks. Examining SemaPhoto on a workpackage basis, we see that each workpackage is lead by a world-renowned research group.

- Analysis – Lead by DCU, who have almost ten years experience of developing media analysis technologies, and are generally accepted to be among the very best multimedia analysis research organisations in Europe.
- Retrieval – Lead by OFFIS, who are working in the field of understanding, retrieving and creation personalized multimedia presentations in different application domains. As a research institute in computer science, OFFIS has a strong expertise also on the transfer of scientific research into applied research and prototypes.
- Authoring - Lead by CWI, Lead by CWI, who have more than ten years experience of bringing multimedia to the web and are one of the initiators of bringing multimedia to the semantic web. In addition, they have many years of multimedia authoring experience, initially from a human-centred point of view and in the last five years increasing the sophistication of the system support.
- Integration – Lead by CeWe Color, the leading European photo services company with over 60,000 trade partners, both stores and Internet retailers, in 19 European countries.
- Exploitation and Dissemination – Lead by Alinari who is leader in traditional and multimedia photographic publishing and is a synonym for the highest quality in the production of artistic prints. Alinari manages almost 20Million pictures on the Italian market such as: Finsiel, Franco, Galleria Doria Pamphilj, Istituto Luce, RAI teche , RCS , Santa Maria della Scala, Seat , Touring Club Italiano, etc.

- Project Management – Lead by OFFIS, who has extensive experiences in coordinating European projects in FP6 and dating back to FP5 and even FP4. It has coordinated not just, STREPs, but, IPs as well and will thus bring this considerable background and all its experience into SemaPhoto coordination to ensure a smoothest possible acting project. But each workpackage leader has both responsibilities, and also proven track records of successfully managing research projects.

### *3.2 Dissemination and/or exploitation of project results, and management of intellectual property*

#### *3.2.1 Dissemination of project results*

A structured dissemination plan will be followed during the SemaPhoto project in order to support an effective exploitation of the project results towards four main communities: researchers, photographic agencies and archives, services providers and end-users. Dissemination activities will be conducted as follows:

- SemaPhoto will set up a **user group** at the beginning of the project, composed of photographic content owners, professional photographers and service providers. Workshops and industrial days will be organized at regular intervals (according to the main releases of project results) to disseminate information to the user group and obtain feedback.
- A **project web site** will be created at the beginning of the project and maintained during the entire project lifetime. Through this web site, the public documents produced within the SemaPhoto project will be made accessible, together with links to specific sites and documentation about the SemaPhoto technological issues.
- A biannual **SemaPhoto newsletter** will be produced and delivered by e-mail and RSS feed to all communities interested to project results. All partners will contribute to the preparation of the newsletter.
- The scientific results of the project will result in articles and documentation to be submitted to **international, high quality journals, conferences and workshops**.
- The partners will organize at least two **SemaPhoto Sessions** (e.g., workshop or panel) in leading conferences in the field (e.g. CIVR, ACM MM, SAMT).
- Sharing of individual partner expertise will be encouraged by the creation of **joint publications**. Project researchers, both senior and junior, will be encouraged to work for periods of time at other institutes.
- Partners will contribute to the **writing of white papers** (e.g., IPTC<sup>2</sup>), **standards** (e.g., JPEG2000<sup>3</sup>) and **recommendations** (e.g. W<sup>3</sup>C Multimedia Semantic Incubator group<sup>4</sup>). In particular, Alinari will be involved with JPEG2000, CWI and OFFIS with W<sup>3</sup>C.

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<sup>2</sup> <http://www.iptc.org/>

<sup>3</sup> <http://www.jpeg.org/>

<sup>4</sup> <http://www.w3.org/2005/Incubator/mmsem/>

### 3.2.2 Industrial exploitation

The industrial exploitation of project results comprises the exploitation of the developed components and the application developed on top of the emergent content framework and the integrated research results. Exploitation will be handled predominantly by the industrial partners CeWe, SEraja and Alinari. CeWe, as Europe's largest photo finisher, sets **de facto standards for consumer photo services**, thus forming and pushing the European photo market and also impacting the international market with only Kodak as a competitor. The consortium members will define a detailed exploitation plan explaining in detail how the output of the project would be introduced into common and individual strategies. In particular, the consortium will have to identify the services and/or the products that could be derived from the project results, based on a scientific/technological survey and on a market survey. It is expected that specific components will be brought to market in commercial products (see below) and some components will be published in the public domain (open source license). Project exploitation will also be coordinated with the dissemination activities in order to promote the adoption of the project "vision" and to demonstrate the feasibility of the project approach.

