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Abstract:	**In this deliverable, the fruit of intense collaboration within the Consortium, we describe a set of user scenarios for the CONVERGENCE system, describe the reactions of users in four focus groups, extract "unique selling points" for the system, and define a provisional, but close to complete set of requirements.**

Keyword List:	**User scenario, use case, requirements, focus group, media, discussion, agriculture, animal husbandry, pharmaceuticals, videos, photography, library**

Executive Summary

Goals

This document is a revised version of Deliverable 2.1 (Preliminary Use Cases and Scenarios), The goal of the work described in the original deliverable was to generate a series of user scenarios, of interest to the partners, to obtain feedback from potential users, to refine the scenarios and, on this basis, to generate preliminary requirements for the CONVERGENCE system. This last goal was achieved. However, reviewers made a number of criticisms of the scenarios and the focus groups.

The Consortium recognizes that these recommendations derive from genuine weaknesses in the original work. In this new version of the deliverable, we have therefore:

- Reduced the number of scenarios concentrating on those in which partners have direct expertise;
- Completely reworked the individual scenarios and use cases;
- Identified for each case the best possible way of implementing the scenario with existing technology;
- Collected new feedback from potential users external to the Consortium;
- Reanalyzed CONVERGENCE's Unique Selling Points;
- Created explicit links between scenarios and requirements generated by the scenario.

Revising the scenarios has produced a number of beneficial side effects that go beyond the need to meet reviewer requests. In particular, the comparison between CONVERGENCE and alternative implementation technologies have led us to identify new advantages of CONVERGENCE that were not apparent to us when we wrote the original deliverable. The original document focused on advantages for end-users. It is now clear to us that CONVERGENCE also offers huge advantages for content providers and developers. The rest of this report will illustrate these advantages.

Scenarios

Scenarios play a fundamental role in the logic of the CONVERGENCE project. The goal is not to provide a representative picture of all possible uses of CONVERGENCE – obviously an impossible enterprise. Rather the scenarios are one step in the process described in the Description of Work in which scenarios are chosen to reflect specific real-life business needs of four CONVERGENCE partners and then used to generate requirements, design concepts and ideas for implementing CONVERGENCE. We believe that the requirements generated in this way are sufficiently broad to meet the needs of a very broad population of potential users.

After the reviewers' request to rework the scenarios, we decided to divide the scenario development process into two phases.

- **The first phase,** described in this deliverable, has focused on illustrating the advantages of CONVERGENCE and on deriving core requirements for the CONVERGENCE system. To this end, the deliverable presents four scenarios, each of which provides a general description of the way one of the partners intends to use CONVERGENCE and to test it in the trials. For each scenario, we describe a limited set of use cases sufficient to illustrate the main features of the CONVERGENCE solutions, and its advantages. For each use case developed in this phase we describe an implementation based on CONVERGENCE and compare it to alternative solutions based on existing technologies. We then go on to exploit these use cases to generate requirements for the project's high-level development strategy, the VDI, the CONVERGENCE framework, the CONVERGENCE network and the CDS. Use cases that are necessary for the trials but which do not introduce new requirements or new features have been deliberately excluded (and will be dealt with in D2.2).
- **The second phase,** which will be described in D2.2, will focus on detailed requirements for the CONVERGENCE trials. The deliverable will therefore describe *the complete set of use cases* to be implemented in the trials and analyze their implementation in greater technical detail. These descriptions will be used to generate detailed requirements for *applications* for running over the CONVERGENCE framework and for the CONVERGENCE network.

This report describes four scenarios:

- Managing and Annotating a large photo archive (Alinari)
- Building, managing and exploiting a video archive (FMSH)
- Augmented Lecture Podcast (LMU)
- Smart Retailing (WIPRO/UTI)

These scenarios can be merged into two main categories, each sharing key features.

- **Media and discussion:** these scenarios show how CONVERGENCE can provide useful support for media professionals (tools to define licensing conditions, tools to define metadata descriptions, tools to publish media) and for end users of media (tools to add comments to media, to discuss media with other users and to republish adapted versions of media). The scenarios refer to three distinct classes of media (photos, videos and podcasts).
- **Retailing**: this scenario shows how CONVERGENCE can be used to handle typical retailing situations such as advertising a product, stock management, post-sales support, managing a safety recall, and managing warranties. A key feature is the use of CONVERGENCE to obtain information about a product identified by a barcode or an RFID.

Focus groups

During the scenario development process, the basic CONVERGENCE concept and the reference scenarios were exposed to potential end-users in four focus groups (roughly 10 users per group), organized respectively in Italy (Alinari), France (FMSH), Germany (LMU) and Portugal (WIPRO). Three of the focus groups were already reported in the previous version of the deliverable. The WIPRO focus group is new and includes important input from outside the Consortium.

In discussions following the project review, LMU and FMSH pointed out that their focus groups *already included* participants from outside the Consortium and that this had not been adequately communicated in the original version of the deliverable. The text of the report has been amended to reflect this fact. Alinari pointed out that their scenario focuses on internal Alinari business processes and that users not involved in these processes would not be able to make a useful contribution.

The focus groups were based on a script developed by XIW and explored users' reaction to the CONVERGENCE concept and to specific use scenarios relevant to their professional experience.

Participants in the focus groups began by discussing the general CONVERGENCE concept, and then went on to discuss specific scenarios, relevant to their situation. Reactions to CONVERGENCE were generally positive, especially in the WIPRO group. Participants in this focus groups were particularly interested in CONVERGENCE functionalities such as providing vendor independent product descriptions, synchronizing VDIs in multiple locations, defining very specific rights for the use of VDIs and in digital forgetting. On the less positive side, some users found CONVERGENCE difficult to visualize, even when they understood the underlying technical concepts. Others wanted to see more details of the way CONVERGENCE would implement digital rights management.

Basic characteristics of the CONVERGENCE system

The revision of the user scenarios has made it possible to clarify and re-organize the Unique Selling Points of CONVERGENCE, described in the previous version of this deliverable. In our current vision, the main such points are the following

CONVERGENCE offers **end-users** the possibility to:

- Bundle data resources and structured metadata describing these resources into a single, standard, self-consistent package (the VDI) with a unique identifier;
- Define a license using a standard language to define who can access the VDI and the precise conditions for access;
- Digitally sign and/or encrypt the content of a VDI;
- Define ontologies making it easier for users to search for the VDIs they publish and make these ontologies available to all users of the CONVERGENCE network;
- Publish the VDI making it available to all authorized users on the CONVERGENCE network, (if desired, to all users);
- Monitor the use of VDIs they have published;
- Update the information in the VDIs they have published, ensuring the update reaches all users of the VDI;
- Rapidly and reliably retrieve VDIs, regardless of the location of the VDI owner (thanks to network caching)
- Search for and retrieve any VDI on the CONVERGENCE network, exploiting the VDI metadata and the semantic capabilities of the CONVERGENCE Community Dictionary Service;

- Subscribe to VDIs meeting specified search criteria, and receive a notification on publication or update of VDIs satisfying the criteria;
- Verify the authenticity of a VDI and decrypt any encrypted content (key owners only);
- Communicate with owners of VDIs without the need to access personally sensitive information;
- Ensure that copies of VDIs do not persist on the network beyond a pre-defined expiry date (digital forgetting).

Developers will be able to build applications that exploit and add value to these functionalities, ensuring that different businesses and individuals can exploit CONVERGENCE functionality in the ways that best meet their needs.

Network operators and content providers will benefit from the move from the current *packet switching* paradigm to a new *content switching paradigm* in which content is efficiently distributed across the network, taking account of network capabilities, traffic conditions and the transmission requirements of specific types of content.

In what follows we will discuss these features, the way in which they are related to the user scenario and the way in which they benefit the different actors in the CONVERGENCE value chain.

Requirements

Analysis of the user scenarios and the CONVERGENCE Description of Work yielded an initial set of requirements for the project. These were refined gradually in intense discussions involving XIW itself, the technical partners, CEDEO (which is responsible for the development of business scenarios in WP9) and the partners who will organize the CONVERGENCE trials. After four rounds of revision plus an additional round after the revision of the scenarios the discussion produced the provisional requirements that appear in this deliverable (see section 7). The requirements are almost identical to those defined in the previous version of the deliverable. They describe:

- High level requirements for the CONVERGENCE system and the CONVERGENCE framework
- Requirements for VDIs
- Requirements for the creation and publishing of VDIs
- Requirements for searching for and subscribing to VDIs
- Requirements for support for multiple hardware devices
- Requirements for security
- Requirements for privacy and for “digital forgetting”
- Requirements for the CONVERGENCE framework
- Requirements for the CONVERGENCE network
- Requirements for the CONVERGENCE “Community Dictionary Service”

The document also defines requirements for the applications to be used in the trials. These requirements should be seen as preliminary and external to the formal requirements for the CONVERGENCE system.

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Glossary

Term	Definition
Access Rights	Criteria defining who can access a VDI under what conditions.
Advertise	Procedure used by a CoNet user to make a resource accessible to other CoNet users.
Application	Software, designed for a specific purpose that exploits the capabilities of the CONVERGENCE System.
Business Scenario	A scenario describing one way in which the CONVERGENCE System may be used by specific users in a specific situation; more narrowly: a scenario describing the commercial products and services bought and sold in such a situation, the actors concerned and, possibly, the associated flows of revenue.
Clean-slate architecture	The CONVERGENCE implementation of the Network Layer, totally replacing existing IP functionality. See "Integration Architecture" and ""Overlay Architecture" and "Parallel Architecture".
CoApp	The CONVERGENCE Application Layer.
CoApp Provider	The user offering Applications running on the Convergence Middleware Layer (CoMid).
CoMid	The CONVERGENCE Middleware Layer.
CoMid Provider	The user providing access to CoMid services. CoMid services may be offered by a single provider or by a federation of providers.
CoMid Resource	A virtual or physical object or service, referenced by a VDI, e.g. a video file, a Real World Object, a person, an Internet service, etc. See "VDI". A resource can be virtually packaged as a VDI, on its own or together with other resources and metadata. The packaging operation includes the creation of an XML file describing the structure of the VDI and the links among its components.
Community Dictionary Service	A Functional Block belonging to the CONVERGENCE Middleware Layer that provides all the matching concepts in a users subscription, search request and

(CDS)	publication. The CDS parses and interprets the ontologies created by the CONVERGENCE users. It thus enables to understand users subscriptions or search requests as well as publications.
CoNet	The CONVERGENCE Network Layer.
CoNet Provider	The user providing access to CoNet services, i.e. it is the corresponding of today's Internet Service Provider.
CoNet Resource	A resource of the CoNet that can be identified by means of a name; it can be either a Named data or a Named service access point.
Content-based resource discovery	A user request for resources, either through a subscription to the CONVERGENCE System or a search request to the CONVERGENCE system. The CONVERGENCE system will then return a list of VDIs compatible with the search criteria. See “subscription” and “search”.
Content-based Subscription	A subscription based on a specification of user’s preferences or interests, (rather than a specific event or topic). In other terms, the subscription is based on the actual content of the considered events, which are not classified according to some predefined external criterion (e.g., topic name), but according to the properties of the events themselves. See “Subscription” and “Publish-subscribe model”.
Content-centric	A network paradigm in which the network directly provides users with contents, and is aware of which content is actually transported, instead of limiting itself to providing communication channels between hosts.
CONVERGENCE Applications layer (CoApp)	The layer of CONVERGENCE that establishes the interaction with CONVERGENCE users. The Applications Layer interacts with the other CONVERGENCE layers on behalf of the user.
CONVERGENCE Core Ontology (CCO)	A semantic representation of the CoReST taxonomy. See “CONVERGENCE Resource Semantic Type (CoReST)”
CONVERGENCE Device	A combination of hardware and software or just an instance of software that allows a user to access Convergence functionalities
CONVERGENCE Engine	A collection of technologies bundled together to deliver specific functionality and made available to users and to other Engines via API

CONVERGENCE Middleware layer (CoMid)	A layer of CONVERGENCE that provides the means to handle resources on the basis of "what" they contain and offer. These functionalities are implemented using a set of technologies that we call CONVERGENCE Middleware (CoMid), which includes the Community Dictionary Service (CDS) Functional Block.
CONVERGENCE Network layer (CoNet)	A layer of the CONVERGENCE system that provides access to named-resources on a public or private network infrastructure. A named-resource is any resource that can be identified by means of a name; named-resources may be either data or service-access-points. Examples of named-resources include: a VDI; an electronic document, an image, a source of information with a consistent purpose, the point of access to a service, and a collection of other resources.
CONVERGENCE Resource Semantic Type (CoReST)	A list of concepts or terms that makes it possible to categorize CONVERGENCE resources, establishing a connection with the resource's semantic metadata.
CONVERGENCE System	A system built by using the technologies specified or adopted by the CONVERGENCE specification. The CONVERGENCE system consists of a set of interconnected CONVERGENCE devices - peers and nodes - connected to each other. See "Node" and "Peer".
Describe, Discover, Distribute (DDD)	The DDD paradigm uses three different axes to aggregate the pillar functionalities offered by the CoMid layer of CONVERGENCE.
Digital forgetting	Techniques designed to ensure that VDIs do not remain accessible for indefinite periods of time, when this is not the intention of the user.
Digital Item (DI)	A structured digital object with a standard representation, identification and metadata. A DI consists of content, content and context related metadata, and structure. The structure is given by a Digital Item Declaration (DID) that links content and metadata.
Discussion	A set or graph of messages each containing links to other messages. In the context of CONVERGENCE discussions and messages within discussions may be represented as VDIs.
Domain ontology	An ontology, dedicated to a specific knowledge domain or application. In CONVERGENCE, domain ontologies will be used to establish associations between VDIs and their semantic metadata. Examples of domain ontologies include the W3C Time Ontology and the GeoNames ontology.

Elementary Service (ES)	A concept imported from the MPEG-M emerging standard. Refers to the most basic unit of functionality offered by the CoMid. ES provide CoMid's main functionality. Elementary Services can be used on their own or in combination with CONVERGENCE entities to implement a series of actions.
Entity	An object which an Elementary Service can act upon or with which it can interact with. Entities can be VDIs, resources, devices, events, group, licenses/contracts, services and users.
Expiry date	The last date on which a VDI may be legitimately used by a user of the CONVERGENCE System. The last date on which the CONVERGENCE system will allow a user to find the VDI in a search or subscription or to retrieve the VDI.
Fractal	A semantically defined virtual cluster in a distributed overlay network composed of all CONVERGENCE peers running CoMid.
Functional Block	Partial or complete implementations of the functionality required by a specific layer of the CONVERGENCE architecture. Functional blocks are implemented as Engines.
Functional layer	An aggregated set of conceptually similar functional blocks. The CONVERGENCE architecture defines three functional layers: Application, Middleware and Network.
Integration Architecture	An implementation of CoNet designed to integrate CoNet functionality in the IP protocol by means of a novel IPv4 option or by means of an IPv6 extension header, making IP itself content-aware. The Integration Architecture does not imply to give up IP, as in the clean-state architecture and performs better than a CoNet placed on top of IP, as in the overlay approach. See "Clean-state Architecture" and "Overlay Architecture" and "Parallel Architecture"
License	A machine-readable expression of Operations that may be executed by a Principal.
Local named resource	A named-resource made available to the CONVERGENCE users through a local device, permanently connected to the network. Users have two options to make named-resources available to other users: 1)

	store the resource in a device, with a permanent connection to the network; 2) use a hosting service. In the event she chooses the former option, the resource is referred to as a local named-resource.
Metadata	Data describing a resource referenced by a VDI, including but not limited to provenance, classification, access rights, expiry date etc.
MPEG eXtensible Middleware (MXM)	A standard Middleware specifying a set of Application Programming Interfaces (APIs) so that MXM Applications executing on an MXM Device can access the standard multimedia technologies contained in the Middleware as MXM Engines.
MPEG-M	An emerging standard proposed by MPEG as an extension of the MXM standard.
Multi-homing	In the context of IP networks, the configuration of multiple network interfaces or IP addresses on a single computer.
Named data	A named-resource consisting of data.
Named resource	A CoNet resource that can be identified by means of a name. Named-resources may be either data (in the following referred to as "named-data") or service-access-points ("named-service-access-points"). Examples of named-resources include VDIs, electronic documents and points of access to a service.
Named service access point	A kind of named-resource, consisting of a service access point identified by a name. A named-service-access-point is a network endpoint identified by its name rather than by the Internet port numbering mechanism.
Network Identifier (NID)	An identifier identifying a named resource in the CONVERGENCE Network. If the named resource is a VDI, its NID may or may not be identical to the VDI identifier (to be decided).
Node	A CONVERGENCE device that implements CoNet functionality. Typically, a node is owned by a Telco or Service Provider.
Overlay architecture	An implementation of CoNet as an overlay over IP. See "Clean-state Architecture" and "Integration Architecture" and "Parallel Architecture"
Parallel architecture	An implementation of CoNet as a new networking layer that can be used in parallel to IP. See "Clean-state Architecture" and "Integration Architecture" and ""Overlay Architecture"

Peer	A CONVERGENCE device that implements CoMid and CoNet functionality. A node will typically be owned by an end-user or by a Service Provider or Telco.
Policy routing	In the context of IP networks, a collection of tools for forwarding and routing data packets based on policies defined by network administrators.
Principal	From the perspective of Rights Expression Language, the definition of Principal is: the User to whom Permissions are Granted in a License. Note: Depending on the approach chosen to assign Network Identifiers (NIDs) to CoNet resources, the concept of principal may be used also for such naming purposes. For instance, each principal may be associated with a string (e.g. assigned by a naming authority), and each CoNet resource may have a NID of the form: NID = <namespace ID, hash (Principal), hash (Label)> hash (Principal) must be unique in the namespace ID, and Label is a string chosen by the principal in such a way that hash(Label) is unique for that Principal. As an example, the principal can be the provider of a service, the publisher or the author of a book, the controller of a traffic lights infrastructure, or, in general, the publisher of a VDI.
Publish	The act of making a VDI available to the users or to a subset of the users of the CONVERGENCE System.
Publisher	A user of CONVERGENCE who advertises resources on the CONVERGENCE system, thus making them available to subscribers.
Publish-subscribe model	A service model based on an asynchronous exchange of messages or events. The CONVERGENCE publish subscribe model, encompasses a set of clients that publish VDIs, which are then forwarded to clients who have expressed interest in receiving them. There are basically two approaches to implementing a publish-subscribe system: 1) topic-based; and 2) content-based. CONVERGENCE adopts the latter. The topic-based approach has 2 variants: list-based and broadcast-based. Both use pre-identified topics to send messages, but their implementations differ. In the list-based approach, the system maintains lists of published. The Content-based approach does not require previous knowledge of topics. Subscribers indicate their preferences and the system dynamically inspects published content to decide which subscribers should be notified. In other terms, the subscription is based on the actual content of the considered events, which are not classified according to

	some predefined external criterion (e.g., topic name), but according to the properties of the events themselves [5]. This approach is harder to implement - it requires efficient, scalable algorithms to inspect content and users' interests, and to provide good matches.
Real World Object	An object existing in the real (as opposed to the virtual) world.
Resource	A virtual or physical object or service referenced by a VDI, e.g. media, Real Life Objects, persons, internet services.
Scope (in the context of routing)	In the context of advertising and routing, the geographical or administrative domain on which a network function operates (e.g. a well defined section of the network - a campus, a shopping mall, an airport -, or to a subset of nodes that receives advertisements from a service provider).
Search	The act through which a user requests a list of VDIs meeting a set of search criteria (e.g. specific key value pairs in the metadata, key words, free text etc.).
Service Level Agreement (SLA)	An agreement between a service provider and another user of CONVERGENCE to provide the latter with a service whose quality matches parameters defined in the agreement.
Subscribe	The act whereby a users requests notification every time another user publishes or updates a VDI that satisfies user-defined subscription criteria (key value pairs in the metadata, free text, key words etc.). Note: subscription criteria should be formulated in the same way as search criteria) Subscribe is a CoMid function.
Subscriber	A user of CONVERGENCE who declares his/her interest in being informed about a VDI. A subscriber can declare her interest using keywords, free-text or by indicating specific VDIs.
Subscription	The registration of an interest in a VDI, by a subscriber.
Timestamp	A machine-readable representation of a date and time.
Trials	Organized tests of the CONVERGENCE System in specific business scenarios.
Un-named data	A data resource with no NID.
User	Any person or legal entity in a Value-Chain connecting (and including) Creator and End-User possibly via other Users.
User (in OSI sense)	In a layered architecture, the term is used to identify an entity exploiting the service provided by a layer (e.g. CoNet user). If the service is the one provided by the application layer then user is an entity outside the CONVERGENCE system, which interacts with the system and uses what the system delivers.
User ontology	An ontology (a set of concepts and their relationships), created by users of

	CONVERGENCE when publishing a VDI or subscribing to a VDI.
User Profile	A description of the attributes and credentials of a user of the CONVERGENCE System.
VDI Browser	A tool allowing users to browse and consume VDIs on the network as allowed by their access rights.
VDI Creator/Editor	A tool allowing users to create, publish, read, update and delete VDIs.
VDI Identifier	A unique signifier assigned to a VDI or components of a VDI.
Versatile Digital Item (VDI)	A structured, hierarchically organized, digital object containing one or more resources and metadata, including a declaration of the parts that make up the VDI and the links between them. VDIs can be seen as an extension of the MPEG-21 concept of a Digital Item (DI).

1 Goals and structure of this document

This document is a revised version of Deliverable 2.1 (Preliminary Use Cases and Scenarios), the first deliverable of WP2: Use Cases and Functional Requirements. The goal of the work described in the original deliverable was to generate a series of user scenarios, of interest to the partners, to obtain feedback from potential users, to refine the scenarios and, on this basis, to generate preliminary requirements for the CONVERGENCE system. This last goal was achieved. However, reviewers made a number of criticisms of the scenarios and the focus groups. In particular they recommended:

- A reduction in the number of scenarios, and a higher level of granularity in the use case descriptions;
- More realism in the use cases;
- A more convincing demonstration of the advantages of CONVERGENCE technology and of progress beyond the state of the art;
- A better projection of the use cases onto technical requirements;
- More attention to feedback from outside the Consortium.