In particular, the following exploitation possibilities and strategies are currently foreseen:

**Photo book authoring exploitation.** This is clearly the main exploitation path of SemaPhoto. The photo book authoring developed in the project will be exploited by the partners CeWe, Seraja, and Alinari. With CeWe and its market power ensuring a European wide uptake of the project results can be expected. Furthermore, some of the components developed in SemaPhoto – such as analysis, retrieval and authoring – could be used to enhance the functionality of existing partner's products.

**Exploitation of business content owners:** Archives of photographic content (such as Alinari and SEraja EventWeb) and photographers will take advantage of project results by improving the visibility and the accessibility of their contents. They will also be able to include into their existing portals new services based on the use of SemaPhoto's authoring and retrieval system, which permit the access other information available on the Web, related to the digital content they already have.

**Service provider exploitation.** Alinari will offer an adopted photo book authoring in a Web portal, which will be specialized for professional photographers and act as a service provider. It will also consider the use of SemaPhoto technology in order to improve some of the services offered in the corporate B2B portal, for example to enhance the information in the business sites by using SemaPhoto's retrieval system. In the long term, Alinari will also experiment the offer of services based on SemaPhoto on mobile devices, in order to offer to professional content brokers or photographers the SemaPhoto services.

#### 3.2.2.1 Exploitation at CeWe Color

Handling digital photos is very different from analogues. CeWe Color found out that after having taken, saved on the computer and quickly examined their photos, many people find themselves overcharged with decisions like "which ones to take for prints" or "which one use for a poster for the grandparents". Taking into account that the amount of digital photos triples the amount of analogue photos taken, one can easily imagine how long it takes to sort out the photos of a two weeks holiday. In the past all photos were printed before it was decided to "some day" put them into an album. With digital photography the selection process is usually done before printing so that about 80 % of all photos never get printed and reside in "digital shoe boxes". A great business potential lies in convincing the user to open this shoe boxes by providing him with advanced digital photo services. A prominent example is the CeWe digital photo book which can be authored on a computer and be printed at CeWe Color in premium quality. Photos can only be a way to capture ones memories when they are looked

at. What is needed are services that immediately bring people the point of using them without great efforts.

The market for advanced digital services clearly is huge and full of potential as there will need to be ways of managing this vast quantity of digital photographs on an individual and inter-individual level. We do believe that we can bring the expertise of this unique consortium to bear on this application. The market size for products for organizing, browsing and retrieving from a personal photo collection can reasonably be expected to be some fraction of the market penetration of image-capable devices.

For CeWe Color as the leading European and one of the world's largest players in digital photo services business it is therefore of evident importance to bind their customers to their digital photo products. To convince them to order at CeWe Color they not only have to be offered interesting and precious products, but more important easy and enjoyable ways place these orders. This is especially true for the creation of photo books. Surely, the print quality of the resulting manufactured photo book is one key aspect to convince him/her to order his/her photo book at CeWe Color and not at another competitor. But it is equally important how easy and intuitive it is to design a photo book. Therefore, a tool that aids the user in this design process and that automates boring and tedious tasks as far as possible is a key aspect to not use competing authoring tools. To achieve this goal **the research results of the SemaPhoto project will be integrated in the present CeWe Photo Book application** and provide customers with more easy ways of automating the authoring process.