The Consortium recognizes that these recommendations derive from genuine weaknesses in the original work. We have therefore:

- Reduced the number of scenarios concentrating on those in which partners have direct expertise;
- Completely reworked the individual scenarios and use cases;
- Identified for each case, the best possible way of implementing the scenario with existing technology;
- Collected new feedback from potential users external to the Consortium
- Reanalyzed CONVERGENCE's Unique Selling Points
- Created explicit links between scenarios and requirements generated by the scenario.

We have also made one change to the technical requirements adding a requirement that only emerged during the revision of the original scenarios.

This does not mean that the scenario generation process is complete. In particular, this deliverable does not attempt to identify or describe the complete set of use cases to be supported in the CONVERGENCE trials. This will be a task for D2.2 – Use Cases and Requirements for Development Work. Our goal in this document is describe a restricted set of scenarios broad enough to identify a core set of requirements, supporting a broad and attractive set of applications.

Revising the scenarios has required significant effort from all the partners. This effort, however, has produced a number of beneficial side effects that go beyond the need to meet reviewer requests. In particular, the comparison between CONVERGENCE and alternative implementation technologies have led us to identify new advantages of CONVERGENCE that were not apparent to us when we wrote the original deliverable.

The original document focused on advantages **for end-users**. It is now clear to us that CONVERGENCE also offers advantages for **network operators, content providers and developers**. The rest of this report will illustrate these advantages.

The basic structure of the report is similar to the original version: Chapter 2 provides the basic rationale underlying the work. Chapter 3 provides a detailed description of the methodology. Chapter 4 describes the revised scenarios. This part of the work is completely new. Chapter 5 describes user reactions to these concepts and to the use scenarios, as collected in a series of focus groups (including a new focus group on "retail scenario"). Chapter 6 extracts from the User Scenarios and the focus groups a set of "Unique Selling Points" for CONVERGENCE. This chapter has also been completely reworked. Finally Chapter 7 uses the user scenarios and the results from the focus groups to define provisional requirements for the CONVERGENCE system. An appendix provides the detailed reports from the focus groups. Other appendices included in the previous version of the report (i.e., template for scenarios, script for focus groups and presentation used for focus groups) have been omitted for purposes of brevity, but are available on the project web site.

2 Scenarios and the CONVERGENCE project

Scenarios play a fundamental role in the logic of the CONVERGENCE project. The goal is not to provide a representative picture of all possible uses of CONVERGENCE – obviously an impossible enterprise. Rather the scenarios are one step in the process described in the DOW in which scenarios are chosen to reflect the real-life business needs of four CONVERGENCE partners and then used to generate requirements, design concepts and ideas for implementing CONVERGENCE. We believe that the requirements generated in this way are sufficiently broad to meet the needs of a very broad population of potential users.

After the reviewers' request to rework the scenarios, we decided to divide the scenario development process into two phases.

- **The first phase,** described in this deliverable, has focused on illustrating the advantages of CONVERGENCE and on deriving core requirements for the CONVERGENCE system. To this end, the deliverable presents four scenarios, each of which provides a general description of the way one of the partners intends to use CONVERGENCE and to test it in the trials. For each scenario, we describe a limited set of use cases sufficient to illustrate the main features of the CONVERGENCE solutions, and its advantages. For each use case developed in this we describe an implementation based on CONVERGENCE and compare it to alternative solutions based on existing technologies. We then go on to exploit these use cases to generate requirements for the project's high-level development strategy, the VDI, the CONVERGENCE framework, the CONVERGENCE network and the CDS. Use cases that are necessary for the trials but which do not introduce new requirements or new features have been deliberately excluded (and will be dealt with in D2.2).
- **The second phase,** which will be described in D2.2, will focus on detailed requirements for the CONVERGENCE trials. The deliverable will therefore describe *the complete set of use cases* to be implemented in the trials and analyze their implementation in greater technical detail. These descriptions will be used to generate detailed requirements for *applications* for running over the CONVERGENCE framework and the CONVERGENCE network.

3 Methodology

3.1 Overview

The original version of Deliverable D2.1 was generated in the following phases:

- Collection of scenarios from partners;
- Scenario Editing and Analysis;
- Generation of final scenarios;
- Focus groups;
- Definition of unique selling points;
- Generation of functional and non-functional requirements.

The revision of the scenarios involved:

- Definition of strategy for revision of scenarios;
- Definition of a revised "scenario description template";
- Revision of scenarios;
- A new focus group;
- Revision of the section dedicated to Unique Selling Points;
- Revision of requirements.

3.2 Collection of scenarios from partners

In the first phase of the work, the WP coordinator (XIW) asked each of the partners involved in the trials (Alinari, FMSH, LMU, WIPRO-UTI) to provide a scenario (a brief narrative) describing a possible application of CONVERGENCE technology, seen from an end-user viewpoint. Scenarios were described using a template provided by XIW. Partner contributions were returned to XIW, which took responsibility for the following phase of the work.

In September 2010, Singular Logic and ICCS collaborated to produce new scenarios, showcasing features of CONVERGENCE that were not present in the first set of scenarios, in particular the automated capture of identifiers from Real World Objects. In the revised key features of these scenarios were merged into the retail scenario. The scenarios themselves were not included in the revised version of the deliverable.

3.3 Scenario Editing and Analysis

XIW edited and classified the scenarios, simplifying some of the narratives and identifying points of commonality, duplications, and aspects of CONVERGENCE that were not properly described. XIW then distributed the revised scenarios to their original authors, to the technical partners, who analyzed their technical feasibility and to CEDEO, the partner leading the development of business scenarios in WP9. On the basis of the ensuing discussions, the authors revised their scenarios.

After some additional editing these scenarios became the final scenarios for the deliverable. For purposes of clarity XIW grouped the scenarios into two classes:

- Use of CONVERGENCE to manage and discuss media (photos, videos, PowerPoint presentations);
- Use of CONVERGENCE in retailing.

3.4 Focus groups

An important goal of the work was to test the CONVERGENCE concept and CONVERGENCE scenarios with potential end-users. To this end, it was decided to organize focus groups involving:

- Managers of a large photo-archive (Alinari)
- Managers involved in the maintenance of a large video library and users of the library (FMSH)
- University students in computing and engineering (LMU)

In preparation for the focus groups XWI provided a script providing guidelines for the discussion, a standard format for the focus group report and a short presentation of the general purposes of the CONVERGENCE project. Each partner involved in the preparation of a trial prepared a presentation of the specific trial for participants in the focus group.

Each focus group session involved approximately 10 participants and two group leaders who alternated in asking questions to the group. Participants had no prior knowledge of the CONVERGENCE project.

Each session lasted approximately between two and three hours and took place in participants' native language. At the beginning of the session, participants were asked to fill out a short form describing their personal characteristics (age, sex, profession, educational qualifications, internet usage, use of mobile phones, use of mobile web and mobile services). The group leader collects the forms for use in the subsequent analysis.

The initial analysis of the focus groups was conducted by the partners responsible for their organization (Alinari, FMSH, LMU). The results from the individual groups were collected by XWI and used to draft the summary report included in Chapter 5 of this deliverable.

3.5 Definition of unique selling points

On the basis of the scenarios and the results from the focus groups, XIW generated a list of "Unique Selling Points" describing the key advantages of CONVERGENCE. This work was amply discussed in CONVERGENCE project meetings with particularly important contributions coming from CEDEO and from CNIT. In this new version of the deliverable it has been substantially revised (see below).

3.6 Extraction of requirements

On the basis of the scenarios and focus groups, XIW extracted an initial set of Requirements. This list was continually revised during the entire duration of work on D2.1. The final list of

requirements included suggestions for change from all partners, with CEDEO and CNIT again making critical contributions.

3.7 Definition of strategy for revision of scenarios

At the CONVERGENCE project meeting that immediately preceded the review it was decided to eliminate the scenarios for vertical applications (later criticized by reviewers) and to focus on just four scenarios (the photo archive proposed by Alinari, the video archive proposed by FMSH, the podcast proposed by LMU and the retail scenario proposed by WIPRO/UTI with support from ICCS and SIL). After the review it was decided to maintain this decision. It was also agreed that the content of the scenarios should be completely revised and that new sections should be added to meet specific requests from reviewers.

3.8 Definition of new template for scenario description

On receiving the recommendations of reviewers, XIW generated a new template to describe the scenarios. The revised template included new sections in which partners were asked to describe (i) the implementation of scenarios and use cases with CONVERGENCE technology; (ii) the best alternative solutions (using current technology); (iii) the advantages of the CONVERGENCE solution; (iv) detailed technical requirements deriving from the scenario.

3.9 Revision of scenarios

Alinari, FMSH, LMU and WIPRO used the XIW template to describe their revised scenarios. XIW edited the scenarios, drastically shortening many of the original texts, and in several cases adding use cases and technical details required to provide a complete definition of the scenario. The revised scenarios went through three rounds of revision with all partners providing comments and suggestions. The scenario description in the next chapter is the result of this process.

3.10 New focus group

WIPRO organized a new focus group involving manufacturers and retailers from outside the CONVERGENCE consortium. The general methodology applied in the focus group was identical to the methodology applied in the previous focus groups. As will be shown in later chapters, the feedback from participants was very positive and extremely valuable.

3.11 Revision of Unique Selling Points

As mentioned earlier, the revision of the scenarios helped the partners to develop a broader vision of the advantages of CONVERGENCE. On this basis, CEDEO proposed a document defining a new vision of CONVERGENCE's Unique Selling Points. XIW enriched the

CEDEO proposal with additional concepts coming from the scenario revision process and the focus groups. The results of this work are reported in Section 6, which has been completely reworked with respect to the text contained in the original version of this deliverable.

3.12 Revision of requirements

On the basis of the work previously described, XIW developed a revised version of the project requirements. Changes with respect to the previous version are minor. Reviewers are asked to note this deliverable focuses on requirements for CONVERGENCE itself and defines only preliminary requirements for *applications* (which are not formally part of the CONVERGENCE system).

4 The Scenarios

4.1 Introduction

This report describes four scenarios:

- Managing and Annotating a large photo archive (Alinari)
- Building, managing and exploiting a video archive (FMSH)
- Augmented Lecture Podcast (LMU)
- Smart Retailing (WIPRO/UTI)

The scenarios can be merged into two main categories, each sharing key features.

- **Media and discussion:** these scenarios show how CONVERGENCE can provide useful support for media professionals (tools to define licensing conditions, tools to define metadata descriptions, tools to publish media) and for end users of media (tools to add comments to media, to discuss media with other users and to republish adapted versions of media). The scenarios refer to three distinct classes of media (photos, videos and podcasts).
- **Retailing**: this scenario shows how CONVERGENCE can be used to handle typical retailing situations such as advertising a product, stock management, post-sales support, managing a safety recall, and managing warranties. A key feature is the use of CONVERGENCE to obtain information about a product identified by a barcode or an RFID.

4.2 Description of scenarios

4.2.1 Scenario: Managing and Annotating a large photo archive (Alinari)

General description
Alinari is a commercial company (http://www.alinari.com) that maintains a large photographic archive and sells photographs from the archive, primarily to professional customers. As part of this business, Alinari offers a growing range of online services. Alinari sees CONVERGENCE as a way of facilitating the management of these services, improving access for users, and making it easier for photographers to contribute and "annotate" photo. A key requirement is that CONVERGENCE should provide the strongest possible protection for the company's valuable Intellectual Property. In the scenario described here, Alinari uses CONVERGENCE to create a collection of photos of the city of Ravenna. The collection consists of archive material and photos contributed by schools and professional photographers. The CONVERGENCE licensing mechanism allows Alinari to define licensing terms for each photo (VDI) in the collection. CONVERGENCE also allows Alinari to define expiry dates for photos. Where required, Alinari can grant free access to photos in the archive while continuing to protect its IP. Professional users (writers, journalists, scholars) and consumers can search for and access photos in the collection and receive a notification whenever Alinari publishes a new photo meeting user-defined search criteria. The same collection is used as the basis for an exhibition at the MNAF museum in Florence. Museum staff use CONVERGENCE to create a mobile application for visitors to the exhibition.
User population
• Alinari managers and staff • Photographers (professional users) and school children (non-professional users) who contribute to the archive • Content users (citizens, students, teachers, journalists etc.) • Managers and staff working for museums, libraries, news agencies etc.

Named users

- **Ilaria,** IPR content licensing manager (B2B) at Alinari
- **Italo:** Journalist and writer
- **Rita**: Senior manager in charge of selecting and cataloguing photos at Alinari
- **Paul**: Cataloguer and translator (EN-IT)
- **Valeria**: Museum IT expert
- **Andrea:** Professional photographer

Implementation

Management of photographic archives

Photographs in the collection are represented by VDIs. Each VDI contains the photo itself (or a link to the photo) and metadata describing the photo. The metadata schema is defined by Alinari managers and includes the date, time and place where the photo was taken, legal data on the author and owner of the photo, technical data about the photo (camera, lens, shutter time, aperture, ISO etc.), historical data about the site represented in the photo, and annotations contributed by Alinari staff and third parties and licensing data. The latter defines who can access the photo under what conditions. Licensing data is represented using the CONVERGENCE REL.

Alinari manages the archive using a custom application that runs on top of the CONVERGENCE framework and the CONVERGENCE network. A special version of the application is also made available to professional end-users. Other end-users can access photos in the archive via a generic CONVERGENCE browser. The dedicated application provides Alinari staff with a user interface making it easy for them to create, publish, un-publish, annotate and update the VDIs. Other users can perform a subset of these operations, defined in the license for individual VDIs.

The CONVERGENCE network enforces the license terms, preventing retrieval of Alinari photos by unauthorized users. The CONVERGENCE framework automatically prevents access to photos that have expired and performs garbage collection to purge outdated copies from network storage.

Implementation with non-CONVERGENCE technology

There are two ways to implement the scenario with non-CONVERGENCE technology:

- Use an existing online photo publication (e.g. Flickr, Panoramio)
- Develop a proprietary solutions (e.g. a new web-based repository a mobile app)

Use of existing repository

Use of an existing repository eliminates the need for software development. However it poses a series of problems that make it unworkable for a large commercial company:

- The services offered to end-users are defined by the owner of the repository. This transforms the owners of resources from *service providers* (offering value added services to their customers) into *content providers* (offering content to a third party).
- Licensing conditions are defined by the owner of the repository. While owners of content may be able to define their own price, they have no means of freely defining terms and conditions (e.g. restrictions on types of use).
- Works stored on third party repositories do not contain full ownership information. This creates the risk they will become "orphan works". This is a problem both for owners and for third parties wishing to use the works.
- Search and subscribe capabilities are more limited than those provided by CONVERGENCE.
- Service providers can add or remove functionality without the agreement of their customers. Supporting new services may be very expensive for commercial providers.
- Non-CONVERGENCE solutions do not guarantee a fair distribution of the royalties with commercial providers.

Development of own repository/app

It is technically possible to implement a proprietary web-based repository offering most of the features offered by CONVERGENCE, including advanced annotation, search and licensing options. Many features could be based on the MPEG-21 standard. However this approach has severe disadvantages:

- Developers would have to re-invent rights management, annotation schemas, search and subscribe functionalities that the CONVERGENCE framework offers "for free".
- A proprietary service would require heavy and continuous investments for updates, upgrades and integration with third party services (e.g. services offered by Alinari partners). Developers would have to develop a special user client or application.
- End-users would need to download and install an app.
- Users would need to know the address of the Alinari site, or find it via a search engine. These requirements would seriously limit the number of users.

Features that *cannot* be implemented with current technology

Use of existing repository

- Definition of rights and payment conditions by media owner
- Definition of metadata in a form desired by media owner
- Innovative semantic search tools
- Digital forgetting
- Full identification of ownership, preventing the creation of "orphan works"

Proprietary technology

Standardized annotation scheme: while a media owner could implement its own annotation scheme, this would be one more proprietary solution with no support for interoperability between different content providers.

Requirements

CODE 1, CODE2, CODE3, VDI2, VDI13, VDI14, VDI17, VDI25, VDI26, VDI31, VDI52, FRA10, FRA11, APP11

4.2.1.1 Photo archive use case: creation of a photographic collection

General description

- Annotation and submission of photos: teachers and professional photographers (such as Andrea) annotate their photos and submit them to the Alinari archive.
- The Alinari manager (Rita) subscribes to all photos generated by contributors.
- Every day she views new photos from contributors and selects those to be included in the archive.
- Paolo retouches the photos, edits user annotations, adds additional annotations from subject experts and translates the texts into English. In some cases he may provide different annotations for different classes of user (e.g. teachers, students, art historians). He adds IPR information about rights holders (author, agency, represented subjects, etc.).
- Rita checks the enhanced photos, where necessary reverting to a previous version.
- Rita publishes the enhanced versions of the photos making them available to end –users and specifying licensing conditions. Licensing conditions are differentiated for (i) photos from the Alinari archive; (ii) photos from professional photographers (contracted by Alinari); (iii) photos contributed by schools. All licenses have a predefined expiration date. Access to some photos is restricted to registered users of Alinari online services.
- Rita "un publishes" a photo by a photographer no longer represented by Alinari

Implementation

- **Annotation and submission of photos.** Photos submitted to the archive are represented as VDIs. The meta-information in the VDI include information (geo-coordinates and name of location, historical notes etc.) that makes it easy for users to locate the photo. Users can also annotate photos using a specialized application. When a user wishes to publish an annotation, the application creates an updated VDI containing the annotation information. The application automatically adds a tag identifying the photos as submissions to the Ravenna archive. It also creates a license that allows only the author and authorized users in Alinari to access the photo. The license is expressed in the CONVERGENCE REL and incorporated in the VDI for the photo. The photo is published to the CONVERGENCE network using standard CONVERGENCE network functionality.
- **Subscription to submitted photos.** The subscription uses the standard CONVERGENCE subscription service.
- **Selection of photos.** Selection of photos for the archive involves the addition of a tag stating that the photograph has been selected for the archive.
- **Adding value to the collection.** Photo retouching uses third party tools. Editing of annotations uses standard CONVERGENCE publication tools. Enhanced photos are published as new VDIs.
- **Reversion to previous version.** This uses standard CONVERGENCE versioning features.
- **Definition of licensing conditions for end users.** Licensing conditions are expressed in the CONVERGENCE REL and incorporated in the VDI for each individual photo. The CONVERGENCE framework ensures that photos are not accessed by unauthorized users

or after the expiry date for the license. Expired VDIs are automatically purged from the network.

- **Publication of photos.** Publication of photos uses standard CONVERGENCE publication features.
- **"Un-publication of photo".** This involves a revoke request to the CONVERGENCE framework. The request is broadcast across the CONVERGENCE network. The VDIs for revoked photos are removed from the network.

Implementation with non-CONVERGENCE technology

Alinari already operates a large proprietary solution built over MS SQL and IIS.

Alinari uses this system as the basis for a workflow to digitalize, retouch and catalogue all photos in its collections and to associate photos with related IP information. The workflow involves many different steps and tools. Annotation uses ACA-Panel, an internal web based client-server interface which communicates with the collection database. Photos are annotated using a standard defined by the Italian Ministry for Culture (so-called "scheda F"). A second set of metadata describes information related to Intellectual Property. Image processing (resize, watermark, storage, etc.) is managed using internal proprietary technology.

Users involved in different stages of this process each work with their own files. Contributors submit photos via FTP and send annotations as MS Word files. Editors then use MS Word to edit the texts, which are copied and pasted into a proprietary in-house format. All these processes generate errors and delay. Collections can only be published when they are complete. Updates and revocations involve repetition of the process.

In its system, Alinari has implemented keyword search and advanced search tools. The Alinari solution uses a proprietary multilingual thesaurus with 6 levels and 8,000 reference concepts. Maintaining this thesaurus is extremely expensive.

In principle, it would be possible to create a database-centric service, providing improved integration. However, it is unlikely that the revenue would cover the costs.

Features that cannot be implemented with current technology
• **A single data representation**. In current solutions, different users work with different representations of the data (different files) at different stages in the workflow. This makes it very difficult to ensure that all users are working with the same version of the data. It also makes it difficult to guarantee that a photo has been completely purged from all Alinari storages. • **Interoperable annotations.** Current solutions provide no way of annotating photos in a way that can be used with third party applications. • **Definition and enforcement of complex IP rights.** Current solutions provide no way of defining and enforcing complex licensing rights and of enforcing them on a network-wide basis. CONVERGENCE provides this capability “out of the box”.

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4.2.1.2 Photo archive use case: finding and using photos

General description
Italo (a local journalist from Ravenna) writes a regular column about "How we lived 50 years ago" and is a registered professional user of Alinari online services. Italo is always interested in finding new photographic material to illustrate his pieces. Given that he intends to use the material in his column he needs an easy way of identifying the owner and purchasing the rights. Alinari offers him this possibility. In this scenario • He "subscribes" to photos of Ravenna taken between 40 and 60 years ago. Given the limitations of his newspaper's budget he limits his search to photos he can purchase for less than Euro 50. • Every time that Alinari staff add a new photo that meets his search criteria he receives a notification that the photo has been published. • He accesses a thumbnail of the photo (available free of charge), using the link in the notification • He likes the photo and purchases a license to download a high resolution version • He searches the CONVERGENCE network to look for modern photos of the same location • He finds a photograph by an amateur photographer, checks the rights to the photo, pays a small fee, and downloads this photo too.

Implementation
The CONVERGENCE subscription function allows Italo to subscribe to all photos meeting his search criteria. When he is looking for old photos of Ravenna he limits his search to the Alinari collection. However he can use the same function to search anywhere on the CONVERGENCE network. Licensing conditions for photos are implemented in the CONVERGENCE licensing mechanism based on the REL. The network automatically enforces these conditions. When Italo searches for modern photos of the same location shown in the archive photo, CONVERGENCE searches for all VDIs of type photo, with geo-coordinates within a small distance of the coordinates of the archive photo. This is a standard feature of CONVERGENCE search that conventional search engines cannot match.