Another key aspect is the **integration of external content**. People are more and more aware of the potentials the Internet is offering with its huge resources of user provided content. To be able to compete against other photo book providers it is of evident importance to meet this challenge. This can be done in two ways. On the one hand CeWe can act as a service provider for Web community sites to offer their users to order a photo book (see Section 0). On the other hand, content from the internet can be considered as a pool for the easy integration of additional image or text material. As the CeWe Photo Book service already consists of a billing system it is also an easy task to integrate billable content, e.g. from Alinari, which is a source of additional revenue.

We would like to stress the importance of this exploitation path for SemaPhoto: Virtually millions of customers throughout Europe use CeWe's services and potentially their PhotoBook software. This huge user community will directly use the SemaPhoto results, when they are integrated into the CeWe Photo Book application. We believe that this very direct and very broad exploitation of research results is truly a unique feature of SemaPhoto.

### 3.2.2.2 *Exploitation at SEraja Technologies*

For a community-driven collaborative event and content sharing platform like SEraja EventWeb essentially three direct sources of revenue can be identified: advertisement revenue, premium membership fees, and revenue from the sale of add-on services and products. The effectiveness of all these sources is based on a fourth, indirect factor: the number of users. Growing its user base and creating opportunities for increasing its revenues from the mentioned sources hence is naturally of fundamental economical interest to SEraja.

The research performed in SemaPhoto is *directly* relevant to this goal. SEraja will prototypically **integrate project results with its EventWeb service** and expose these to a selected set of users for evaluation. Based on the results and insights obtained from the evaluation, SEraja will **develop the integrated results to production quality** and make them **part of the official EventWeb service**.

Exploitation and integration of SemaPhoto results in SERaja EventWeb will be directed along the following major thrusts:

- *Media collection enrichment facilities:* The tools and techniques developed in SemaPhoto for the automatic enrichment of media collections with media from external sources will be integrated with EventWeb. They will be used to automatically discover media documents about events in external sources and to link the events to these media. The resulting experience for users visiting events at SERaja will be richer, thus increasing the attractiveness of the overall EventWeb system. This will positively impact EventWeb user numbers, in turn resulting in increased revenues from advertisement and membership fees and in increased opportunities for sale of add-on services.
- *Photo book authoring facilities:* SERaja will connect EventWeb to the photo book authoring tools that will be developed in SemaPhoto together with CeWe Color. Users will be given the opportunity to create event books – i.e., photo books about events – out the pictures connected to an event in EventWeb. This has two impacts: firstly, photo book creation and printing is an attractive add-on service for EventWeb users with additional revenue potential for SERaja. Secondly, the event book service will establish **a link between SERaja's virtual content sharing business with CeWe's business of physical photo product production**. This cooperation not only provides an additional exploitation and marketing channel for CeWe Color. Also, new insights will be gained about **how to position traditional media printing and production business in the Web 2.0 age** as well as **how to support Web 2.0 virtual social networking and content sharing business with established business models** from traditional media printing and production services.

### 3.2.2.3 Exploitation at Alinari

Alinari's main interest in the SemaPhoto project is in the deployment of a powerful **photo book authoring application** for professional photographers. This application integrates the search and authoring capabilities of SemaPhoto **into an online portal** that can properly and efficiently help **professional photographers** to be **channelled into the market through Alinari's services** to share, enrich, enhance and sell their digital content. Alinari will be responsible for WP5 Exploitation & Dissemination but will also play a significant role in WPs 4 (Integration and Application) for the development of the professional photo book authoring and the integration of professional content. We believe that this application will contribute to exploitation of SemaPhoto's research results in a professional, **B2B** domain

### 3.2.3 Management of IPR

The issue of Intellectual Property Rights (IPR) is central to topics studied in SemaPhoto. The goal of SemaPhoto is an intelligent creation, analysis, retrieval, and authoring of and with photo collections creating photo book authoring application, which illustrates how the results of SemaPhoto contribute to a much easier, intuitive and effective handling of consumer photos.

For SemaPhoto, three different types of knowledge, IPR and privacy protection are relevant:

1. Management of **knowledge** that is being created during the project and access to pre-existing know-how that is required for successful operation and exploitation.
2. Ensuring privacy and content protection for **experimental access to content** during the lifetime of the project.
3. Ensuring IPR management for **access to content in the commercial operation** of the SemaPhoto system after the end of the project.