Implementation with non-CONVERGENCE technology
Most of the services just described could be implemented on a proprietary client-server system such as the service already operated by Alinari today. However, the cost of designing, building and maintaining such a system would be prohibitive.
Features that cannot be implemented with current technology
CONVERGENCE allows Italo to find the photos without knowing the address of the Alinari service and without using a search engine.

4.2.1.3 Photo archive use case: mobile application for museums

General description

In this scenario, a museum uses the CONVERGENCE framework to build a mobile application to guide visitors around an exhibition on Ravenna at the MNAF museum in Florence. The museum will be able to use the same software for other exhibitions in the future.

The app allows visitors to:

- View photos in the exhibition before and after they come to the museum;
- Navigate round the museum paying special attention to photos they find particularly attractive;
- View historical and other information about these photos;
- Purchase copies of photos (low cost, low resolution copies for use as digital "wall-paper", high-resolution digital reproductions of the photo).

A special web application allows museum staff to:

- Select the photos visitors will be able to see with the mobile app;
- Update this selection as required;
- Enhance the photos with historical and other information provided by museum staff;
- Enhance the photos with location information showing visitors how to find them in the museum;
- Analyze which photos and information visitors are accessing most frequently;
- Cancel access to the photos when the exhibition is over.

Implementation

In this scenario, each photo in the exhibition is represented by a new VDI, derived from an original Alinari VDI and enriched with additional information provided by the museum. The metadata for the new VDI includes navigation, category historical and licensing information.

The mobile application takes the form of a dedicated client-server application built on top of the CONVERGENCE framework and the CONVERGENCE network. The app automatically retrieves all photos in the exhibition by subscribing to photos with the exhibition tag. When museum staff publish a new photo or a revised version of a previous photo, the app is updated automatically. Navigation, search and e-business functions exploit the information embedded in the VDI.

Museum staff manage the app through a web application that interfaces the CONVERGENCE framework on the server side.

To set up the app, the staff publish new photo VDIs to the CONVERGENCE network, tagging them with an exhibition identifier and signing the VDIs to guarantee their authenticity. To update or revoke photos (e.g. at the end of the exhibition) they use the

appropriate CONVERGENCE functions. The original license ensures they are not viewed after the “expiry date”.

Implementation with non-CONVERGENCE technology

Alinari has already implemented prototype applications for guided tours with iPhone support. Typical functions include “select tour”, “open gallery”, “select collection”, “view single item” and “view description of item”. It would be technically possible to add other functions such as e-business. However, each such application requires the development of dedicated client software, a dedicated database and dedicated management functions. This is expensive and is not practical except for very large exhibitions. Museums would find it difficult or impossible to re-use the mobile app and the management system for new exhibitions.

Features that cannot be implemented with current technology

Generic solution for exhibitions usable with materials not provided by Alinari

4.2.2 Scenario: building, managing and exploiting a video archive (FMSH)

General description

This scenario is based on one of the FMSH's key activities, namely the collection, management and exploitation of audiovisual material documenting the intangible cultural heritage of rural communities throughout the world and the ethically sound exploitation of the material for purpose of research, education and in commercial projects (e.g. the creation of documentaries for use on commercial TV).

Valérie is a doctoral researcher doing fieldwork with Quechua communities in Peru. As part of her work she collects audiovisual material about performing arts, rituals, spoken language, music, etc. She uses this material for her doctoral research. However, it is also of interest to Quechua communities themselves and may interest researchers and students elsewhere in the world. She therefore intends to create a partially open archive using the system made available by FMSH. One of the key issues is how to respect indigenous peoples' right to control the use of material concerning them. She therefore reaches the following agreement:

- The Quechua community in Cuzco is a co-owner of the video material she produces;
- A committee representing the community decides which videos of the material can be made available on Valérie's audiovisual channel (see below) or on other channels;
- Certain segments of videos may be subject to specific restrictions. Public broadcast of filmed rituals is prohibited; information of potential economic interest (e.g. on traditional medicines) may also be restricted;
- No material can be broadcast or transmitted over social media without prior notification to the community;
- The community is free to revoke any license it has granted at any time.

The CONVERGENCE network enforces these conditions.

General user population:

- Researchers and professionals working to produce audiovisual documentation of different communities' cultural heritage;
- University teaching staff;
- University students;
- Archivists and librarians;
- Journalists etc.;
- "Community members" (Peruvian people and people from other Andean countries).

Named users

- Valérie, a doctoral researcher working with Quechua speaking communities in Peru and Bolivia;
- A committee representing the Quechua community in Cuzco, Peru;
- Elisabeth, university lecturer specialized in intercultural communication;
- Elisabeth's students;
- Audiovisual production companies;

- Peter, a concept designer responsible for the management of meta-linguistic resources (description and indexing schemas, ontologies and thesaurus, standards) for the CONVERGENCE System.

Use cases

- Registration and uploading of audiovisual materials
- Systematic analysis of the material.
- Creating a personal video channel
- Creating an ontology
- Use of selected video segments by a third party.
- Use of video materials by Quechua community.

Implementation

Support for FMSH managers and staff

FMSH uses the CONVERGENCE network and framework to create a dedicated application for its managers and staff. The implementation strategy and tools are almost identical to those described in the previous scenario. Media are represented as VDIs containing meta-information and a license. Although the terms of the license on FMSH materials are completely different from those of the Alinari license, both are specified using the CONVERGENCE REL and both are enforced by the CONVERGENCE network. As in the Alinari scenario, there is no centralized server, except (possibly) for resource servers holding videos and ontologies. In principle, resources may be distributed across the CONVERGENCE network.

As a tool for researchers, the FMSH video library requires more sophisticated search facilities than Alinari. The FMSH scenario will therefore make intensive use of CONVERGENCE ontologies. This makes it easier for researchers to describe materials and easier for users to find specific items (e.g. materials describing a particular kind of religious rite, a particular kind of building or a particular item of clothing). FMSH researchers will not only use third party ontologies but may also create their own, making them available to other users via the CONVERGENCE CDS. FMSH will make extensive use of CONVERGENCE's synchronization facilities – to facilitate the handling of material by different actors in FMSH.

Support for researchers and teaching staff using FMSH materials

Like FMSH's own managers and staff, external researchers and teaching staff will be able to create, annotate and publish VDIs of video material. They will also be able to extract and annotate "virtual segments" of material. Each of these segments will become a new, annotated VDI inheriting features of the original VDI. Different users may extract different, overlapping segments. This process will probably use a dedicated application.

Researchers wishing to *search* for materials will be able to use a generic CONVERGENCE browser. The semantic search capabilities embedded in the CONVERGENCE network and the CDS will exploit the metadata embedded in the VDIs, which in this case may be extremely rich.

Researchers wishing to *subscribe* to materials will again use the CONVERGENCE browser.

Support for Quechua-speaking communities using FMSH materials

At a technical level, the underlying CONVERGENCE technology (the CONVERGENCE network and framework) used by Quechua-speaking communities will be the same as the technology used by researchers. However, the user interface will be very different. CONVERGENCE will make it easy to build customized front ends to the CONVERGENCE network.

Network caching

Although the specific FMSH application is unlikely to generate very heavy volumes of traffic, generalizations of the application (large scale community video services) could indeed generate large amounts of traffic. In these cases, CONVERGENCES caching features could be extremely useful.

Implementation with non-CONVERGENCE technology

YouTube – like Daily Motion, etc. – allows users to create and manage video channels. However, authors have very little ability to monitor the use of their materials[1] or to moderate comments left by users. This makes such services unsuitable as a medium for distributing culturally sensitive materials. Given FMSH requirements for fine-grained rights management (different rights for different segments of videos), it would be impossible to implement the scenario with this kind of commercial video repository. Proprietary services also offer very limited options for providing/searching for structured information about resources, except in the limited format defined by the service provider. This means that they are less than ideal for researchers.

Given these limitations, the only alternative to implementation with CONVERGENCE would be a proprietary solution, probably using MPEG-21 to reference video resources and their licenses. However this would be difficult and expensive to implement. Many features that CONVERGENCE offers out of the box (rights management, data formats, semantic technology for search, publish and subscribe solutions) would have to be developed from scratch.

DRM tools obviously exist. However they are mainly designed for the needs of commercial information providers and are poorly adapted to personal, creative uses of video material (e.g. publishing of personal video channels, annotation of videos or parts of videos, publishing and republishing of segments of videos).

Content distribution networks offer caching facilities. However these facilities are proprietary and do not offer a “neutral service”. For an organization such as FMSH that may need caching but does not have the commercial strength of large internet companies, the neutrality of CONVERGENCE is an important feature. It could also be very important for users, who would like to set their own priorities for the materials they view, and do not want these to be decided by commercial (or government) organizations.

[1] Normally the only information provided is the number of « hits » or downloads.

Features that cannot be implemented with current technology

The key feature of CONVERGENCE that cannot be implemented with other technologies is *sharing* of resources between users belonging to different organizations. This requires:

- The common VDI data format;
- Standard ways of representing metadata (part of the format);
- Standard ways of representing rights (the REL);
- Standard ways of representing ontologies;
- Sharing of ontologies;
- The possibility of publishing materials to the whole network;
- The possibility of searching for/subscribing to materials on the whole network and not just those provided by a particular service.

Requirements

BA 1 2;

VDI 1 2 3 4 5 8 9 10 11 12 13 14 15 18 20 21 22 23 25 26 27 28 30 32 34 35 36 37 38 39 40 41 43 49 51 52 56 58 61 62 63 64 65 66 67 74; 77

FRA 1 2 4 7 8 9;

NET 3 10 16 17 20;

CDS 1 2 5 7;

APP 1 6 8 11;

4.2.2.1 Video archive use case: basic registration, uploading and verification of video material

General description
• Valérie uploads her videos to her video channel. The videos are automatically transcoded to the correct data formats for the channel (e.g. streaming, mobile communication, high quality format); • She fills in a *basic registration form* for each video. The form specifies the author, the title, the time, date and location of recording, and information making it possible to identify the theme of the video; • She "watermarks" the content as belonging to the Quechua community; • She defines the license for the video: in the case of videos that are not intended to be public she can: - Encrypt the video so that video channels without a license cannot broadcast it, - Restrict use of the video to specific users (e.g. people in Quechua communities, her scientific director in Paris, research and teaching colleagues in Paris), or specific channels (e.g. the Dialog Archives (IDA) channel, owned by Elisabeth), - Allow users with appropriate rights to access the video for a specified period; • She publishes the VDI for the video; • She monitors the use of her videos in social media (Facebook, Twitter, etc.); • CONVERGENCE automatically notifies Valérie and the representatives of the Quechua community when other users access or download the video; • If the video is used in ways the community does not approve, she modifies the license; copies of the video on the CONVEGENCE network are updated automatically. If necessary she can also "un-publish" the video.

Implementation
Video resources are represented by VDIs. A single VDI may contain links to video resources in different formats. This makes access to the correct format transparent to the end-user. Rights to video resources are stored in the form of licenses, represented in the CONVERGENCE REL and included in the VDI. The same VDI incorporates information about the video format. The different actions described in the scenario are implemented as follows: **Upload video to video channel/automatic transcoding.** A video channel application enables a user to upload the source video file to a transcoding server. The server transcodes the video into a set of pre-specified formats and stores the resource files. The VDI for the video is updated containing links to these files (one per format). The new VDI is published to the CONVERGENCE network. **Fill in form with basic information.** The form is a standard form defined by FMSH. Valérie fills in the form using a standard CONVERGENCE publishing tool that automatically incorporates the information as metadata in the VDI for the video resource.

Encrypts the video. When necessary, the video is encrypted to the public keys of users who are authorized to access the video; encryption and decryption rely on standard features embedded in the CONVERGENCE framework.

Defines license for video: Valerie defines the license for the video using a standard form provided by FMSH. The licensing information is expressed in REL and incorporated in the VDI.

Publication of VDI. Valerie publishes the VDI using the standard CONVERGENCE publishing tool. The VDI is then published to the CONVERGENCE network, where it becomes available to other authorized users.

Monitoring of use of VDI. In the license for her VDIs, Valérie specifies that she and the Cuzco committee should receive a notification every time a user accesses or downloads a copy of the VDI.

Modification of license. Valerie modifies the license using the same mechanisms used to create it. CONVERGENCE propagates the modification to all copies of the VDI on the network (e.g. videos published on video channels, videos downloaded by users, etc.).

Implementation with non-CONVERGENCE technology

See General description

Features that cannot be implemented with current technology

See General description

There is currently no technology that allows the updating of licensing conditions for material already distributed to multiple internet sites.

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4.2.2.2 Video archive use case: creation of an ontology

Peter creates the ontology, using a specialized application (such as Protégé). This involves the definition of conceptual terms and of semantic relationships between these terms. Peter also creates a specialized thesaurus containing domain-specific terminology (e.g. place names, language names, names of relevant natural entities) and predefined forms allowing users to describe specific objects, defined in the ontology (e.g., a building, a religious rite, an article of clothing). The new ontology is linked to the existing FMSH ontology and thesaurus. When it is complete, Peter uploads the files to the CDS Server. The CDS makes the ontology available to all authorized CONVERGENCE users anywhere on the CONVERGENCE network. This means that any CONVERGENCE search or subscribe operation can exploit the ontology.
Implementation with non-CONVERGENCE technology
Tools and languages for the definition of ontologies are of course common. It is therefore relatively easy to *define* an ontology. The main advantages of CONVERGENCE concern the use of these ontologies (see use cases later in this scenario)
Features that cannot be implemented with current technology
None

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4.2.2.3 Video archive use case: annotation of a virtual video segment

Video segments and annotations are represented by VDIs. VDIs may describe overlapping segments. Rights to use segments are stored as licenses inside VDIs. The specific actions described in the use case are performed as follows:

Virtual extraction of a video segment: Valérie uses a dedicated FMSH Video Annotation Application. The application allows her to browse a video and define video segments in a timeline. Each segment is created as a VDI, referencing the video resource VDI and providing time codes (starting time, duration time) for the video fragment.

Annotation of a video segment: Valerie creates a new VDI to represent her annotation and creates a link between the annotation and the segment. She then loads the QCHO Ontology from the CDS Server. She chooses the appropriate form for the segment she wishes to annotate (e.g. a form to describe a religious ritual) and uses it as the basis for the VDI.

Definition of use rights for annotations. She defines the license for the VDI using a standard template defined by FMSH, filling in the licensing conditions with the CONVERGENCE publication tool. The licensing conditions are represented in the REL and stored in the VDI.

Publishing the VDI: see general scenario

Implementation with non-CONVERGENCE technology

Applications providing rich annotations of videos, using domain ontologies, are not very common. One such application is LOGOS Studio, developed by INA, French National Institute of Audiovisual. However, this application, like many others, does not allow users to set rights on annotations.

The MPEG-21 standard allows referencing of video segments and the corresponding licenses. However, use of the standard would require a custom application.

Features that cannot be implemented with current technology

- Interoperability with other systems (currently, systems similar to the FMSH system have their own meta-data schema and their own ontologies)
- Updating annotations to a video that have already been released (i.e. unless the video is stored on a centralized server).

4.2.2.4 Video archive use case: creating a personal video channel

General description
Valérie intends to create a personal video channel where she will publish her video materials. She will call it "*Quechua Cultural Heritage Archives"(QCHA)*. Like a YouTube video channel, the channel will consist of a library of videos. Unlike such channels, videos will be enriched with rich semantic information, facilitating re-use by researchers and other interested parties. Videos made available over the channel will be associated with detailed licensing information (different for different videos) ensuring they are only used in ways approved by the Quechua Community. The creation of the channel involves the following steps: • Valérie creates the "*QCHA*" video channel; • She sets access/publishing rights for the channel; • She publishes the channel to the CONVERGENCE network. Once the channel has been created, authorized users in Paris and Cuzco (Peru) will be able to receive material broadcast over the channel as an annotated videostream from the CONVERGENCE network and view it using a CONVERGENCE video player. Authorized users will also be able to download video segments and their annotations for later viewing.
Implementation
The video channel is represented as a VDI linking to other VDIs representing the annotated video segments broadcast over the channel. The creation of the channel, the definition of user rights and the publication of the channel use the same standard mechanisms described in earlier scenarios. Video resources are cached in the network. This guarantees that download and streaming performance is the same in Peru as in France.
Implementation with non-CONVERGENCE technology
See general scenario
Features that cannot be implemented with current technology
No existing system allows users to describe a video channel using the same tools and the same container used to define video segments, complete videos and annotations to videos. No existing system allows caching of content without the use of a proprietary Content Distribution Network.

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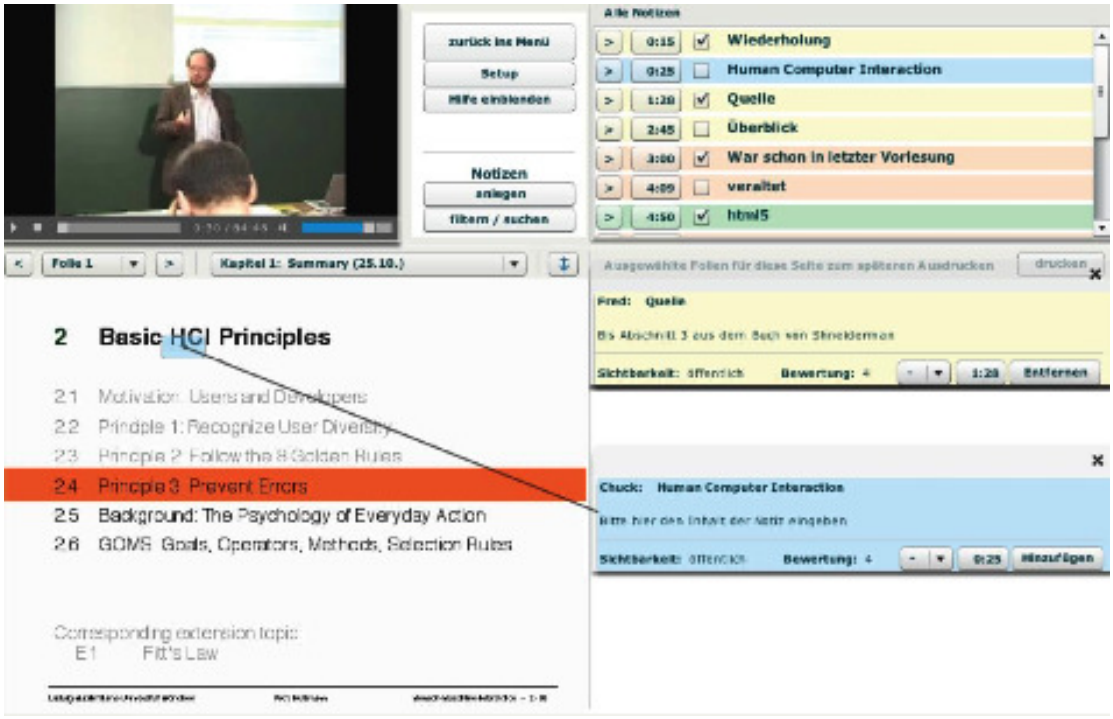
4.2.2.5 Video archive use case: authorized re-use of video segments

General description
Elisabeth manages the *Dialog Archives (DA) channel*, owned by FMSH. As part of her work, she maintains a collection of videos describing music and dance in different Andean communities: • Elisabeth uses CONVERGENCE's semantic search features to subscribe to video materials recording music and dance in Quechua-speaking communities; • When Valérie publishes her video segments, Elisabeth receives a notification from the CONVERGENCE subscribe service; • She uses CONVERGENCE to send a message to Valérie requesting permission to publish and selected video segments, and to enhance them with her own annotations; • Valérie is notified of the license request, accepts it and registers a new license for Elisabeth; • Once the request has been accepted, Elisabeth is notified and publishes the video on her channel; • Elisabeth annotates the videos from her own point of view using terminology based on the *Cultural Diversity & Intercultural Dialogue (CDID) Ontology.*
Implementation
As in the previous use case, Elizabeth's video channel, the CDID, the video segments and their annotations are represented as VDIs. Valérie creates Elizabeth's license using the licensing tool described earlier. All subsequent operations use the same mechanisms already described in the earlier use cases.
Implementation with non-CONVERGENCE technology
All the features mentioned above could be implemented on a centralized server. However, they would only work for materials stored on the server. CONVERGENCE would offer these services regardless of where the materials were located.
Features that cannot be implemented with current technology
• Automatic notification of all new material on a certain topic, whenever it appears anywhere on the network (except for materials residing on a single server); • Automated identification of the owner of new material even the material does not reside on a centralized server; • Sending a message to the owner of any materials; • Easy mechanism to grant a license to the person making the request.

4.2.3 Scenario: Augmented Lecture Podcast (LMU)

General description

One approach to Internet-based learning is to use "lecture podcasts", consisting of video or audio recordings of lectures, possibly accompanied by synchronized presentations. The material is often distributed over the lecture's website, but there are also other possibilities. One possibility is to use *podcasts*, augmented with additional features such as annotations or group-work functionalities. In this scenario, a University uses CONVERGENCE technology to implement such a system. Each podcast consists of several "episodes", each containing a recorded lecture and synchronized slides.



Example of an augmented lecture podcast

Lily Leeds and Tom Mansfield are 3rd year computer science students from two different universities who are attending a course on "algorithms and data structures" which their universities organize jointly. The course is complemented by a lecture podcast delivered through CONVERGENCE. All the students on the course subscribe to the podcasts. CONVERGENCE notifies them when new episodes become available, allows them to download episodes to their smart phones or PCs, updates the episodes when necessary and supports student discussion and annotation of individual episodes.

Description of general user population:

- Lecturers who wish to provide students with the up to date learning materials and to encourage student participation in the learning process
- Students who use augmented podcasts to revise and discuss course content

Named users

- Tom Mansfield: 24. 3rd year computer science student attending the course on "algorithms and

data structures".
- Lily Leeds: 23. 3rd year computer science student from another university, attending the same course

Use cases

- Publishing and updating the lecture podcast
- Subscription to the augmented lecture podcast or partial components of the augmented lecture podcast
- Individual and collaborative learning with the augmented lecture podcast
- Digital Forgetting

Implementation

Students use applications, developed on top of the CONVERGENCE framework and the CONVERGENCE network. Different applications support different terminals (smart phones, pads, PCs etc.); each with their specific characteristics (e.g. display formats). All run over the same CONVERGENCE technology.