### 3.2.3.1 Knowledge and Pre-Existing Know-how

The results of the project will be methods implemented as software demonstrators and prototype software tools. Most of the partners in the consortium will contribute to the project with their respective pre-existing know-how, which again is, apart from patents, documentations and scientific publications, laid down in software. The consortium agreement will clearly regulate the access to pre-existing know-how, the management of knowledge generated during the project and the procedure of protecting intellectual property rights in general and specifically for software. These regulations will be based on the following assumptions:

1. Access to pre-existing know-how will be granted if it is required for carrying out the project and in a way appropriate to fulfil the specific tasks of the specific partners. A list of pre-existing know-how will be added to the consortium agreement as an annex. Software will be delivered to the partners preferably in object code, but, in case a partner would not be able to perform his tasks, access to source code will be granted.
2. Knowledge generated within the project will be available to the other partners. However, decisions about patent protection of knowledge are the competence of the organisation or organisations in which it has been generated, and the PCC should not interfere with this process, as well as with the licensing policies of these organisations.
3. In general the process of protecting IP shall not be delayed by the respective partners to not deter the publication of project results, which is essential for creating awareness for the project.
4. The access to the pre-existing know-how and the knowledge generated within the project may be subject to license fees. The owning party must, however, grant favourable conditions for the access rights.

The management of knowledge generated within SemaPhoto will be based on the following procedure:

1. Identify and document the (new) knowledge
2. Decide on its formal protection by filing patents.
3. Create awareness of the new knowledge after protection.

The regulations on transfer of knowledge will take into consideration that the **transfer to third parties**, particularly those not established in a Member State or Associated State – e.g. in the USA –, **may be objected by the Commission**, if such a transfer is not in accordance with the interests of developing the competitiveness of the dynamic, knowledge-based European economy.

### 3.2.3.2 Content Privacy and Content Protection during the project

Content Privacy and Content protection are an important issue already during the accomplishment of the project, mainly for two reasons:

1. Having access to the content of SEraja and Alinari during the runtime of the project is necessary for the partners in order to be able to experiment and to evaluate the feasibility of the system and the processes. On the other hand, the content is a major asset for both companies, so its protection is particularly important for them.
2. Privacy protection of the customer's photo data is obviously highly relevant for CeWe Color. Although so far it is not foreseen that the SemaPhoto system accesses any other photo data except for the data of the individual customer currently using the system, it is clear that the data protection is not to be taken lightly.

Although these issues are to a large extent already dealt with by the standard rules on Pre-Existing Know-how as outlined above, specific care will be taken by the consortium to ensure that on the one hand the necessary access to content as required for carrying out the project is possible, and on the other hand the vital interests of the partners for the protection of their content are considered appropriately. The precise rules will be laid out in the consortium agreement, according to the following assumptions:

1. Partners owning content that is needed to fulfil the needs of the consortium will ensure that appropriate access to that content is made possible. They will take measures to ensure that the access is restricted to only as much content as required and that no inadvertent access to other content is possible by the other partners.
2. Partners needing to access content will take measures to ensure that confidentiality of any content is guaranteed. Employees will only be allowed to access content that is needed for the purposes of fulfilling their duties within SemaPhoto.

### *3.2.3.3 IPR management after the end of the project*

The SemaPhoto framework will organize content material acquired from the Internet and from big and small content creators (archives agencies, professional photographers), analysed, annotated and distributed, in accordance to needs of providers and consumers. It is essential that the intellectual property rights of content creators and providers are respected: in the first instance links will be provided to material crawled from the web; specific agreements for content disclosure will then be formulated with the cultural heritage institutions that want to become SemaPhoto content providers. In fact, SemaPhoto will provide a professional service to photo archives and professional photographers. By collaborating, they will increase their visibility (and profit) at the same time helping SemaPhoto to enhance its own visibility and improve the service offered, thus creating a floating effect that eventually will benefit both SemaPhoto and professional photographers communities.