The course, individual podcasts, and segments of podcasts are represented as VDIs nested inside each other and published on the CONVERGENCE network. As in the FMSH scenario, the same VDI may contain links to media resources in different formats. This makes the format transparent to the user. The CONVERGENCE network provides synchronization between users using different devices, ensuring that podcasts are always up to date.

Implementation with non-CONVERGENCE technology

Many e-learning platforms providing centralized storage of e-learning materials and support student discussions. A few also support podcasts. At least in principle, such platforms have no difficult in implementing security/privacy features including digital forgetting.

Examples of proprietary solutions commonly used in German universities include Social virtPresenter (University of Osnabrück), Electors (University of Freiburg), UnterrichtsMitschau (University of Munich). Several universities distribute their content via Moodle, an open source course/learning management system that also provides facilities for discussion. However, each of these solutions has its own specific problems:

- When lectures are downloaded as podcasts it is no longer possible to update them. This prevents the lecturer from improving sections where she may not have been clear;
- The podcast formula makes it very hard to update a small part (a segment) of a podcast; when universities offer small segments of a course as separate videos they have to keep the segments in sync with other versions that reuse the same material;
- Different universities each provide their own proprietary services; this creates problems in interoperability.

CONVERGENCE's ability to support multiple terminals, to synchronize learning materials and student comments across these terminals and to interoperate with third party distance learning

platforms provides a decisive advantage.

Features that cannot be implemented with current technology

- Current technologies do not allow the synchronization of materials once users have downloaded them to their phones/pads/PCs
- Current technologies do not allow transparent sharing of materials between users of different e-learning platforms.

Requirements

BA 1;

VDI 1 3 4 5 8 9 11 13 14 15 16 19 33 34 35 36 40 41 43 45 46 47 48 49 62 70 72 74;

FRA 3 4 6 10

APP 15 16

4.2.3.1 Podcast use case: publishing and updating the podcast

General description

Tamara and John are attending a course on "algorithms and data structures", jointly organized by their two universities. Each lecture is recorded on video, structured into sections and synchronized with the slides used during the lecture – making a "lecture podcast". CONVERGENCE lets the two universities deliver the podcasts through their own e-learning platforms. Tamara's university uses a proprietary solution. John's uses *Moodle*. Students access the podcasts through these platforms. Both solutions support student discussion about the lectures. A key feature of the system is that students can add public annotations to slides and lecturers can update their slides to take account of student annotations.

Implementation

The whole lecture podcast, the slides, the video of the lecture, and student annotations are all represented as nested VDIs. The VDI for the lecture podcast contains metadata, supporting synchronization between the slides and the video.

VDI Publishing. When a lecture podcast has been assembled, the VDI for the podcast is published to the CONVERGENCE Network. Segments of the podcast are published separately, as standalone components.

VDI Subscription. Students participating in the course *subscribe* to all podcasts for the course. When a new podcast becomes available, they are automatically notified.

VDI Update: Whenever a lecturer updates a slide, instances of the slide on the CONVERGENCE network are automatically updated

Implementation with non-CONVERGENCE technology

Update of content

It is easy to update content on a single centralized system. However it is difficult to synchronize learning materials stored on two different systems. This will usually involve manual transmission of files, which sometimes need to be converted to a new format. In most cases it will be necessary to transfer whole files. There is no simple and reliable way of transferring small components of the file (e.g. a single slide in a PowerPoint presentation). In cases where students download content for later offline use, it will be necessary to notify them of the update so they can download the material a second time. This means that some students will not download the material. It also makes it very hard to introduce incremental improvements to the learning material.

Using the same content in different applications of different universities

Collaboration between universities with different e-learning platforms is difficult. One approach is to create a common database and content management system meeting the needs of both platforms. However, this requires significant investment in design, implementation and management.

Features that cannot be implemented with current technology

CONVERGENCE does not add core functionality to existing podcasting solutions. However, it

provides an innovative infrastructure offering improved management and interoperability solutions on top of existing solutions. In particular CONVERGENCE facilitates:

- Automated synchronization of learning materials that has already been downloaded
- Automated synchronization of learning materials across multiple e-learning platforms
- Automated access to materials provided at different levels of granularity (whole course, individual podcast, lecture, slides, individual slide etc.)

4.2.3.2 Podcast use case: partial subscription to the podcast

General description
Stephanie Meyer has finished her studies in computer science, but she is still interested in algorithms and data structures. Searching the CONVERGENCE Network, she finds the lecture podcast. However, she is only interested in the slides. She downloads them and subscribes to them, meaning she will be notified when new slides are published or when the existing slides are updated. Later she realizes she *does* want the video but she does not know where to find it. She uses the search function on her CONVERGENCE browser to enter the identifier for the slides and chooses the "search for related VDIs" function. Quickly she finds the videos (and also all the slides for the other lectures in the course).
Implementation
(Partial) VDI Subscription: As each component of the podcast is a VDI, the CONVERGENCE subscription service allows students to subscribe to *components* of the podcast (slides, videos, podcast episodes) as well as to the whole podcast. **VDI Notification:** When new slides or new podcasts become available, students who have subscribed are notified automatically. **Finding a related video:** The VDI for the course specifies a relationship between the slides and the associated videos. CONVERGENCE's semantic search functionality uses this information to find the video.
Implementation with non-CONVERGENCE technology
One way to check if a podcast has been updated is to monitor the website providing the podcast (e.g. by using RSS-feeds). However, this forces the user to monitor a lot of superfluous information. Apple's *iTunes U* (http://www.apple.com/education/itunes-u/) allows students to download podcasts of a lecture and to receive updates when new episodes become available. However, once a new podcast episode has been downloaded it is no longer updated. A user can find files related to a podcast downloaded at an earlier date, if she knows the address of the site from which it was downloaded. Otherwise, Stephanie would have to search for the lecture on the Internet – sometimes a difficult task. She could also use a specialized search engine such as TinEye (http://www.tineye.com/) to perform a reverse search for a specific image. In this case, however, she would need to know that the search engine exists.
Features that cannot be implemented with current technology
None

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4.2.3.3 Podcast use case: collaborative learning

General description
When revising lectures, Tom doesn't just want to watch the video podcast. He has noted a question he wants to discuss with other students. He publishes his question, which immediately becomes available to all students on the course regardless of the platform they are using. Lily, a student from another university in Munich, uses Moodle to reply to Tom's comment anonymously. Tom sees the answer immediately.
Implementation
In this scenario it is comments that are represented as VDIs. **VDI Publishing.** All comments are published as VDIs to the CONVERGENCE network. Private comments are only visible to the author of the comment (who can see them on any terminal she owns). Public comments are visible to a predefined group of users (in this case the members of the course and (possibly) the teacher. **VDI Security:** Comments are not visible to all users. The author uses a license (expressed in REL) to define who can access the comment.
Implementation with non-CONVERGENCE technology
Most centralized e-learning platforms will allow the sharing of comments among users of the platform. However, to the knowledge of the authors, no current e-learning platform supports open discussion with users of a different platform. The only way of organizing such a discussion is by using chat tools (IRC, Skype etc.) or by exchanges of email messages. These approaches lose the integration with the platform.

Features that cannot be implemented with current technology
No current technology allows users to freely define a “license” for their comments. In all cases the equivalent permissions are defined by the owner of the platform.

4.2.3.4 Podcast use case: digital forgetting

General description
At the end of the course, Tom feels uncomfortable that future users (maybe a future employer) should read his contributions to the discussion. He knows that all his comments have an "expiry date". Now, however, he opens the augmented lecture podcast application, searches for the discussion and selects the option to un-publish his comments immediately. With this decision, all his annotations are removed from the CONVERGENCE Network.
Implementation
Expiration Date for VDI. When a user seeks to access a VDI the system checks its expiry date and will not deliver the VDI if it has expired. Expired VDIs may be periodically purged from the system. **Revoke VDI.** When Tom wants to delete a comment, he can revoke it. The VDI is automatically removed from all CONVERGENCE nodes where it is present.
Implementation with non-CONVERGENCE technology
When a user deletes a comment from an internet discussion it may be flagged for deletion on the database used to manage the discussion (if the system provides this functionality). If the comment has been republished on other systems it will remain accessible to other users. X-Pire! (http://www.x-pire.de/) attempts to resolve this problem for photos. A key is stored on a Server together with its expiration date. Once the photo is encrypted, the owner can upload it to the Internet. To retrieve the photo, other users have to install the X-Pire! Software, which retrieves the corresponding key from the Server, decrypts the photo and displays it. Once the expiration date is reached, it is no longer possible to retrieve the key. However, if an attacker retrieves a key before the expiry date he/she will still be able to decrypt the photo. In some cases, services (like Facebook) may compress the photo before storage. In this case, it is no longer possible to decrypt the photo. For more detailed information see http://www.infsec.cs.uni-saarland.de/projects/forgetful-internet/ (in German)

Features that cannot be implemented with current technology
Digital forgetting for arbitrary objects.

4.2.4 Scenario: Smart Retailing (WIPRO/UTI)

General description
This scenario describes CONVERGENCE applications that help manufacturers and retailers to create and maintain self-contained packages of information (VDIs) describing the products they sell to customers. The scenario describes how the use of VDIs helps them to serve customers and helps consumers to find, purchase and use products. The CONVERGENCE platform allows manufacturers and retailers to transmit information about their products among themselves and to customers. The CONVERGENCE network and middleware ensure that the information provided is always accurate and up to date, *even when it is provided via a third party retailer or broker*. CONVERGENCE makes it easier for manufacturers and retailers to reach customers who have bought their products (e.g. for market research, advertising safety recalls etc.). CONVERGENCE allows consumers to look for products whose VDIs have been published on the network, without relying on any specific manufacturer or retailer site (whose address they would have to know). This makes it easier for them to find products from small manufacturers who do not spend heavily on advertising. It also makes it easier for small manufacturers to reach customers.
Description of general user population:
• Manufacturers wishing to sell their products without investing heavily in marketing • Retailers • Customers
Named users
• John: manufacturer • Mark: retailer • Hanna: sales clerk • Alice: customer

Names of Use cases

- A retailer orders a product
- A customer checks product information
- The customer buys the product
- The customer returns the product
- Repairing the product
- A safety recall
- Giving away the product – second hand sales

Implementation

CONVERGENCE allows manufacturers and retailers to associate a product with a VDI, itself associated with a unique identifier represented by a bar code (or some other unique identifier such as a two-dimensional bar code or an RFID).

The VDI allows the manufacturer to create a complete package of searchable, structured information for a product. The information provided may include technical characteristics, country of origin, availability information, information on discontinuation, links to user and maintenance manuals, warranty information etc. The bar code allows manufacturers, retailers and consumers to find this information rapidly.

In the scenario described here, manufacturers create the original VDIs for their products and publish them to the CONVERGENCE network. Retailers create and publish VDIs that incorporate or link back to the manufacturer VDIs, augmenting them with new information (on prices, availability, discounts etc.).

When manufacturers and retailers update the VDI for a product they use updating functions provided by the CONVERGENCE framework. CONVERGENCE reliably propagates the information to all copies of the VDI wherever they are located on the network. Critical data (e.g. on date of purchase) is protected using CONVERGENCE security. The CONVERGENCE REL allows authorized users to specify who can modify which parts of the VDI. Manufacturers and retailers can also use CONVERGENCE send messages to the owners of VDIs for their products. This capability can be used for market research, active marketing and in other circumstances (e.g. for product recalls).

Consumers access product information either directly (by scanning the bar code and finding the VDI associated with the product), or indirectly via CONVERGENCE's search and subscribe functions. These allow consumers to find all products meeting a given criterion (class of product, price, characteristics etc.) or all products similar to a product they already know.

In the scenario, retailers and manufacturers use dedicated applications built on top of the CONVERGENCE framework and the CONVERGENCE network. Different organizations use different applications. The CONVERGENCE framework and network guarantee interoperability. Shoppers can use a dedicated application supplied by a shop or a generic VDI browser (in their homes, on a mobile device).

Implementation with non-CONVERGENCE technology

An individual manufacturer or retailer can use standard mobile application, database and web technologies to implement this kind of service for its own products. Theoretically such services could allow users to search for products using their bar code[2] and perform semantic searches as in CONVERGENCE. However implementing such functionality would be very expensive. Proprietary solutions force retailers and consumers to keep up to date with many different web sites, many of which have low visibility Neither manufacturers nor retailers have any control over the information provided by brokers or price-comparison sites.

Existing applications on mobile devices already allow users to scan bar codes. However, the majority of these applications only interpret the information within the barcode, and do not provide any link to additional information. The CONVERGENCE application will not just read the barcode, but will search for connected information, in real time.

Features that cannot be implemented with current technology

CONVERGENCE allows manufacturers and retailers to define products in a unitary manner, within a standard, yet flexible structure (the VDI). Consumers who have bought a product will be able to find out information about the product (e.g. a user manual) simply by scanning its bar code with a standard tool. No current technology provides this possibility.

VDIs published to the CONVERGENCE network are accessible to all authorized users, regardless of the terminal or service they are using. This means that customers will be able to search for products without knowing the addresses of specific sites and services. This possibility, unique to CONVERGENCE, will allow manufacturers and retailers to reach a larger number of customers and to provide them with more reliable, up-to-date information than is currently possible. The use of VDIs will allow providers of services (e.g. repair companies) to advertise their services through VDIs associated with product's VDI, thereby creating a new business ecosystem.

Requirements

BA 1;

VDI 1,2,5,8,9,12,15,17,18,20-25, 29, 34, 35, 37,40, 42,43,45,47,49-53,55-58,61, 63,64, 67;

FRA 1-10;

CDS 1-4,6,7.

[2] This capability is beginning to appear in iPhone and Android apps.

4.2.4.1 Smart retailing use case: a retailer orders a product

General description
John, an electronic manufacturer, is releasing a new Blue-Ray player. He therefore creates and publishes a "product type" VDI for the new model. The VDI contains a broad range of technical and non-technical information (e.g. manufacturer, wiring diagrams, parts details, users manuals, firmware details...). The license for the VDI allows retailers to issue "child licenses" removing some of the information in the "product type VDI" and adding new information (e.g. on price, availability, special offers, co-marketing opportunities etc.). Mark, a big retailer who deals with John frequently, wants to add a new player to his product portfolio. He starts by creating a CONVERGENCE subscription for players with the characteristics he is looking for. Once this is done, CONVERGENCE notifies him every time a new player meets his search criteria. In one of these notifications Mark find's John's new model. He subscribes to it. This means he will receive a notification when the player is ready to be ordered. Once the notification arrives, Mark orders the player. The VDI for the player is automatically transferred to his ERP system, avoiding the need to input the product details. What was once a time-consuming task is now much simpler. Given that all the data is already in the ERP system, product labelling and advertising can be created automatically.
Implementation
VDI creation: The electronic manufacturer creates and publishes a "product type" VDI for the player, as described above. **VDI subscription.** The retailer subscribes to all players meeting a specific set of criteria. Retailers may also subscribe to a specific player. **VDI notification**. CONVERGENCE notifies the retailer whenever a new player meets his search criteria or whenever a manufacturer updates the information for a player he has subscribed to. The retailer can use the notification to access full information about the player.
Implementation with non-CONVERGENCE technology
The manufacturer can provide information about his products through his own web site, RSS feeds or custom defined newsletters. The retailer can subscribe to RSS feeds / newsletters.

Features that cannot be implemented with current technology
Standard mechanism to access information on any product from any manufacturer. Standard subscription/notification process for any product from any manufacturer.

4.2.4.2 Smart retailing use case: a customer orders a product

General description
Alice wants to buy a Blue-Ray player. She searches for the product using CONVERGENCE search functionality in her CONVERGENCE browser. The application allows her to specify exactly the features she requires (price, technical characteristics etc.). She receives a list of products that match her criteria, with links to retailers who sell the product. She settles for a retailer. She goes to the shop. When she gets to the shelf with the product, she uses her smart phone to read the bar code for the player and access its VDI. She checks it has 7.1 audio channel output, which is what she is looking for. She searches for related VDIs. She finds that the store has some new Blue-Ray movie releases and discovers she can get a 10% discount for 3 Blue-Ray disks if she buys the player.
Implementation
VDI search: Alice defines her search criteria using the CONVERGENCE browser. The Browser requests the CONVERGENCE network to return a list of VDIs matching the search criteria and displays them for Alice. **VDI Consult:** Alice chooses a VDI on the list. The browser downloads the VDI and displays the information it contains. She can follow the links to retailers' VDIs to obtain information on price, and availability. Alternatively she can search retailer's VDIs, filtering by specific search criteria. **Product identification:** Alice picks up the product and uses her mobile or a shelf device to read the VDI identifier contained in the barcode. **Product matched / VDI Consult:** The application uses CONVERGENCE network capabilities to retrieve the VDI corresponding to the identifier and to display the information it contains.
Implementation with non-CONVERGENCE technology
Alice can access a particular retailer's site or manufacturer's site and access product information there. This implies she has to know the address of the site or obtain it from a search engine where it may have a low rank. She can use a mobile application to interpret the barcode, but the application can only display the information already contained in the code. No current technology allows her to directly access information from the manufacturer.
Features that cannot be implemented with current technology
• Standard search mechanisms for any product from any manufacturer or retailer. • Standard mechanisms to access key product information (price, technical specs etc.). • Automatic matching between a barcode of a physical product and rich product information.

•

4.2.4.3 Smart retailing use case: the customer buys a product

General description
Alice is just about to buy a new Blue-Ray player. After she has paid, Brian, the sales clerk, asks her to put her wallet close to the store's VDI-enabled reader. The POS reads the RFID in the CONVERGENCE card she keeps in her wallet and uses her digital signature to generate a new VDI for the player she has bought. This certifies that Alice is the owner without providing any personal information about her to the storeowner. The new VDI inherits relevant information from the generic VDI for the model she has bought, certifies that Alice is the owner of the player and includes the serial number of the player, the warranty and the user manual. The VDI is digitally signed, guaranteeing the authenticity of the information it contains.
Implementation
• **VDI creation:** The application generates an owner VDI that links Alice with the VDI's product and includes the warranty and the user manual. • **VDI signing:** The application guarantees the authenticity of the information provided by digitally signing the ownership VDI.
Implementation with non-CONVERGENCE technology
Current technology makes it theoretically possible to create and sign a digital document with the same information contained in the ownership VDI. To the knowledge of the authors, the only manufacturers or retailers to use such technology are online resellers of computer software. All solutions using current technology would require customers and other interested parties (e.g. maintenance services) to own and understand the cryptographic software necessary to authenticate the retailer's digital signature. The majority of retail customers are unlikely to satisfy this requirement.
Features that cannot be implemented with current technology
The features described could in theory be implemented using standard cryptographic tools. For practical reasons (see above) this is very unlikely to happen in practice.

•

4.2.4.4 Smart retailing use case: the customer returns the product

General description
Alice wants to return the player she has recently bought and buy a new one. The store where she bought the player has a policy of accepting returns in the first month after purchase. However, in many cases the customer has lost the receipt. CONVERGENCE eliminates this problem. When Alice returns the player, Hanna, the customer service agent, checks Anna's ownership VDI. This contains all the information she needs. She takes back the player and revokes the VDI. Alice goes off to buy her new machine.
Implementation
• **VDI consult:** Hanna uses the store application to read the bar code for the player and to verify the associated ownership VDI • **VDI revoke:** Hanna revokes the ownership VDI.
Implementation with non-CONVERGENCE technology
This use case could theoretically be implemented with standard cryptographic technology. For reasons described above this is unlikely to happen in practice.
Features that cannot be implemented with current technology
See above

4.2.4.5 Smart retailing use case: repairing the product

General description

Alice's Blue-Ray player has broken down and she has to repair it. She starts by checking if there is any information about repair shops in the VDI for the player. If she finds a shop, she sends the shop the VDI for the broken player. The shop checks the warranty and gives her a date when they will come and pick it up. If the VDI for the player has no information on repair shops she can search for a repairer using the VDI search tool. The alternative is to take the player back to the original retailer.

In the end this is what she does. She goes to the shop's after sales service and explains the problem to Hanna. Hanna checks the warranty details in the VDI for the player, finds that the repair is covered by the warranty and sends it in for repair. A few days later, Alice comes in to pick up the player. It has been repaired and its VDI has been updated to describe the repair. Arriving home, Alice can query the VDI to see what the problem was.

Implementation

- **VDI search.** Alice searches for repairing shops using her player's VDI to define the search criteria.
- **VDI consult.** Alice reads out details of nearby retailers how to reach them.
- **VDI update:** Hanna updates the player's VDI with information about the repair process.

Implementation with non-CONVERGENCE technology

Manufacturers and retailers can put information about repair shops on their web sites. Repair shops can also advertise their services directly. However users will only find the repair shop if they already know its web address or if they are sufficiently skilled to find it with a search engine.

Often the user will not know enough about the product (model, serial number etc.) to interact efficiently with maintenance staff. In many cases they will have to go to the repair shop in person, only to find their equipment cannot be serviced or their warranty is invalid.

Features that cannot be implemented with current technology

Entire feature.

4.2.4.6 Smart retailing use case: safety recall

General description
One of John's players catches fire in a customer's home. The fire brigade rapidly informs John of what has happened. Within a few hours, he has traced the problem to a faulty component. He updates the VDI for the players with an emergency recall notification. Shops stocking the player receive an alert and immediately withdraw it from their shelves. Consumers who have bought the player receive a message on their browser reinforced by an email or an SMS.
Implementation
• **VDI update:** The manufacturer updates the player VDI with the recall details. After the safety recall, the product VDI is updated with information informing consumers and sales people about the risk. The information automatically propagates to retailer and owner VDIs. • **VDI notification**. CONVERGENCE notifies the owners of players (owners of owner VDIs) of the recall. • **Sending a message to all users owning a VDI** with particular characteristics (by email, SMS, etc.).
Implementation with non-CONVERGENCE technology
Manufacturers can keep a record of all users of a product. However, this is unusual for low value products with no specific safety risks and has implications for user privacy. Users can register their products leaving contact information. However, the percentage of users doing so is very low.
Features that cannot be implemented with current technology
Notify the entire user population for a product rapidly and with high reliability.

4.2.4.7 Smart retailing use case: a second hand sale

General description
Alice wishes to sell her player on the second hand market. However, she knows many potential buyers do not trust the information provided by sellers. CONVERGENCE resolves the problem. She uses the CONVERGENCE publisher to create a special "sales VDI" linking to the ownership VDI for the player. The VDI includes everything a buyer might want to know: model, manufacturer name, date of purchase etc. She enriches the VDI with information of her own: (e.g. a tag indicating the player is for sale, condition of player, price). Now, any CONVERGENCE user wanting to buy a player will be able to find Alice's player and make contact with her.
Implementation
VDI update: Alice creates a new VDI for the player linking to her original ownership VDI. The information that the player is for sale is encoded in a "For sale" tag in the meta-information. She publishes the VDI using standard CONVERGENCE features. **Search and subscribe:** Users wishing to purchase a second hand player can search for a player using CONVERGENCE's search features. Alternatively, they can subscribe to all new VDIs meeting their search criteria. Users will probably specify that they are looking for "Blue Ray" players" that are "for sale", have a price within a particular price range and are located in their own country (this information is contained in the geo-referencing information in the ownership VDI).
Implementation with non-CONVERGENCE technology
Not available.
Features that cannot be implemented with current technology
Entire feature.

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5 The Focus Groups

5.1 Description of the focus groups

5.1.1 Overview

The reviewers suggested that it was problematic for the partners to use focus groups of participants coming exclusively from within the Consortium. In principle this is correct. The report below therefore includes a description of a new focus group organized by WIPRO with representatives of major retailing companies from outside the CONVERGENCE Consortium. In this focus group, participants held an extremely useful discussion of the retailing scenario. Key points in the discussion are summarized later in this chapter.

In discussions following the project review, LMU and FMSH pointed out that in reality their focus groups *already included* participants from outside the Consortium and that this had not been adequately communicated in the original version of the deliverable. Alinari, on the other hand, pointed out that the use scenario focuses on internal Alinari business processes and it is difficult for external users to provide useful input in this phase.

The paragraphs below summarize the main features of the four scenarios. Appendices I-4 provide the original reports provided by the focus group coordinators. The texts are deliberately unedited to preserve the "flavour" of comments from participants.

5.1.2 Alinari

The focus group at Alinari was organized in Florence, Italy. The group was made up of 8 Alinari employees involved in projects and activities ranging from education to professional content indexing, picture annotation etc. The group was predominantly female (1 male and 7 female). All participants had a university degree. Ages ranged from 27 to 45 with the majority of participants in their late 20s and early 30s. 5 users out of 8 considered themselves to be expert users of personal computers, 3 out of 8 reported that they were average users.

5.1.3 FMSH

The FMSH focus group took place in Paris, France. The group included 10 participants (male: 3, female 7), 4 came from universities and other institutions not participating in the CONVERGENCE project, 2 from FMSH laboratories with no link to the project and 4 from ESCOM – the laboratory representing FMSH in the project. This mix ensured that the focus group represented all potential users (FMSH staff and potential users). 2 participants were students. 8 worked in teaching or research. All had university degrees. Ages ranged from 27 to 58. 6 users considered themselves to be technicians or expert users of personal computers. 4 reported they were average users. All participants were experienced in the use of the kind of

video materials described in the user scenario. Five jobs described in the scenario were represented in the group: pattern designer, video producer, analyst, author, and developer.

5.1.4 LMU

The LMU focus group was organized in Munich, Germany. It comprised 7 subjects (5 male and 2 female) with an average age of 26. All participants were undergraduate or PH.D students either at LMU or at Technische Universität Muenchen (not a member of the Consortium). None had any previous involvement with the CONVERGENCE project. One subject had a background in finance. All remaining participants had a background either in computer science or media informatics. 4 of them had their High School Certificate; 3 of them had already achieved their University Degree. 4 out of 8 participants rated themselves as technicians or expert users of personal computers, 3 stated that they were average users.

5.1.5 WIPRO

The WIPRO Focus Group took place on in April 2011, on the premises of Wipro in Porto, Portugal and was the only focus group to take place *after the release of the first version of D2.1, after the project review and after the initial review of the user scenarios.* This made it possible to present participants in the group with a very concrete, realistic view of CONVERGENCE.

The group consisted of 13 participants including representatives of two major electronics retailers: Worten and Radio Popular. Worten is the market leader retailer in the electronics and entertainment area in Portugal with a turnover of €708 million; Radio Popular is another well-known electronics retailer with a turnover of €300 million. Other participants included 7 technical specialists from WIPRO staff with no previous involvement in the CONVERGENCE project. These participants were included to provide an end-user perspective. The ages of participants were uniformly distributed in the range 24 to 40. 9 participants were male and 4 female. Of the female participants two held senior management positions. All except one participant had a university education. All except one considered themselves to be expert users of PC and Internet technology.

5.2 The CONVERGENCE concept

5.2.1 Understanding the concept

At the beginning of the focus groups, participants were shown a PowerPoint presentation explaining the CONVERGENCE concept and were asked to give their first reactions. The presentations to the Alinari, FMSH, and LMU groups were relatively general. By contrast, the WIPRO presentation focused on comparing current retailing solutions with the possibilities offered by CONVERGENCE. To make the discussion more concrete, the presentation illustrated how Worten, Radio Popular and their competitors in Portugal are handling Roomba

– a popular vacuum robot. The presentation showed differences in the product information provided on the web sites of different retailers and examined the way second-hand sales sites, described the product.

In the three groups that received the general presentation, participants had some difficulty in forming a clear idea of the system. This was true even for participants with a computer science background:

> "I understand the concepts you have described, but I can't imagine it in my everyday life with Internet. How do users use your system? Is it a desktop application? Is it a website? How do you enter the market?" (LMU user)

Participants in the Alinari focus group wanted to understand where VDIs are stored. Many had difficulty with the idea that a VDI could be stored "on the network". One of the participants in the LMU group asked:

> "Have you decided on the structure of the VDI? Is it like a folder with my name (first name, last name), does it contain everything about me?"

Several participants said that they would like to see real CONVERGENCE applications before expressing a view of the system.

Participants in the WIPRO group did not express any particular difficulty with the CONVERGENCE concept. In general, however, they were more interested in what CONVERGENCE could do for their business.

5.2.2 Attractive features of CONVERGENCE

5.2.2.1 Ownership and control

Despite the difficulties reported in the previous paragraph, general reactions to CONVERGENCE were positive. Probably the concept that most attracted participants was the idea that an author *owned* a VDI and could control what other users saw.

> "My résumé is something that belongs to me, it is so much mine that I think I should be able to decide who has access to it and who hasn't" (LMU participant)

The media professionals who participated in the Alinari focus group attached great importance to the fact that CONVERGENCE could guarantee the authenticity of a photo and protect against copying.

> "Authenticity of photographs is for Alinari the number one priority! It is important to make sure that from a legal and technical point of view (…) the authenticity and ownership of content is fully guaranteed".

An LMU participant made the same point:

> " You have to ensure, that no raw data can be extracted from the VDI. Otherwise, someone could just do that and publish the data as his own." (LMU participant)

Participants in the FMSH focus group were also interested in security but from a different perspective. The main interest of this group was not in protecting the commercial value of media but in controlling the way it was used by information consumers.

> "It is very reassuring for people who own an audiovisual collection and are frightened what other users could do with it" (FMSH participant)

In general, there was scepticism about CONVERGENCE's ability to protect media. Participants pointed out that once a user has copied a photo onto her local machine she could do what she wants with it. One user liked CONVERGENCE's security features, but insisted that they should not become too complicated. Hard-to-use procedures for rights management could be a barrier to take-up.

5.2.2.2 Standardized descriptors

The participants in the WIPRO group, mainly the senior managers, reacted very favourably to the idea of using VDIs as standard vendor-independent descriptors for products. Several participants suggested that lack of such a descriptor was a major problem. Reasons given included:

- The cost of obtaining product information;
- The globalization of the supply-chain for electronic goods;
- The time required to update online and paper catalogues;
- The importance of technical features as the only differentiator for otherwise identical products;
- The lack of standardization in the product descriptions provided by manufacturers.

5.2.2.3 Synchronization

Another feature that was seen positively was synchronization.

> *"The solution that the system is synchronizing the data in a seamless and efficient way (in the background) make the project extremely powerful and useful for our needs! (Alinari participant)"*

5.2.2.4 Search

Several participants compared CONVERGENCE to Google. They were impressed by the idea that CONVERGENCE might give a far shorter list of search results than Google. However, those with a technical background questioned this assertion.

> *"I have a question about the search thing: You had this example where the company calls up a VDI about Mr. Brown. With today's Internet you have to search with thousands of results. But with CONVERGENCE you just look for the VDI and all of a sudden you got the right one. It sounds so simple, but actually it isn't." (LMU participant*)

5.2.3 Scenarios for the trials

5.2.3.1 The discussion

After the discussion of the general CONVERGENCE concept, participants discussed possible user scenarios, in some cases suggesting concepts that differed from the scenarios originally proposed by the partners.

Figure 1: A moment during the Alinari focus group

5.2.3.2 Alinari

The leader of the group presented four possible scenarios, with many features in common.

- The first used VDIs as the basis for a photographic exhibition at a local airport and an *ad hoc* web site showing the same content. The advantage of using VDIs was that it would make it easy to take an exhibition designed for one airport and use it for another.
- The second scenario showed the use of CONVERGENCE to create e-learning content for local schools. In this case too, CONVERGENCE was seen as a tool making it easy adapt content designed for one context for use in another.
- In the third scenario, CONVERGENCE was used as the basis for a photographic exhibition. In 2009, Alinari published a book celebrating the 20th anniversary of the fall of the Berlin Wall. In this scenario, the book is used as the basis for an exhibition that can be adapted to the needs of different customers in different parts of the world.
- In the fourth scenario, CONVERGENCE was used to create customized photographic portfolios and newsletters for distribution to Alinari customers. As in the previous scenarios, the main advantage of CONVERGENCE was that it made it easy to adapt the portfolios and the newsletters to the needs of specific customers.

Participants in the focus groups reacted very positively to the scenarios. One stated that the synchronization feature and the VDI concept were a perfect match for the Alinari workflow and for Alinari needs. Another suggested the creation of a CONVERGENCE package for Alinari customers including the tools and instructions necessary to use CONVERGENCE

efficiently. Another focused on possible business models and asked whether Alinari adopt a "pay for view" or a subscription model.

5.2.3.3 FMSH

Participants in the FMSH focus group suggested a large range of scenarios in which CONVERGENCE could be usefully applied within FMSH.

- One suggestion was to use CONVERGENCE to create a resource center for members of the Quechua-speaking community. CONVERGENCE would allow members of the community to define how other users could use the resources, and would allow them to add value of their own (e.g. by subtitling, adding descriptions etc.).
- Another participant proposed a media library on the history of the mathematics, designed for non-mathematicians. The library would contain in-depth interviews with mathematicians, based on a common set of questions and could be used for scientific popularization. If interviewees knew that the library was based on CONVERGENCE, they could be confident they could control the way the library was exploited.
- Another participant proposed the development of a resource center for Azerbaijani culture. The features of the center were very similar to those of the Quechua resource center proposed earlier.
- Another idea was to create a video library on the "intercultural city", dedicated to intercultural teaching and learning.

In general, participants identified several useful features of CONVERGENCE:

- CONVERGENCE would make it possible to create replicas of a resource library in several different locations (e.g. in Cuzco and in Paris). CONVERGENCE would guarantee that the replicas were always in sync.
- Participants liked the idea that users could add value to a resource (e.g. by adding subtitles), and that all users could benefit. This is another advantage of CONVERGENCE's synchronization features.
- They also liked the idea of being able to create new resources, using extracts from a range of original sources.

They also identified two weak points in the scenarios

- The scenarios did not show how users other than the original authors could exploit CONVERGENCE rights management (e.g. to define rights for enhancements they have added to original content.)
- The scenarios did not exploit CONVERGENCE's digital forgetting features.

Participants agreed that the scenarios used in the trials should remedy these deficiencies.

5.2.3.4 LMU

Participants in the LMU focus group focused on the podcast scenario described earlier in this document. The general opinion was that this was an interesting scenario. However, most of the participants were finishing their studies and would not therefore have an opportunity to test the scenario for themselves.

For this group, CONVERGENCE's main advantage was its ability to support discussion. One participant stated she particularly liked the possibility of downloading VDIs for the lecture rather than watching a "stream". However participants also noted at least two possible problem areas.

- Participants in the discussion might suffer from information overload. One participant suggested that CONVERGENCE needed some kind of filter to prevent users from having to process too much information.
- Several users wondered about to implement digital forgetting in a conversation in which one user might comment on a node that was later deleted. As one user put it:

  "If you want to realize the concept of privacy, you have to allow users to delete their comments; otherwise you won't be able to keep your promises. But you'll be confronted with a lot of difficulties".

  Another said:

  "It's completely different to what we are used to. When I download something and all of a sudden it is gone. I can't imagine that. There should be something like a notice period of 2 weeks, so the user is prepared."

There were several suggestions for improvement to the scenarios. One participant suggested that users should receive a notification every time someone changed one of the exercises. Another suggested the introduction of a user rating system so that users could focus on the slides that were most interesting i.e. those with the highest ratings.

5.2.3.5 WIPRO

Before beginning the discussion, the leader of the WIPRO focus group gave participants a detailed description of the trial scenario, which was very well received. Several participants suggested how they could use CONVERGENCE to resolve actual business problems:

- Radio Popular obtains product information from a company called JFK, which offers a proprietary solution. The disadvantages of this solution are cost and limited possibilities for integration with the Radio Popular ERP (JFK supports only one ERP platform). Participants suggested that CONVERGENCE could resolve these problems by providing standard vendor-independent product descriptors of products, available over the CONVERGENCE network. Such descriptors would have the added advantage that they would work with any ERP platform.
- Competition in the retail market is very aggressive. One key differentiator among retailers is the product information provided to customers. CONVERGENCE would help the retailers provide more and better in-store information to customers, including the possibility of accessing information associated with bar-codes.
- CONVERGENCE would enable digital warranties. This would bring many benefits, for retailers as well as customers. It would resolve frequent problems related to customers losing their receipts or the receipts fading over time. It would also help to reduce fraud (e.g. when a customer exchanges the receipts for two identical product).

- CONVERGENCE would make it easier for retailers to keep track of the serial number of products, which are usually not registered at the cash desk. Being able to keep track of serial numbers could make an important contribution to inventory management.
- CONVERGENCE could make an important contribution to Customer Relationship Management making it easier for retailers to contact and monitor customers who have bought products from them, without collecting personally sensitive information.

Several participants made important suggestions about the general conditions in which CONVERGENCE could be implemented:

- One suggested the need for legislation explicitly allowing shoppers to photograph product barcodes (many shops have policies prohibiting use of cameras).
- Another pointed out that any process involving CONVERGENCE (e.g. generation of digital warranties) needs to be rapid. Retailers have an essential requirement not to create any delay that could induce customers to abandon their purchases.
- Another observed that some customers do not want to be identified. It is very important to define how CONVERGENCE should deal with this kind of situation.
- Participants were critical about the idea of using CONVERGENCE to compare prices between different retailers. As one put it,

  > *"Retailers struggle everyday to differentiate themselves from each other in order to build competitive advantages that enable them to attract more customers. And once they gain these competitive advantages the last thing they want is to give them up"*.

  Participants were adamant that CONVERGENCE should attract retailers and not drive them away.

5.2.4 Improving CONVERGENCE

Participants in the focus groups made several suggestions for improving CONVERGENCE and identified points that designers might neglect.

- Alinari participants believed it was very important that the code for CONVERGENCE should be released in Open Source format.
- Another important issue for these participants was multiple language support.
- Alinari participants raised the issue of technical support, stating that this was essential if CONVERGENCE was to be successful.
- Another – again from Alinari - suggested that users should be able to "roll-back" VDIs and previous versions of a current VDI. This could work like the "Time Machine" on an Apple Macintosh[3]
- Several participants at Alinari and at FMSH insisted on the need for fine control over user rights. Users should be able to control rights not only for the VDI as a whole but also for segments of a VDI.
- A participant at FMSH pointed out that not all rights are "access rights". In film-making and photography, for instance, people who are photographed have to give their permission before the image can be used.

[3] This feature has now been included in the requirements.

- One user at LMU agreed that control was a good thing but was worried it could endanger anonymity, which he saw as another positive feature of the system.
- Another LMU user thought it would be "awesome" if CONVERGENCE could provide information on how often a VDI is downloaded. [4]
- -A WIPRO participant suggested that CONVERGENCE could facilitate customer purchases of warranty extensions.
- CONVERGENCE could also make it easier for retailers to provide customers with information on products they do not have in stock, and to order such products.
- WIPRO participants argued that the availability of good repair services is essential for sales. CONVERGENCE could make it easier to organize customer support networks.

5.2.5 User opinions on the focus group

Participants' opinions on the focus group were extremely positive, although at LMU several thought it had been too long and suggested it would have been better if some of the questions had been asked by questionnaire.

5.2.6 Final assessment of CONVERGENCE

For one user at Alinari,

> "*VDIs will create a new standard, a new workspace, a new method to work and share content in cleverer, more efficient way!"*

This view reflected a generally positive impression. However, Alinari users were very much concerned about CONVERGENCE Digital Rights Management. From an Alinari point of view, the way CONVERGENCE handled this problem would determine the acceptability of the product.

For participants in the FMSH focus group, the most important features of CONVERGENCE was its ability to synchronize replicas of VDIs stored in different locations, the control it gave users, and digital forgetting.

In the LMU group, the four words most frequently used to describe CONVERGENCE were "versioning", "linking", "trust" and "control". Like the FMSH users, they thought users should be able to access old versions of a VDI that had been updated. Many users referred to the possibility of "nesting" one VDI inside another VDI or linking to another VDI. Finally users were favourably impressed by the control that CONVERGENCE offered to users.

The WIPRO group also gave very positive feedback. The leader of the group summarized the conclusions as follows:

> *"CONVERGENCE has the potential to bring many advantages for the retail industry, at least from the standpoint of the retailers that participated in the Focus Group. But those advantages will only prosper if the project keeps in mind retailers' problems and determines the best way to bypass them."*

[4] This feature too is now included in the requirements

6 Unique features of CONVERGENCE, as illustrated by the user scenarios and the focus groups

6.1 CONVERGENCE as a standard

In the original version of D2.1 we presented an analysis of CONVERGENCE'S "Unique Selling Points", as they emerged from the scenario development process and the focus groups. Today we are able to present a more complete, better-organized list (see following paragraph). An analysis of this list points to two overarching conclusions:

- The majority of end-user features provided by CONVERGENCE could in principle be, individually, implemented with existing technology.
- The main advantage of CONVERGENCE is that it offers standard, non-proprietary features to all users of the CONVERGENCE network.

In what follows we will argue that these aspects of CONVERGENCE provide fundamental advantages to consumers, businesses, software developers and network operators.

6.2 CONVERGENCE: Unique selling points

6.2.1 Overview

The revision of the user scenarios has made it possible to clarify and re-organize the Unique Selling Points of CONVERGENCE, described in the previous version of this deliverable. In our current vision, the main such points are the following:

CONVERGENCE offers **end-users** the possibility to:

- Bundle data resources and structured metadata describing these resources into a single, standard, self-consistent package (the VDI) with a unique identifier and the capability to represent media, services, people and Real World Objects;
- Define a license using a standard language to define who can access the VDI and the precise conditions for access;
- Digitally sign and/or encrypt the content of a VDI;
- Define ontologies making it easier for users to search for the VDIs they publish and make these ontologies available to all users of the CONVERGENCE network;
- Publish the VDI making it available to all authorized users on the CONVERGENCE network, (if desired, to all users);
- Monitor the use of VDIs they have published;
- Update the information in the VDIs they have published, ensuring the update reaches all users of the VDI;
- Rapidly and reliably retrieve VDIs, regardless of the location of the VDI owner (thanks to network caching);

- Search for and retrieve any VDI on the CONVERGENCE network, exploiting the VDI metadata and the semantic capabilities of the CONVERGENCE Community Dictionary Service;
- Subscribe to VDIs meeting specified search criteria, and receive a notification on publication or update of VDIs satisfying the criteria;
- Verify the authenticity of a VDI and decrypt any encrypted content (key owners only);
- Communicate with owners of VDIs without the need to access personally sensitive information;
- Ensure that copies of VDIs do not persist on the network beyond a pre-defined expiry date (digital forgetting).

Developers will be able to build applications that exploit and add value to these functionalities, ensuring that different businesses and individuals can exploit CONVERGENCE functionality in the ways that best meet their needs.

Network operators and content providers will benefit from the move from the current *packet switching* paradigm to a new *content switching paradigm* in which content is efficiently distributed across the network, taking account of network capabilities, traffic conditions and the transmission requirements of specific types of content.

These Unique Selling Points offer a finer-grained, technically more accurate, definition of the six key features of CONVERGENCE originally described in the Description of Work (i.e.: Real world Object support, Dynamic VDIS support, Digital forgetting, Security and privacy, Semantic handling, User generated content and easy sharing). In what follows we will discuss these features, the way in which they relate to the scenarios and use cases and the way in which they benefit the different actors in the CONVERGENCE value chain.

6.2.2 VDIs "bundle" resources and metadata into a self-consistent package of information with a unique identifier and the capability to represent media, services, people and Real World Objects;

The advantages of this feature came out very clearly in the focus groups. In the Alinari and FMSH focus groups, for example, users suggest scenarios in which VDIs are used to package a complete library of media resources. The podcast scenario shows how VDIs can be nested inside other VDIs where they can be manipulated either as a single unit or one by one. In the retail scenario, VDIs provide the ideal support for vendor-independent product descriptions, make it easy for end-users to find documents they frequently lose, such as receipts and user manuals and provide useful support for companies wishing to provide repair services and consumers wishing to sell products on the second hand market.