It will be the responsibility of **WP 5** to ensure the careful management of Intellectual Property within the scope of the project through the formulation of specific agreements with professional photographers and photographic content owners (archives, agencies) wishing to disseminate/deliver/distribute their content via the SemaPhoto system.

## **Section 4: Ethical Issues**

### **User studies**

Users who take part in user studies will be made aware that they are part of an experimental setting. They will be informed of this before the study, or afterwards if the experiment would be influenced by prior knowledge of the goals. When the same users are asked to take part in future studies their experimental results will be kept independently of their personal data to ensure anonymity.

### **Gender issues**

The project partners are acutely aware of the gender issues in technical projects and will do their utmost to ensure adequate female participation at all levels of the project, given the scarcity of the resource and while maintaining quality norms. The coordinator of the project is a woman, which is extremely unusual. We will ensure that the interfaces created in the project are tested by equal numbers of male and female users and will consider the potentially different communication needs of these users in creating the applications.

### **Privacy**

Users of the content repository being developed should be able to commit their personal photos in the knowledge that they will remain confidential to the project, and otherwise will be explicitly informed beforehand to what extent their material and annotations will be available and to whom. Users will be able to create one or more virtual identities when using the system publicly.

### **Provenance issues**

Content collected in the SemaPhoto repository will come from many different sources, and will contain edited versions of material created by other users. A user should at all times be able to trace the creation and editing history of the content, including appropriate IPR.

### **Accessibility**

While the emphasis of the project is on collecting and arranging images, the envisaged system will contain large amounts of semantics about the content and characteristics of these. Different categories of annotations can be used to improve accessibility by, for example, selecting high-contrast images for those with visual impairments. In addition, an important side-effect of the work in the project is that the annotations used to describe the images can be used for other means of accessing them, for example, to drive text-to-speech systems for providing non-visual access to the content.

We do not see accessibility issues as addressing the needs of a small part of the population, but rather view them in the wider sense of providing appropriate interfaces for users in "interface challenged" situations, such as driving a car ("visually impaired") or with frequent interruptions from children ("cognitively impaired").

|  | YES | Page |
|--|-----|------|
| Informed Consent   |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve children?</li> </ul>  |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve patients or persons not able to give consent?</li> </ul>  |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve adult healthy volunteers?</li> </ul>  |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve Human Genetic Material?</li> </ul>  |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve Human biological samples?</li> </ul>  |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve Human data collection?</li> </ul>   |     |      |
| Research on Human embryo/foetus  |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve Human Embryos?</li> </ul>   |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve Human Foetal Tissue / Cells?</li> </ul>   |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve Human Embryonic Stem Cells?</li> </ul>  |     |      |
| Privacy  |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)</li> </ul> |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve tracking the location or observation of people?</li> </ul>  |     |      |
| Research on Animals  |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve tracking the location or observation of people?</li> </ul>  |     |      |
| <ul style="list-style-type: none"> <li>Are those animals transgenic small laboratory animals?</li> </ul>   |     |      |
| <ul style="list-style-type: none"> <li>Are those animals transgenic farm animals?</li> </ul>   |     |      |
| <ul style="list-style-type: none"> <li>Are those animals cloned farm animals?</li> </ul>   |     |      |
| <ul style="list-style-type: none"> <li>Are those animals non-human primates?</li> </ul>  |     |      |
| Research Involving Developing Countries  |     |      |
| <ul style="list-style-type: none"> <li>Use of local resources (genetic, animal, plant etc)</li> </ul>  |     |      |
| <ul style="list-style-type: none"> <li>Benefit to local community (capacity building i.e.access to healthcare, education etc)</li> </ul>   |     |      |
| Dual Use   |     |      |
| <ul style="list-style-type: none"> <li>Research having direct military application</li> </ul>  |     |      |
| <ul style="list-style-type: none"> <li>Research having the potential for terrorist abuse</li> </ul>  |     |      |
| ICT Implants   |     |      |
| <ul style="list-style-type: none"> <li>Does the proposal involve clinical trials of ICT implants?</li> </ul>   |     |      |
| I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL   | X   |      |

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