Current technology provides effective methods of bundling information (e.g. in ZIP files or in proprietary file formats). The unique advantage of CONVERGENCE does not reside in the ability to bundle information, but in the ability to bundle it **in a standard and versatile way and for a broad range of possible applications**.

From an end-user perspective, this means any user of the CONVERGENCE network can exchange VDIs with any other user. In the photo archive scenario, for example, the VDI standard facilitates the flow of information across different stages in the Alinari workflow; in the video archive scenario it allows collaboration between actors inside and outside FMSH; in the podcast scenario it supports collaborative study by students using different e-learning platforms, in the retail scenario it is the essential glue that allows manufacturers and retailers to work together.

Absent the VDI standard, each pair of users wishing to exchange bundles of information needs to choose or define a proprietary file format. In practice this means that the interchange of structured electronic data is restricted to users who exchange data on a regular basis (e.g. users of electronic patient records in a national health service). This excludes the "long right tail" of users who exchange information only sporadically. CONVERGENCE thus opens the road to completely new applications. Organizations using VDIs to exchange information can each use their own applications, running on top of the CONVERGENCE framework and the CONVERGENCE network, differentiating the services they offer to staff and customers. In fact, the CONVERGENCE framework makes it easier for developers to implement complex services, and therefore favours differentiation.

6.2.3 CONVERGENCE gives media owners control over licensing

Licensing and intellectual property rights are a vital feature of any media business and many businesses offering services to media professionals (e.g. Flickr) allow them to sell licenses to use their products (e.g. photos, audiotracks etc.). In nearly all cases, however, the range of options is very limited. This means that for most commercial providers, the only way to manage IPR in a way that meets their requirements is to create their own proprietary service. CONVERGENCE, by contrast, allows author or owners of media content to freely define their own licensing and pricing conditions and enforce the conditions of the license in the CONVERGENCE network. This advantage was clearly perceived by participants in the Alinari and FMSH focus groups – the first concentrating on a "commercial" media business, the second on a less conventional "community-driven" service.

In this case, as in the previous one, the advantage of CONVERGENCE depends only partly on the functionality on offer. The CONVERGENCE REL is extremely flexible and makes it possible to express licensing conditions that could not be expressed by proprietary systems of DRM. However, these systems exist. The added value of CONVERGENCE lies in the fact that it provides a single, standard solution to all users of the CONVERGENCE system (content providers and content consumers), in a versatile way and for a broad range of possible applications. From a consumer point of view CONVERGENCE offers a maximum of choice; from the point of view of small and medium scale content providers it avoids the need to manage the separate protection schemes provided by the various intermediaries they may use to offer their products to the public. For smaller organizations (such as those

considered in our scenarios) this may be a *sine qua non* condition for engagement in e-commerce.

6.2.4 CONVERGENCE allows users to digitally sign and/or encrypt content

In many business settings it is essential that a consumer of information can ensure the authenticity of information received from an information provider. The WIPRO focus group, for example, saw CONVERGENCE as a way to prevent fraud on product returns (e.g. users swapping receipts for identical products). As in the cases cited earlier, this kind of functionality is not unique to CONVERGENCE: highly effective cryptographic standards and products have been available for many years. The Unique Selling Point of CONVERGENCE is that it allows *any user* to sign, and encrypt a **VDI** (which, we remind**, is a data unit of which the network is aware and that the network is able to handle**) and to be sure that *any other user* with the appropriate keys can authenticate and read the content.

6.2.5 Definition of ontologies

In the FMSH scenario, we see how CONVERGENCE users can create ontologies, defining specialized terminology for use with specific kinds of VDI. In the scenario, the ontology itself is created with a standard tool, using standard semantic technologies. The Unique Selling Point of CONVERGENCE is the possibility of uploading the ontology to the CONVERGENCE Community Dictionary Service, where it will be potentially available to any user of CONVERGENCE and any application running over the CONVERGENCE network. The possibility of creating custom ontologies will make it easier for specialized content providers (such as Alinari and FMSH) to structure the information they provide and will help search engines and other services to exploit the structured information contained in VDI metadata.

6.2.6 CONVERGENCE allows users to publish content to the whole network

When a CONVERGENCE user publishes a VDI, it is immediately available to all users specified in the license: potentially all users of the network. This represents a radical break with the current situation in which users are split into separate communities each centered on a specific intermediary or content provider using its own proprietary technologies. This makes CONVERGENCE an ideal medium for advertising and for political and social campaigning and limits the ability of intermediaries to arbitrarily restrict the free flow of information across the network.

In principle, users can make content available to the whole population of web users, by publishing content on a web site or web service. This means, however, that users seeking a specific class of information (e.g. in the retail scenario, retailers looking for information on products from multiple manufacturers) have to navigate across multiple websites or build technological interfaces to multiple services. In cases where users do not know where to find

the content they are looking for they will have to rely on ranking by third parties (search engines, intermediaries such as Flickr, YouTube etc.). Materials with a low ranking are invisible. This makes it very difficult for small companies and individuals to reach their potential target audiences.

CONVERGENCE improves this situation by severing the tie between a content and the original source of that content, allowing caching in the network. CONVERGENCE semantic search (see below) *and metadata embedded in the VDIs* make it far easier for users to find the content that interests them and for advertisers and campaigners to reach their audiences.

6.2.7 Monitor access to resources

The standard definition of a VDI makes it possible to notify the owner every time a user accesses or downloads the VDI. The FMSH scenario shows how a VDI owner can use this information to refine the conditions defined in the VDI license (avoiding the use of the VDI in ways that were not foreseen when the license conditions were originally formulated). More generally, monitoring of VDI use is a fundamental requirement for the use of VDIs in sales and advertising. Again the main value of CONVERGENCE is not that it provides monitoring functionality – this is available on any e-commerce site. CONVERGENCE's value is that it provides a *standard* way of monitoring use on a network wide basis. This means for instance that, if retailers agree, a manufacturer who sells products through many different outlets can rapidly obtain an overall picture of how many consumers are accessing information about and purchasing a product without having to build interfaces for many different logging systems.

6.2.8 Update the information in a VDI (synchronization)

A key feature of CONVERGENCE is that the owner of a VDI can update the VDI even when it has already been released "into the wild". The podcast scenario illustrates how a lecturer can update the slides accompanying a podcast and immediately distribute the update to all users. In the retail scenario, manufacturers continually update product information as this becomes necessary. The focus groups proposed additional applications. In particular participants in the FMSH group suggested that CONVERGENCE could be used to synchronize libraries of video content in different locations.

Today it is easy for a user to update the information provided on a centralized web site. In this case, however, there is no guarantee that users will read the information. Again the Unique Selling Point of CONVERGENCE is that it provides a *general solution* valid for all users of the CONVERGENCE network. Compared to proprietary solutions, CONVERGENCE makes it much easier for users to be sure the information they need is up to date, and much easier for content providers to supply this information.

6.2.9 Rapidly and reliably retrieve VDIs, regardless of the location of the VDI owner (network caching)

As a content-based network, CONVERGENCE automatically distributes content to maximize the speed and reliability with which end-users can access the content. A recent report by the CONET Project, points out that this is a possibility inherent in content-based networks, and precluded to Internet Content Providers (such as youTube) Content Distribution Networks (such as AKAmai) and P2P platforms (such as Otoshape), which, unlike content-based networks have no control over network capabilities, traffic conditions, or of transmission requirements for specific types of content (COMET D2.1: Business Models and System Requirements for the COMET system).

In CONVERGENCE, this possibility is well illustrated in the FMSH user scenario, when caching facilitates access to content by farming communities with low-bandwidth Internet access. From the point of view of network operators, CONVERGENCE's caching facilities provide an alternative to controversial and expensive and proprietary Content Distribution Networks. It should also be noted that this sort of caching makes it *harder* for network operators or government authorities to filter content, for commercial or political reasons.

6.2.10 Search for VDIs exploiting VDI metadata and the CONVERGENCE Community Dictionary Service

CONVERGENCE's basic functionality allows any user of CONVERGENCE to search all VDIs on the CONVERGENCE network. CONVERGENCE search features allow users to search by specific attributes contained in the metadata (e.g. all VDIs produced by a certain organization, all VDIs from retailers selling a specific product at less than a given price, all photos taken within 100m of a certain location). The same meta data can be used by third party search engines to implement their own schemes for indexing and retrieving VDIs on the CONVERGENCE network, The Community Dictionary Service facilitates this operation by helping content providers to structure the meta-information, and by helping end-users to find synonyms, translations etc. for specific terms.

Once again the value of CONVERGENCE is as a standard. Current users of the web are forced to choose between "weak", full-text search covering a large proportion of the web (though never the complete network) or more precise structured searches, provided by specific sites (e.g. e-retailers, price comparison sites, sites of scientific journals). There is currently no practical way in which a user can perform a structured search over the whole network. CONVERGENCE makes this possible.

6.2.11 Subscribe to VDIs meeting specified search criteria, and receive a notification on publication or update of VDIs satisfying the criteria

A key feature of CONVERGENCE is that it allows users to subscribe to all VDIs meeting a set of search criteria, and to receive a notification whenever such VDIs are published or

updated. Today no such functionality is available on a network wide basis. In some cases (e.g. in the Apple Apps store, on sites managed by Microsoft SharePoint, on the eLearning platforms cited in the podcast scenario), a site may generate notifications for users, whenever specific content is updated. These, however, are proprietary solutions. The Unique Selling Point of CONVERGENCE is that it provides a general solution valid for all users of the CONVERGENCE network, for all classes of content represented by VDIs.

6.2.12 Verify the authenticity of a VDI and decrypt any encrypted content (key owners only)

As described earlier, any user of CONVERGENCE can digitally sign and/or encrypt a VDI or a part of a VDI. Similarly any user with the appropriate keys can authenticate and/or decrypt this content. As mentioned earlier this is not, in itself a new capability. The Unique Selling Point of CONVERGENCE is that it makes this functionality available within the network and in a self-contained way (we remind that the VDI **is a data unit of which the network is aware and that the network is able to handle**). Protecting the content itself is better than protecting the pipe through which it is transported. Privacy and security information built into the VDI will avoid the need to delegate this function to applications and transport protocols, ensuring that VDIs are genuinely trustworthy.

6.2.13 Communicate to owners of VDIs without the need to access personally sensitive information;

In many cases commercial and other operators may wish to communicate with a specific set of users on the network. The retailing scenario provides the example of a "safety recall". In other cases the motivation may be to provide customer support (e.g. to provide information about a technical problem) or purely commercial (e.g. to contact customers likely to be interested in a new product release).

This kind of communication raises issues of privacy (users may not wish to give third parties their contact information or may not want to be contacted at all). CONVERGENCE provides a solution for this problem allowing the author of a VDI to send a message to all users owning a copy of the VDI, without knowing their personal details, and allowing the owner of a VDI to authorize or refuse reception of such messages.

6.2.14 Ensure that copies of VDIs do not persist on the network beyond a pre-defined expiry date (digital forgetting).

When users of online services participate in discussions or make resources available to other users, they often leave electronic traces of their actions, which are difficult or impossible to erase. This creates the risk that a government or an employer or a journalist will find these traces and use them against the user. This has led privacy advocates to argue that citizens should have a right to "digital forgetting". To date, however, the length for which information

is stored by service providers depends to a very large extent on the policy of the service provider. On the Internet, there exists no general-purpose functionality allowing users to request or enforce the deletion of information they no longer wish to be public. CONVERGENCE provides this option – in two forms.

First, all VDIs have a default expiry date which users can modify to suit their needs. Once the expiry date is past, users can no longer access the VDI via the CONVERGENCE network. The inclusion of the expiry date in the metadata means that CONVERGENCE applications can delete expired VDIs even when they are in local storage, thereby enforcing a sound privacy policy.

Second, CONVERGENCE provides an "un-publish" feature that allows a user to delete a VDI she has previously published (unless she has given up this right when she defined the licensing conditions for the VDI). For participants in the LMU focus group this was a very important feature. The Podcast user scenario shows how this functionality allows a user to delete a mistaken comment on an exercise. Even if the user neglects to "un-publish" the VDI she can rest assured that at its expiry date, CONVERGENCE will automatically delete it from the network. For participants in the LMU focus group this was one of the most important aspects of the whole system. It also played an important role in the Alinari and FMSH scenarios.

6.2.15 CONVERGENCE for developers

In the previous paragraphs, we have seen that, in principle, it is possible for developers to develop web sites and services that provide many of the services offered by CONVERGENCE. CONVERGENCE's most important advantage is that it can provide these services to *all users of the CONVERGENCE network*, and not just to *users of a particular service* – and that it covers *all classes of content*.

However, CONVERGENCE also has a second advantage that specifically concerns developers. It provides key functionality "out of the box". In principle, any provider could develop its own schemes for packaging, signing and encrypting information, for notifying users of updates, for structured search, for digital forgetting etc. But as pointed out by members of the Alinari focus group, this kind of solution would be very expensive to create and maintain and would continually risk obsolescence.

By contrast, the CONVERGENCE framework abstracts away the complexity underlying this kind of functionality, enormously facilitating the development and maintenance of new applications and services. In this sense, the CONVERGENCE offering could be compared to TCP, HTTP and HTML, which released developers from the need to develop their own communications and transport protocols and their own technology for rendering multimedia information.

6.2.16 Convergence for Network Operators and content providers

Finally, CONVERGENCE is significantly contributing to a paradigm shift in network operation, completing a path that started with circuit-switching, continued with packet switching, and is now moving towards content-switching.

In *circuit-switching*, information travels "alone". The network is completely unaware of the meaning of the information it handles, so much so that the bits crossing the network do not event "contain" a destination address. Handling of the information by network nodes requires additional supporting information that has to be stored in network nodes. Network nodes need to be aware of the "state" of the communications they handling.

In pure (datagram) *packet switching*, the information units (packages) travelling across the network already contain some supporting information. This means that nodes do not need to handle states. Here too, however, the content of packets is not known to the network, which is used as a pipe.

Finally, in the content-switching model envisaged by CONVERGENCE, information units (VDIs) explicitly contain all the supporting information the network needs to handle them. This means they can be intrinsically secure, removing the need to secure the channel over which they are transmitted and allowing the authentication of the content they contain. It also means they can be stored in network caches, allowing users to retrieve them from nearby nodes rather than from the original source of the information, and reducing the overall flow of traffic across the network.

7 Requirements

7.1 Introduction

The tables below describe provisional requirements for the CONVERGENCE system. Each requirement is associated with one of the scenarios, the DOW or a technical proposal from one or more of the partners.

The list is based on the requirements defined in the previous version of the deliverable. Analysis suggests that a small number of these requirements are not required by any of the scenarios. These are flagged for discussion. One requirement has been removed. However the reference to the requirement is maintained to guarantee consistency in the numbering scheme. The list also includes one completely new requirement not included in the previous version.

At the time of writing, the requirements have achieved a high degree of consensus within the CONVERGENCE consortium. However, there is an ongoing debate about the way they should be implemented. The results of this debate will be reflected in future deliverables from WPs 2, 3 and 4.

Requirements for applications should be regarded as preliminary.

7.2 High level requirements

Area	Sub-area	Code	Requirement	Scenario or other source of requirement
Basic characteristics of the CONVERGENCE system		BA1	The CONVERGENCE system shall allow any Internet user to create, publish, search for, subscribe to and retrieve any VDI (unless access to the VDI is restricted by the author)	All
		BA2	The CONVERGENCE system shall be based on open standards	FMSH
Characteristics of the code for the CONVERGENCE system		CODE1	The interfaces and general design of CONVERGENCE shall be public	Alinari
		CODE2	All code for the CONVERGENCE Framework, and for basic applications (e.g. the VDI Creator/Editor and the VDI Browser) shall be made available in Open Source Format	Alinari
		CODE3	The programming languages and libraries used in development shall be designed to be as accessible as possible to developers	Alinari
VDI capabilities	High level	VDI1	A VDI shall be capable of referencing a broad range of different kinds of resource	All
		VDI2	VDIs shall be capable of storing information on the physical location of a resource	Alinari, FMSH,WIPRO
		VDI3	VDIs shall offer a range of security/privacy protecting features including but not	Alinari,

			limited to the definition of access rights, the enforcement of access rights (trials only), automatic authentication (when appropriate), support for encrypted metadata and content, digital signatures, digital forgetting	FMSH, LMU
		VDI4	Users shall be able to publish/un-publish a VDI to all users or to a subset of users of the CONVERGENCE System	All
		VDI5	Users shall be able to subscribe/unsubscribe to a VDI or to all VDIs meeting specified search criteria	All
		VDI6	The CONVERGENCE System shall provide specified public interfaces supporting third party tools and applications handling VDIs (see also FRA1)	XIW suggestion
		VDI7	The CONVERGENCE System shall allow service providers to conclude, and monitor SLAs with information consumers	This is not required in any of the current scenarios. To be discussed
		VDI8	The CONVERGENCE System shall provide for the distribution of VDIs across an entire CONVERGENCE Network	All
		VDI9	The CONVERGENCE System shall provide for the storage of VDIs on the CONVERGENCE Network	All
VDI capabilities	Resources	VDI10	A VDI shall be capable of referencing a person and his/her attributes	FMSH
		VDI11	A VDI shall be capable of referencing a profile and credentials for a user of the CONVERGENCE System	FMSH, LMU
		VDI12	A VDI shall be capable of referencing arbitrary real world objects	FMSH, WIPRO
		VDI13	A VDI shall be capable of referencing a discussion	FMSH, LMU

		VDI14	A VDI shall be capable of referencing a contribution to a discussion	Alinari, FMSH, LMU
		VDI15	A VDI shall be capable of referencing another VDI	All
		VDI16	A VDI shall be capable of referencing a set of synchronized slides plus a structured video recording	LMU
		VDI17	A VDI shall be capable of referencing a photo	Alinari, WIPRO
		VDI18	A VDI shall be capable of referencing a video	FMSH, WIPRO
		VDI19	A VDI shall be capable of referencing a podcast	LMU
		VDI20	A VDI shall be capable of referencing an internet-based service	FMSH, WIPRO
		VDI21	A VDI shall be capable of referencing a domain ontology	FMSH, WIPRO
		VDI22	A VDI shall be capable of referencing a *set* or *collection* of resources (e.g. the same media object in different languages)	FMSH, WIPRO
		VDI23	A VDI shall be capable of referencing a *set* or *collection* of VDIs	FMSH, WIPRO
		VDI24	As far as possible, a VDI shall be capable of referencing arbitrary classes of resource not included in the requirements above	WIPRO
	VDI metadata	VDI25	A VDI shall be capable of representing attributes of a resource specific to that particular kind of resource (e.g. author, owner, time and date of production, location of production, current location, content information etc.) for a resource	Alinari, FMSH, WIPRO
		VDI26	A VDI shall be able to express attributes of a resource expressed in terms of	Alinari,

			location (e.g. the location where a photograph was taken). Such attributes shall not be restricted to the current physical location of the resource.	FMSH
		VDI27	A VDI should be able to associate a resource with timestamps identifying the beginning, the end or the duration of an attribute of the resource	FMSH
		VDI28	A VDI shall be able to associate a resource with typed links to other VDIs (e.g. <derived from>, <name of VDI>; <full version available in>, <name of VDI, <has also been bought by>, <set of VDIs>	FMSH
		VDI29	A VDI shall be able to reference a RWO via an RFID tag, a bar code or any other form of unique identifier for the RWO.	WIPRO
		VDI30	A VDI shall be able to support user annotations in the form of key words, texts, visual icons, spoken text, references to geographical locations, temporal data, etc.	Alinari, FMSH
		VDI31	A VDI shall be able to specify the way user annotations appear in the VDI browser (e.g. the visual presentation of annotations to a photo)	Alinari
		VDI32	A VDI shall be able to support user-defined tags	FMSH
		VDI33	VDIs shall support both public comments (legible to all subscribers to the VDI) and private comments (legible only to one user or a user-defined subset of users)	LMU
	Creation/ Publishing of VDIs	VDI34	The CONVERGENCE System shall provide users with an easy to use tool (VDI Creator/Editor) allowing them to create, update, publish and un-publish a VDI, beginning with a set of pre-existing resources and/or VDIs and including all necessary metadata, definitions of access rights, tags etc.	All
		VDI35	The VDI Creator/Editor shall allow a user of the CONVERGENCE System to publish/un-publish a VDI to all users or to a subset of users of the system	FMSH, LMU, WIPRO
		VDI36	The VDI Creator/Editor should allow the author to select or otherwise define all elements to be included in the VDI	FMSH, LMU

		VDI37	The VDI Creator/Editor shall allow a user to select/create a schema to describe the metadata of a VDI representing a particular class of resource.	FMSH, WIPRO
		VDI38	The VDI Creator/Editor shall allow users to define a template showing how users can annotate a VDI. The template should include instructions for the user, default values for fields etc.	FMSH
		VDI39	The CONVERGENCE System shall provide a standard tool allowing a user to create a publishing template for another user in which all fields are predefined. The template should include instructions for the user, default values for fields etc.	FMSH
		VDI40	The VDI Creator/Editor shall allow users with appropriate rights to update the metadata and/or the resources of a VDI *after* it has been published. When a user updates a VDI all copies of the VDI accessible to the CONVERGENCE system shall be automatically updated. This includes all copies of the VDI on the CONVERGENCE network and all copies under the support of a CONVERGENCE application that supports local updating of VDIs	All
		VDI41	The VDI Creator/Editor shall allow users to change access rights to a VDI *after* it has been published	FMSH LMU
		VDI42	The VDI Creator/Editor shall allow users send a message (e.g. a warning) to all subscribers to a given VDI	WIPRO
	Browsing, subscription	VDI43	The CONVERGENCE System shall include an easy to use tool (VDI Browser) allowing users to browse, acquire rights and subscribe to VDIs, to cancel their subscriptions and to define attributes of their subscription (e.g. willingness to accept messages from a VDI Creator/Editor, expiry date)	All
		VDI44	The CONVERGENCE system shall implement restrictions preventing users from subscribing to impractical numbers of VDIs	Technical requirement

				suggested by ICCS
		VDI45	Users shall be able to subscribe to VDIs without knowing their physical location	LMU, WIPRO
		VDI46	Users shall be able to subscribe to a VDI by clicking on a link on a web page	LMU
		VDI47	The VDI browser shall be able to track the history of a VDI and provide access to different versions, with the latest being the default"	LMU, WIPRO
		VDI48	All applications shall allow users with the appropriate rights to download a VDI to a local device	LMU
		VDI49	The VDI Browser shall allow users with the appropriate rights to access the resources and metadata of a VDI	All
		VDI50	The VDI browser shall allow users with the appropriate rights to follow links contained in a VDI	WIPRO
	Search	VDI51	The VDI browser shall allow users to search for VDIs meeting specific criteria (e.g. presence of a specific value for a specific item of metadata) and specify actions to be taken when such a VDI is found	FMSH, WIPRO
		VDI52	Searches shall be semantic (e.g. a search using synonyms for keywords as well as keywords themselves)	Alinari, FMSH, WIPRO
		VDI53	The VDI browser shall be able to track the history of a VDI and provide access to different versions, with the latest being the default"	WIPRO
		VDI54	Searches shall support context sensitivity including sensitivity to location (e.g. it shall be possible to search locations stored in metadata by proximity to the center of a city or a place of interest or an address)	Alinari, ICCS

		VDI55	It shall be possible to search for a VDI with a given RFID tag or for other comparable identifiers.	WIPRO
		VDI56	It shall be possible for a user to subscribe to a known VDI or to all VDI meeting given search criteria. Users shall be able to request updates related to their subscriptions (e.g. when a subscribed VDI is updated, when a VDI meeting the search criteria becomes available)	FMSH, WIPRO
		VDI57	The CONVERGENCE system shall make it possible to describe ontologies for all classes of meta data/tags and links used in VDIs	WIPRO
		VDI58	The CONVERGENCE system shall allow users to select terms from a list of ontologies	FMSH, WIPRO
	Device/ communications support	VDI59	It shall be possible to deploy tools for VDI management over multiple devices, according to the capabilities of the device.	DOW, ICCS
		VDI60	It shall be possible to transfer a VDI from one device to another as a file or as a stream	DOW, WIPRO
		VDI61	It shall be possible to access VDIs using web and internet technologies (i.e. using a web browser attached to a CONVERGENCE-capable server and equipped with a plugin allowing it to interact with the CONVEGENCE system)	FMSH, WIPRO
	Security	VDI62	A VDI shall allow users to define access rights for VDIs	FMSH, LMU
		VDI63	A user shall be able to sign a VDI	FMSH, WIPRO
		VDI64	Users shall be able to automatically authenticate a signed VDI before/after they download the VDI	FMSH, WIPRO
		VDI65	It shall be possible to encrypt specified fields of a VDI including content,	FMSH

			comments and metadata	
		VDI66	It shall be possible to create a VDI in such a way that media contained in the VDI is marked with an inerasable watermark	FMSH[5]
		VDI67	It shall be possible to place a digital signature on certain fields of a VDI including resources, comments and metadata	FMSH, WIPRO
		VDI68	The VDI creator and the VDI browser shall support the use of "Personal Secure Tokens" for use in authentication. It shall be possible to use the token on any device attached to the CONVERGENCE system	SAGEM
		VDI69	The CONVERGENCE system should support the secure transmission of VDIs across the network	ICCS
	Privacy	VDI70	Users shall be able to send, share and receive VDIs without revealing their identity	LMU
		VDI71	The VDI Browser shall allow users to define minimum levels of authentication for VDIs they are willing to access (e.g. refusing to accept anonymous VDIs)	XIW suggestion
	Digital forgetting	VDI72	A VDI shall allow an application that creates a VDI to define an expiry date for legal access to the VDI	LMU
		VDI73	All VDIs shall have a default expiry date	XIW suggestion
		VDI74	The VDI creator shall allow users to un-publish all copies of VDIs they have published	FMSH, LMU
		VDI75	The CONVERGENCE System shall include a standard tool providing automated	DOW

[5] This requirement is currently under discussion within the Consortium and should not therefore be considered as final . For this reason, watermarking is *not* included in the current version of the FMSH scenario. However, FMSH considers it to be highly desirable and it may be included in the scenarios for the trials if it proves to be feasible.

			garbage collection of VDIs residing on the network that have passed their expiry date. This implies that users will no longer be able to retrieve such VDIs.	
		VDI76	The CONVERGENCE System shall make it possible to design an application that automatically deletes or encrypts information on a VDI whenever a given condition is met (e.g. customer has left store)	This requirement has not been specified in any scenario. To be discussed
		VDI77	The CONVERGENCE system shall make it possible to notify other predefined users, each time the VDI is accessed by a user. The notification shall not contain any personal information concerning the user accessing the VDI	FMSH
Framework capabilities		FRA1	The framework shall provide APIs making it possible for third party applications with appropriate rights to access the full capabilities of the CONVERGENCE System	FMSH, WIPRO
		FRA2	The framework shall provide functionality to generate unique VDI identifiers	FMSH, WIPRO
		FRA3	The framework shall have functionality allowing a local application to update copies of VDI in local storage with data from updated VDIs stored on the network	LMU, WIPRO
		FRA4	The framework shall have functionality allowing an application to publish a VDI to the network	LMU, WIPRO
		FRA5	This requirement was a duplicate and is no longer valid	WIPRO
		FRA6	The framework shall have functionality allowing an application to immediately retrieve a VDI with a known VDI identifier	LMU, WIPRO

		FRA7	The framework shall have functionality allowing an application to subscribe to a VDI or to all VDIs (existing VDIs, VDIs that have not yet been published) meeting given search criteria	FMSH, WIPRO
		FRA8	The framework shall have functionality allowing an application to search for a VDI meeting a given set of search criteria (operating on VDI metadata), without referring to a given physical location where the VDI is stored	FMSH, WIPRO
		FRA9	The framework shall allow an application with appropriate rights to modify/delete a VDI which has already been published	FMSH, WIPRO
		FRA10	It shall be possible for users to define a set of VDIs meeting certain search criteria (e.g. distance between a physical location referenced in the metadata and a second, user-defined location)	Alinari, LMU, WIPRO
		FRA11	It shall be possible for an application to monitor how often users have downloaded or played a resource	Alinari
		FRA12	The CONVERGENCE System shall support the use of persistent names for VDIs whose referenced resource changes (e.g. a VDI referring to the front page of a newspaper)	Technical requirements from Ponza meeting
Network capabilities		NET1	The CONVERGENCE Network (CONET) shall distribute and provide access to resources identified in the network by a network identifier (NID); examples of such resources include: a VDI; an electronic document, an image, a source of information with a consistent purpose, the point of access to a service, and a collection of other resources.	Technical requirements from Ponza meeting
		NET2	It shall be possible to retrieve a resource without reference to the location where it is stored except insofar as such references are required to support the scope and policy routing functionality	Technical requirements from Ponza meeting

				discussions
		NET3	It shall be possible to replicate and cache a resource with a given NID over different network nodes, while maintaining the same NID on all copies; the CONET shall provide the functionality to access the "best" (i.e. the closest) resource in this set. In other words the NID shall be treated as an anycast address and the CONET shall provide anycast routing functionality	FMSH, Technical requirements from Ponza meeting
		NET4	A Network identifier (NID) may be either a flat name or may have a hierarchical structure (for example, for scalability reasons or to support storage or to advertise a resource in a restricted geographical area).	Technical requirements from Ponza meeting
		NET5	CONET routing shall not necessarily rely on a structured naming scheme	Technical requirements from Ponza meeting
		NET5	Network Identifiers (NID) shall be designed independently of VDI identifiers. *COMMENT: this does not preclude using the VDI identifier as a network identifier, if possible and desirable.*	Technical requirements from Ponza meeting
		NET6	The CONET shall provide mechanisms to assign unique Network Identifiers to a resource *COMMENT: to be discussed; this action could also be done by an external application*	Technical requirements from Ponza meeting
		NET7	The CONET shall support multi-homing, policy routing, and scope (advertising and/or storage in a restricted geographical/admin area) *COMMENT: future discussion will examine how far the concept of multi-homing currently employed in IP networks can be adapted for use in the CONET*	Technical requirements from Ponza meeting

			COMMENT: To be discussed; we need to investigate if support for these functions should be provided natively by CONET or if should use COMID, at least for some classes of contents, (e.g. protected content)	
		NET8	The CONET shall natively support user mobility, allowing users to store and retrieve resources independently of their location.	Technical requirements from Ponza meeting
		NET9	The CONET shall provide means to support a point-to-point communication between the upper layer entity that is sending un-named resources (service-data) and the receiving upper layer entity (e.g. a server). In this way the CONET can support services requiring the interactive exchange of service-data *COMMENT: This is required to make it possible to select a node belonging to the anycast group identified by a given NID and to address terminals not identified by a NID. A possible way to do this is to introduce Location Identifiers (LIDs) and use them to identify both terminals and service access points. The LID would be a unicast address.*	Technical requirements from Ponza meeting
		NET10	The CONET shall provide a proper security model making it possible to decide whether a CONET user is allowed to store, retrieve and delete/update a given resource.	FMSH, Technical requirements from Ponza meeting
		NET11	CONET shall allow the use of a NID to identify the point of access to a service	Technical requirements from Ponza meeting
		NET12	The CONET shall offer functionality to advertise to the network that a resource	Technical

			identified by a NID is stored in a specified node or in a specified set of nodes.	requirements from Ponza meeting
		NET13	The CONET shall offer functionality to send a resource to a specified node.	Technical requirements from Ponza meeting
		NET14	The CONET shall offer functionality to retrieve a resource identified by a NID	Technical requirements from Ponza meeting
		NET15	The CONET shall allow a user to request a sequence of updates of a resource identified by the same, known NID. A user should thus be able to request a sequence of logically resources such as a. a real time movie, or a sequence of updates to a document)	Technical requirements from Ponza meeting
		NET16	The CONET shall offer functionality to revoke the advertising of a resource identified by a given NID, and to delete the resource from a specified storage node or from a set of nodes	FMSH, Technical requirements from Ponza meeting
		NET17	The CONET shall offer functionality to update a previously advertised resource, identified by a given NID and stored in a specific node.	FMSH, Technical requirements from Ponza meeting
		NET18	The CONET shall make it possible to control where (or in which administrative	Ponza, e-mail

			domain) a resource is stored. *COMMENT: It is not acceptable that storage should be completely random. This may imply that DHT cannot be used for this purpose.*	and internal CNIT discussions
		NET19	The CONET shall support mechanisms to delete a resource, supporting digital forgetting and garbage collection operations *COMMENT: Future work will investigate whether this functionality should be provided natively by CONET or whether it will be performed in cooperation with COMID (for some classes of contents, e.g. protected content)*	Technical requirements from Ponza meeting
		NET20	The CONET shall support mechanisms to update resources stored in any node *COMMENT: Future work will investigate whether this functionality should be provided natively by CONET or whether it will be performed in cooperation with COMID (for some classes of contents, e.g. protected content)*	FMSH, Technical requirements from Ponza meeting
		NET21	The CONET shall support the possibility of accessing a source of information through a persistent name, even if the source consists of a changing set of VDIs (name persistence)	Technical requirements from Ponza meeting
		NET22	The CONET shall support access to the latest version of a series of related VDIs; e.g. referenced by the same source of information, and to earlier versions of a series of related VDIs *COMMENT: Future work will investigate whether this functionality should be provided natively by CONET or whether it will be performed in cooperation with COMID*	Technical requirements from Ponza meeting

		NET23	The CONET shall provide native support for caching. Unlike a Content Delivery Network, CONET will, in principle, support caching on every node and also on user terminals. Users can retrieve a resource from any node where it is stored. This shall not necessarily require a connection to the CONET but only to a single node storing a copy of the desired resource. *COMMENT: This requirement is fundamental to support recently proposed schemes such as wireless caching, distributed storage, and recommendation strategies. By making the network aware of the contents that is handling it is possible to shift traffic away from congested regions and balance loads, for instance by offloading cellular networks, or by implementing other distribution strategies beneficial to network operators. This functionality will strengthen network operators' control over traffic generated by so-called over-the-top players (such as Facebook, YouTube, etc.),*	Technical requirements from Ponza meeting
		NET24	A network node needs information about the rights to replicate/cache resources	Technical requirements from Ponza meeting

7.3 CDS requirements

	CDS	CDS1	The CDS should make it possible to describe ontologies for all classes of meta data/tags and links used in VDIs	FMSH, WIPRO
		CDS2	Users of the CDS should be able to select terms from a list of ontologies	FMSH, WIPRO
		CDS3	The CDS should be able to use ontologies that rely on machines that do not	WIPRO

			belong to it. This way we can exploit already existing concepts and add new ones.	
		CDS4	CDS machines should be able to cooperate and combine multiple ontologies residing on different machines.	WIPRO
		CDS5	The CDS should contain concepts not only related to resources description, at the semantic and structural level, but also related to security and privacy issues for Access control and resource usage governance."	FMSH
		CDS6	CDS, as the knowledge base of CONVERGENCE, should be able to learn from the users; that is the users can create new concepts and then, the CDS can match them with already existing ones.	WIPRO
		CDS7	CDS should provide an easy-to-use tool for creating and browsing concepts.	FMSH, WIPRO

7.4 Requirements for applications and trials

The following requirements are not formally part of the requirements for the CONVERGENCE system – however they form the basis of the applications to be developed for the trials.

Application capabilities		APP1	Applications developed for trials shall allow authorized users to publish VDIs on behalf of their organizations	FMSH
		APP2	The CONVERGENCE project shall develop a generic VDI Browser	DOW
		APP3	The CONVERGENCE project shall develop a generic VDI Creator/Editor	DOW
		APP4	The applications created for the trials should make it easy for an authorized user to transfer a VDI to another authorized user (one-click VDI transfer)	XIW

		APP5	The project should integrate the browser/publisher with software hardware to read RFIDs and/or barcodes	SIL/ICCS
		APP6	Applications developed for trials shall allow authorized users to update/delete VDIs after they have been published	FMSH
		APP7	Applications developed for trials should synchronize VDIs held in local storage with VDIs stored on the network	XIW suggestion agreed with CNIT
		APP8	Applications developed for trials shall allow authorized users to search for/subscribe to VDIs	FMSH
		APP9	Applications developed for trials shall demonstrate the definition and automated enforcement of access rights	Technical requirements from Ponza meeting
		APP10	Applications developed for trials shall demonstrate support for CONVERGENCE privacy features and digital forgetting	XIW suggestion
		APP11	At least some applications shall allow users to annotate the VDI	Alinari, FMSH
		APP12	The application used in the UTI scenario shall make it possible to use a VDI as an access key to a location/service	This requirement is no longer present in any of the scenarios. To be discussed
		APP13	It shall be possible for an application to track a set of VDIs and take an action (e.g. issue a warning) when the set meets a certain condition (e.g. when the number of VDIs meeting a given criteria falls below a pre-defined threshold)	This requirement is no longer present in any of the scenarios. To

				be discussed
		APP14	All applications shall provide default expiry dates for VDIs and allow users to modify these dates	DOW
		APP15	The application developed for the LMU trial shall allow a user to structure originally unstructured materials (e.g. an unstructured video) into a structured VDI	LMU
		APP16	The application developed for the LMU trial shall make it possible to synchronize one kind of media object (e.g. slides) with another (e.g. video)	LMU

Appendix 1: Report on Alinari focus group

PARTNER:	ALINARI	DATE:	NOVEMBER 12, 2010	TARGET:	FOCUS USER GROUP

PRELIMINARY (PARTICIPANTS INFO):

Add any information on the composition of the group you feel may be relevant

This group of users has been selected according to their education, personal profile, interest and experience generally speaking in education, cultural heritage, tourism, social networking, new technologies, content sharing, intelligent content access.

The selection of this user group has been done according to the user profile, experience in the IT and cultural sector, working experience at Alinari, motivation to provide convincing feedback during the trial studies.

The users are currently involved in various projects and activities at Alinari, from the education to the professional content indexing, picture annotation and so on.

All users have a strong background in art history, visual art and photography.

THE CONVERGENCE CONCEPT:

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

All participants found the slides and questions very interesting and the common feedback was that some questions were just too early to answer when the prototype was not yet running. However as general consensus, all find the proposed technology and VDI solution extremely interested and useful not only for the community but also, and most important, for their every day work, providing a clear sustainability interest and opportunity to use and adopt the system in the real world, as soon as it get to a stable status.

The project is for sure interesting for real adoption in the Alinari every day work and more important, it could (and should!) be also promoted and recommended to the Alinari external end users and photo agency partners!

All users (8/8) agreed that for the Alinari business model it is important to provide the authenticity, integrity and security of the content owner as proof of the origin of the original photograph/multimedia content.

7 out of 8 users agrees however that it will be very important and maybe delicate to fully understand how the VDI will be used and integrated for example into their everyday work. As today, they did not find enough or concrete answers to this matter and they want to see the technology at first and once ready before making a final statement and commitment for the usability.

6 out of 8 users were also interested to know where exactly the VDI will be stored and how the VDI will be saved and preserved in the long term and if they could be accessed also in a very late time without compatibility or accessibility issues.

4 out of 8 users also had some concern about where VDI fits in the real world and for example they did not see any clear adoption nor integrations with social networks like Facebook (for example).

All 8 users also see the usage on CV in the VDI scenario not much for personal needs but rather for commercial and business outcomes. The VDI is seeing by all as a very interesting concept, especially the opportunity to synchronize and update data in real time, all together.

At least 3 interesting quotes from user answers:

1. The possibility to inject into the VDI so many items and information makes the project very interesting.
2. The solution that the system is synchronizing the data in a seamless and efficient way (in the background) make the project extremely powerful and useful for our needs!
3. Privacy and security or personal information remains always a risk so we want to better understand how the technology will indeed assure that no personal info will be shared without the permission of the owner?
4. Authenticity of photographs is for Alinari the number one priority! It is important to make sure that from both legal and technical point of view, once a VDI container has been created, for example, with an original picture provided by the content owner, the authenticity of the origin and ownership of the content if fully guarantee,.

TRIAL SCENARIO:

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

Trial scenario identified by the user group were several but we decided to focus on 3 major examples to make the work and feedback to the Consortium more clear and

simple.

The first scenario is to use for example the Convergence solution to an existing Alinari project made with an Italian airport (aviation) authority where the airport needs to use Alinari images and Alinari historical content to decorate the local airport and to create also an ad-hoc web site with Alinari images (image of airports, aviation, etc.). The possibility to synchronize and adopt this specific project of a specific airport, for example, to other airports or similar requests, make the VDI very useful and the usage of Convergence very natural and obvious for our business model! It means saving money, time (in creating new projects), and optimize the company effort.

Another interesting trial case scenario is the creation of a cooperation with a local Foundation and Bank to provide educational and e-learning content to the local schools. Again it will be great to use the VDI synchronization module to create various projects like this and use them in other/similar scenarios.

One more example is for example the Celebration of the collapse of the Berlin Wall in 2009 with the 20 years anniversary. We created for that event a book, a photo exhibition and it will be great, once again, to use Convergence to export this specific event into a series of different events/celebrations/anniversaries that we can promote/export to various clients, worldwide. This again will optimize Alinari expenses, timing and overall workflow and project managements work.

Also an popular scenario at Alinari is the creation of specific newsletters and dedicated and focused photographic portfolios sent to Alinari partners or clients for specific occasions. Again the VDI plays here an important role where the whole work can be done to different clients with different scope and needs, using one single VDI that can be modified or changed according to the user profile or specific event momentum.

At least 3 interesting quotes from user answers:

The synchronization feature and the VDI concept perfectly match Alinari workflow and Alinari every day needs! It is really considered a very credible an sustainable project.

We should create for our partners/client a specific business model to be exported and recommended, a simple package of tools, information and text describing how to use an solution of Convergence in an efficient way.

It is wise to create a pay per use or subscription business model

Different people within the same Institution should have the same (or different?) privileges to access and possibly modify one specific given VDI container. This should be managed by a trusted authority (i.e. company webmster or manager).

IMPROVING CONVERGENCE:

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

1. **all users agreed that it is important of being able to control and manage the rights and authorization to modify and update the VDI**
2. **5 out of 8 users said that the VDI owner should be able to decide to which extent a given VDI can be update and eventually if all VDI elated to it should be synchronized and updated as well**
3. **7 out of 8 users said that it will be very important to have the opportunity to roll back and manage the VDI update or downgrade process in terms of timing and space (date). It means the VDI manager should have the option to roll back and forward information like Apple is doing today with Time Machine!**

At least 3 interesting quotes from user answers:

1. **The project should be based as open source only solution.**
2. **The project should be available in Multilanguage for large adoption**
3. **providing support to the end users should be clearly define and agreed among the consortium in order to provide a convincing sustainable business model. A technical partners should be in charge of that.**

THE FOCUS GROUP

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

In most occasions all users agreed in the same vision of the questions and answers and they all seems very excited about the project and opportunity offered.

Supporting services of tagging, automatic management of expiry dates, semantic and location-based search for tagged photos, submission of photos by photographers, monitoring download of photos, IPR management

At least 3 interesting quotes from user answers:

Useful, but we have to keep in mind the types of users involved: different reactions are expected from different types of users.
WRAPPING UP
Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways
The 8 users were very interested and happy about this experience. We took some photos to demonstrate how we did the test and everyone seems very attracted and thrilled about the possibility to work one day with the VDI solution!
At least 3 interesting quotes from user answers:
1. **VDI is a great concept but in terms of security and usage we want to known in more details how the VDI for example can be compared to an Adobe .pdf file and what are exactly all the features and tools that a VDI can offers?** 2. **The VDI will create a new standard, a new workspace, a new method to work and share content in a more clever and efficient way!** 3. **The IPR and watermarking are important security parts for Alinari distribution content so everyone was curious to know, in a simple way, how Convergence will provide the DRMS (digital rights management) to its users?**

Image from the user group @ Alinari:

Appendix 2: Report on FMSH focus group

PARTNER:	FMSH	DATE:	02/11/2010	TARGET:	FOCUS GROUP REPORT

PRELIMINARY (PARTICIPANTS INFO):

Add any information on the composition of the group you feel may be relevant

The Focus Group took place on Thursday, 28th of October in the premises of FMSH in Paris. The video-recorded meeting was presented by ESCoM; Peter Stockinger for main presentation and scenarios, Francis Lemaitre for technical presentation. 10 persons participated to this Focus Group who lasted for 3 hours.

- **From the 6 kinds of actor identified in our scenarios (Pattern Designer, Video Producer, Analyst, Author, Developer, End User), only Developer profile is not represented (this is due to the institutional context of ESCoM-FMSH, i.e. Research in Social & Human Sciences).**

- **From the 10 participants, 2 students represent the End User profile.**

- **The 8 other are all linked with Teaching and/or Research domains (due again to our institutional context): 1 teacher, 3 researchers and 4 research engineers/project managers in the field of Research. All are working actively on/with audiovisual documents, as producers and/or authors. They all work on projects of constitution and exploitation of audiovisual collections (in the field of Teaching and Research), that's why most of their remarks and interests deal with applications of Convergence in the audiovisual field.**

THE CONVERGENCE CONCEPT:

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

First of all, the participants appreciated the Convergence presentation which appeared very clear and made them react and identify possible applications on their activities. If applications and interests of Convergence were very clear for everybody, some points

of the concept itself were more difficult to assimilate for several participants (taking into consideration that all of them had a non-technical profile):

- **Convergence is not a tool, but a concept. Participants better understand the interest of a tool, rather than a concept, quite abstract for non-technicians.**

- **A VDI represents any kind of information, i.e. a video, an author, a picture, a part of video, etc... This led sometimes to the confusion between the VDI representing a video and the VDI representing the description of the content of the same video.**

- **The concept of "data stored in network" appeared also to be abstract for participants, who wondered where the data (VDIs and videos) would be stored.**

Here are main answers of participants about the Convergence concept :

- **4 participants see Convergence as a very good way to improve the visibility of non-textual information, more particularly audiovisual information. This is a recurrent and growing need in the field of Teaching & Research, and more particularly in the field of cultural & scientific heritage where oral communication is very important and where a lot of collections remain unexploited or insufficiently exploited.**

- **5 participants pointed out the fact that Convergence could improve the use of Internet for internet users, in the fields of information retrieval and privacy of their personal data. For example, many internet users do not know how to protect their data on Facebook, or what Internet application to use when looking for specific information. An interesting application would be to enable the retrieval of every document/publication from the same author, using a single web application.**

- **5 participants see interesting and clear applications of Convergence for social networks, regarding data synchronisation, privacy protection and information lifetime. More, lifetime of information is seen as a very practical and innovative feature. Everybody agrees to say that this feature does not exist in most of specialized proprietary services, more particularly in social networks where it would be an important innovation and would answer a growing need for**

Internet users.

- **Almost all participants see significant capabilities of Convergence for <u>users content re-appropriation</u> in any context (i.e. not only for social networks and not only using specialized proprietary services). For example, audiovisual documents produced by an anthropologist about Quechua people could be exploited by these Quechua people for the valorisation of their culture (by adding relevant description of video content, for example).**

- **On the other side, they believe that Convergence could provide <u>security for video producers</u> to control who use their material and how this material is used. In this case, rights management, lifetime, but especially synchronised information are very useful. Many people from Teaching/Research domain who own audiovisual collections don't want to publish them because they wonder how it will be re-used. Quechua people could give only the anthropologist the rights to comment their audiovisual documentation.**

- **Finally, some participants find very important that a VDI can describe as well a full video as a part of a video.**

At least 3 interesting quotes from user answers:

"Is the notice linked to the video? Is it possible to use the video without notice?"

"It is very interesting that people can re-appropriate the content, without inevitably use a specific application. More, this is very interesting in a linguistic point of view."

"It is very reassuring for people who own an audiovisual collection and are frightened on the uses that could be done on it"

TRIAL SCENARIO:

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

The scenarios were well received and correspond to problems of many participants. Some of them detailed the application of our scenarios in their work :

- **Constitution of an audiovisual resources centre (archives, media library) dedicated to the Quechua people. Create a collection on the oral heritage (singing, dancing, oral literature ...), a collection about the know-how in traditional handicraft, with the aim to facilitate the re-appropriation of this material by the local communities and to create a cultural centre in Cuzco... Give assurance to filmed people about the conditions of the uses of this collection, and give them the opportunity to re-appropriate it by valorisation, descriptions, subtitles, etc.**

- **Development of a media library dedicated to the history of the mathematics with the aim to share this knowledge with e non-mathematicians. The idea is to realize interviews in-depth with mathematicians, to create an open corpus of video on the basis of a set of common questions proposed during an interview. Give interviewees assurances about the exploitation of this collection. Re-exploit this collection for scientific popularization.**

- **Creation of an audiovisual portal in order to put online a scientific heritage, give the access to a wide public about the Azerbaijani culture. To promote and broadcast the activities, the studies and the products connected to the studies of languages; to present the Azerbaijani cultural heritage (music, technical culture, everyday life, minorities...), more particularly using audiovisual documentation which is yet rather rare in Azerbaijan. It is important to pass on the cultural heritage to future generations.**

-

- **Develop a video library dedicated to the intercultural teaching and learning. More specifically on the theme of the "intercultural city". The idea is to create, in association with Bachelor 2 and 3 as well as Master 1 students, a video portal emphasizing the various surrounding areas of the everyday life of the intercultural city and to explain and develop their experience of the educational usage of the audiovisual by taking into account new forms of communication of the digital culture.**

Here are the main strong points about scenarios, as revealed by the participants:

- **It is important to enable the constitution of archives where audiovisual content is stored in several different places (Baku & Paris, Cuzco & Paris, etc.)**

- **It is very interesting to enable different persons/communities to exploit an existing audiovisual collection in their way, and to enable the synchronisation of the information provided by each actor. For example, ESCoM creates a notice of a video about mathematics produced by the ESCoM team (names of participants, legal notice, etc.). Marie describes the content of the video. Then, she describes again the video, selecting specific parts and adapting the description to scientific popularization. These 2 descriptions feed her "History of Mathematics" portal. Some data provided by Marie is synchronised with the video notice. More, the popularization description is used by ESCoM to feed also the ARA portal. Later, if Marie makes changes on her "popularization" description, information will be synchronised with ARA portal.**

- **Another interesting point is the possibility to make publications that use abstracts from several different videos.**

Here are the weak points :

- **Our scenarios do not exploit the rights management out of a specified/known community. The scenarios plan to enable a VDI author to specify who can update/moderate his VDI, but involved people have to be known by the author. The scenarios should have taken into account the case when an unknown person asks to update a VDI and the case when the author of a VDI doesn't know yet who will ask to update the VDI. An application could have helped authors to manage VDIs to moderate, rights requests from unknown persons, control how VDIs are used, etc.**

- **The same remarks were made about VDI lifetime. Our scenarios could have managed how it affects the publications and the workflow when the lifetime of a VDI is indicated. Since we realised this is a very interesting point, we will try to implement this request on our trial scenarios.**

At least 3 interesting quotes from user answers:

"When I publish my video, I don't give any authorisation to use it. On the other side, I would pay attention to any update proposal, case by case, but I cannot know who will

ask for an update."

"As a graphic designer, if I want to use a part of a video, can I obtain the authorisation? How?"

"Is it possible to create publications on channels that use abstracts taken from different videos? "

IMPROVING CONVERGENCE:

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

Here are the remarks pointed out by the participants that seemed for us to represent possible improvements of Convergence, in the limit of our own knowledge of Convergence system and features (meaning that maybe some of these points are already covered by Convergence) :

- **When managing user rights on VDI, giving the possibility to specify exactly on which parts of the VDI the authorization has its effects (for example: user can update the description section, but not the title).**

- **Giving the user the possibility to update any previous version of a VDI.**

- **To update a video notice, user should have the authorization of the author of VDI. But the authorization of filmed persons is sometimes also necessary. This should be taken into account in Convergence.**

- **In the field of Video, in certain cases, copyrights and image reproduction rights are not sufficient (for example, image reproduction rights of a person appearing in the background of a video). Convergence should take into account different kinds of copyrights, and be progressive enough to be able to integrate new kinds of copyrights after time.**

At least 3 interesting quotes from user answers:

"Can the user, at any time, access to the initial description, or to the stage number n of

the description of a video?"

THE FOCUS GROUP

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

This experience of Focus Group was very interesting and productive. In our point of view, participants have made more remarks and had deeper thoughts than if they had to listen and fill in forms.

After 3 hours, the limits seemed to be reached. Participants felt they said everything they thought about, and felt they needed more time and more (temporal and intellectual) distance to evaluate better what we presented.

Finally, they all expressed their satisfaction about this experience, asking for the presentations of Convergence project and to plan a new meeting again before the end of this year.

At least 3 interesting quotes from user answers:

WRAPPING UP

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

To conclude, the three main centres of interest in the Convergence project and the identified scenarios are :

1. **Power of synchronisation and lifetime in VDIs. This will enable very interesting features for content providers who will be able to control who use their content, and how they use it. More, this enables users to re-appropriate the content and propose their own interpretation and/or valorisation of content. This last point is also seen as the most important in our trial scenarios.**

2. **Participants were also curious to know how a user can ask for updating a content description, and how authors can give this authorization, check for**

descriptions to moderate and control the uses of their content.

-

3. **Finally, participants were aware of the copyrights management: how they will be implemented, what kind of copyrights can be set, if some specific cases can be taken into account, etc.**

At least 3 interesting quotes from user answers:

Appendix 3: Report on LMU focus group

PARTNER: LMU	DATE: 31-10-2010	TARGET: STUDENTS

PRELIMINARY (PARTICIPANTS INFO):

Add any information on the composition of the group you feel may be relevant

Altogether, 7 subjects took part in the focus group (5 male and 2 female; with an average age of 26 years). All of them were students or PhD students at LMU or TU (the Technical University of Munich). One subject had a background in finance whereas the remaining ones had a background in computer science or media informatics. 4 of them had their High School Certificate; 3 of them already have achieved their University Degree. 3 of them rated their experience with PC and Internet as average, 3 subjects described themselves as technician and 1 of them would consider himself as expert.

THE CONVERGENCE CONCEPT:

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

If you were describing Convergence to a colleague, what words would you use?

It was actually very difficult for subjects to explain the Convergence system. One reason was, that subjects actually did understand the concepts, but couldn't project its use to their everyday life. Nevertheless, all of them described the important aspects of convergence with the words synchronization, non-redundant data, and container.

For you, what are the most attractive aspects of the system? What are its least attractive aspects? Advantages; Disadvantages?

The most attractive aspect of the system was actually the actuality of files and the feeling of being in control of what is published. All subjects liked the idea of being the owner of the VDIs they create and distribute. However, most subjects doubted the possibility to realize the protection of data (e.g. pictures) because in their opinion there is always the possibility to find a workaround to avoid DRM issues. One subject also stated, the she found the concept too complex, which would intimidate normal users, so that they will keep on using today's internet instead of testing Convergence. All other participants agreed, that in order to prevail Convergence's concept, it must not get more complicated. The more a user has to decide, the more difficult it will be for them to use. Therefore, subjects found that the selection of privacy, DRM or expiry date settings should not be exaggerated.

Are there any new features you would like to see in Convergence?

One subject described Convergence as an exploration, which he thought was very interesting. He also noted, that the feature to have versioning of data is very desirable. When reading an article in a newspaper, there should be the possibility to flip through similar articles over the past 50 years. Another subject wanted to define access control for other people. When allowing some company to view her résumé, she wants to be able to say, that after a year, they won't be able to access it anymore, whereas a company she is currently applying to should still be notified about updates in her résumé. Another subject found certification as very important for the use in the area of e-commerce.

How would you see the system to be used in your organization?

One subject could imagine using convergence for the coordination of tutorials. They could share information with other tutors and determine what others are allowed to do and also restrict what others can see of the shared data. Another subject suggested the use of convergence for an intranet for students. He thinks, that many students would use it, which enables Convergence to gather valuable feedback from end-users.

At least 3 interesting quotes from user answers:

" You have to ensure, that no raw data can be extracted from the VDI. Otherwise, someone could just do that and publish the data as his own. "

"I have a question about the search thing: You had this example where the company calls up a VDI about Mr. Brown. With today's internet you have to search with thousands of results. But with Convergence you just look for the VDI and all of a sudden you got the right one. It sounds so simple, but actually it isn't."

"It's hard for me to estimate what the system is capable of and what not."

"Actually, you have something like Google."

"Have you decided on the structure of the VDI? Is it like a folder with my name (first name, last name) and it contains everything about me?"

"You always get the latest version of a VDI, so can you get the version of a VDI at a certain timestamp?"

"Can I get the other versions of the VDI by clicking or how does it work? It just often happens to me, that I visit a webpage and find some interesting information and the day after that I want to read it again, but it's just gone."

"My résumé is something that belongs to me, it is so much mine that I think I should be able to decide who has access to it and who hasn't."

"I understand the concepts you have described, but I can't imagine it in my everyday life with internet. How do users use your system? Is it a desktop application? Is it a website? How do you enter the market? Do you work with or against Google?"

"I actually like the idea of being in control over my own data. I just put it into a VDI and I am the owner of that file inside the VDI."

"I wonder if you really can realize this project."

TRIAL SCENARIO:

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

Do you think the trial is relevant to your work?

All subjects found the idea of an augmented lecture podcast as something useful and it is also something they would have wished for when preparing exams. But since almost all of them (6 subjects) are almost done with their studies, they don't see the real benefit for themselves anymore. One subject, who is still at the beginning of her studies, would use the augmented lecture podcast and described it as a good alternative to discuss problems with colleagues while learning.

What are its strong points/ weak points?

The main advantage of the system is the possibility to make comments and to ask questions. However, several subjects were concerned about the number of information. They pointed out the need to find a mechanism to filter information in an appropriate way. Subjects said that this is a difficult thing to do, since it has to be decided which content is relevant and which is just disturbing. Another subject liked the availability of the augmented lecture podcast for download, since she preferred this to streaming. One subject, who has experience in managing a public forum, also noted, that it will be difficult to manage the VDIs, when the origin of referenced VDIs is lost (e.g. when the first topic of a thread is deleted). In order for Convergence to keep their promise about privacy (digital forgetting), deletion has to be allowed, but this will result in further problems (e.g. citation in other threads, meaning of

threads, etc.).

How would you enrich the scenario to make it more relevant to your work? What would you change?

Subjects wanted to be updated about changes in the augmented lecture podcast. Which means, that they can see when someone answers their questions or when some new questions are posted. Furthermore, another subject suggested to include an automatic VDI search about the content of the shown slide, so he automatically gets more detailed information. Furthermore, one subject thought it would be helpful, to rate content, allowing to quickly grasp the most important slides. Students then may focus on these slides when learning.

Would you join the trial yourself and would you advise a friend/colleague to join it?

All subjects would try the application by themselves first, before recommending it to friends or colleagues. If they then talk to someone they think would benefit from the application, they would definitely recommend it.

At least 3 interesting quotes from user answers:

"If you want to realize the concept of privacy, you have to allow users to delete their comments, otherwise you won't be able to keep your promises. But you'll be confronted with a lot of difficulties".

"There will be a lot of people who will try to disturb the system."

"The question is, how will people be notified when I post a question. It doesn't help me, when I ask something, but no one answers me. So I want to be notified when changes are made."

"It's completely different to what we are used to. When I download something and all of a sudden it is gone. I can't imagine that. There should be something like a notice period of 2 weeks, so the user may be prepared."

"I need to know how the whole thing is realized in order to know what features I need."

"A big issue I see is in filtering the whole information."

"You could have slides and automatically search for further VDIs regarding the content shown in the slides."

IMPROVING CONVERGENCE:
Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways
Could you imagine other applications for Convergence? One subject was convinced, that Convergence could contribute to the fight against child pornography. It would be easier to delete inappropriate movies. He also suggested to use Convergence for spam filtering. Another subject wanted to have the possibility to observe the number of times a created VDI is published or copied, which is an important thing in the area of photography.
At least 3 interesting quotes from user answers:
"It's a vision. It's so complicated and you have to take care of a lot of things. I am not sure if users are yet ready for something like this." "Control is an important point, but it may endanger anonymity which is a strong point of the current solution." "I want to know, how many times and where my VDI is republished. That'd be awesome."
THE FOCUS GROUP
Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways
Based on your experience today, what do you think of focus groups as a way of evaluating a new technology? Do you think they can contribute to improving a prototype or the design of a trial? All subjects agreed that a focus group is a good mean to evaluate a new technology, however opinions were still slightly different. So one subject said, that it would be better to conduct the focus group discussion at a later stage – when the concept is more mature and more things are clear. Contrary, another subject found the time for the focus group at this stage as perfect, since the development of concepts is still in progress. This facilitates the discussion for technical as well as non-technical persons. All subjects also found the focus group as a good mean to observe which parts of the Convergence system are difficult to understand or what users probably will be afraid of, when encountering the described system. *In this specific focus group, did you feel free to express your ideas and views?* Subjects had no difficulties in expressing their ideas and views. They stated, that the number

of participants was appropriate for discussion and helped them to participate and express their opinions. For example, when they were not clear about what to say, they could first listen to what the other participants discussed and could then join the discussion easily.

What were the best aspects of the focus group? And the worst? What improvements would you suggest for the future?

All subjects described the atmosphere of the focus group as comfortable. The combination of presentation and discussion made the whole focus group more enjoyable and easier to follow. However, all subjects criticized the duration of the discussion and would suggest a shorter length as well as including short breaks to enhance concentration. In order to shorten the discussion, three subjects suggested postponing some questions to a questionnaire, whereas another subject expressed that he was quite happy, that there was no questionnaire to be filled out.

Will you be willing to participate in other focus groups in the future and would you invite a friend or colleague to join a focus group like this?

All subjects would be willing to participate in another focus group when their time schedule is free. One subject also stated, that he really liked the focus group discussion, because he learnt something about something new – so it was definitely no waste of time. If there's a chance, they would also asked their friends to join the next focus group.

At least 3 interesting quotes from user answers:

"A tiny break would have been great."

"The combination of presentation and discussion was nice."

"Also the number of participants was appropriate for discussion."

"I think a lot of things could have been put into a questionnaire."

"The focus group is a nice thing to understand what has to be changed about the concept – and even if you don't want to change it, it is a good mean to see what you have to do or avoid to 'sell' your concept to other people."

WRAPPING UP

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

Give the three words you think provide the best description for Convergence.

Versioning, linking, trust and control were the most words subjects used to describe the Convergence system. It was often associated with the concept versioning, since not only was it important for subjects to get the latest files, but it was also important to be able to get older files that would have been overwritten otherwise. The possibility to link VDIs and to nest them was also remembered by subjects as a feature of Convergence. 5 of 7 subjects named control as an important word to describe the Convergence system. They had the feeling, that using Convergence would enable them, to be the owner of the data they publish and made them feeling in control to decide who has the right to work, manipulate or see their data.

The single best aspect of the system / the worst aspect of the system.

All subjects agreed, that control was the best as well as the worst aspect of the system. On the one hand, it allows them to be in control of their data (who has access, what can be done), but on the other hand, they also felt being controlled by the system, because so many options can be made when creating a VDI (who is the creator, encryption, expiry date,…). With the concept of control and DRM, subjects noted, that convergence is less anonym than the current Internet, which is an advantage as well as disadvantage at the same time. It was however important to subjects, that anonymity is granted when desired by users.

Would you use the system if it were available and fully functional?

In general subjects were open to try out something new. One subject noted, that he would use it for certain applications (like observing how many copies of his data is wandering around), but he would not add a long tail of information to the system (like name, DRM options, expiry dates,…). He would like to maintain the feeling of anonymity. Also the availability of other options would influence their decision and how many applications for Convergence do exists. Altogether, all, but one of them would try out the new Convergence system. Whether they would use it over a longer period of time, would depend on the aspects mentioned before. Only one subject stated that the Convergence system seems too complicated for her.

At least 3 interesting quotes from user answers:

“We expressed a lot of scepticism during the focus group. But that’s not a bad thing. It’s normal that you’re sceptical when there is something new.”

“It’s really difficult to compare your system with the current Internet and to build my own opinion. Today’s internet is something I have used a lot and I know almost every facet about it, but your system – I’ve just been talking about it for 2,5 hours.”

"But it's a good thing to talk about it at an early stage. You can explore the topic and see where users have their difficulties in understanding or what they are afraid of."

Appendix 4: Report on WIPRO focus group

PARTNER:	WIPRO	DATE:	07/04/2011	TARGET:	FOCUS GROUP REPORT

PRELIMINARY (PARTICIPANTS INFO):

Add any information on the composition of the group you feel may be relevant

The Focus Group took place on Friday, 7th of April on the premises of Wipro in Porto. Attending to this Focus Group we had two electronics retailers: Worten and Radio Popular. Worten is the market leader retailer in the electronics and entertainment area in Portugal with a turnover of 708M€ while Radio Popular is a well known electronics Portuguese retailer with a turnover of 300M€.

The focus group was presented by José Ribas and Daniel Sequeira. 8 high specialized persons and 5 others representing the end-users perspective participated on this Focus Group:

(names omitted for reasons of personal confidentiality)

THE CONVERGENCE CONCEPT:

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

The Convergence concept was briefly presented to the participants avoiding too much technical details and using common sense examples so that they could have a better perception and understanding of it. The major part of the participants of this focus group were not familiar with the technical issues of Convergence.

Our approach consisted on comparing the retail solutions we have at our disposal nowadays with the new ones that Convergence will offer (standardization, etc.), regarding mainly the retail use cases and covering major features like:

- **Subscribe product information and upload it to the retail merchandise system (RMS)**
- **Improve product information: compatibility, upgrades, similar products, etc.**
- **Better in-store information available for customers**

- **Digital warranties**
- **Product return, recall and repair**
- **Second-hand sales**

For the presentation of the Convergence concept we used examples from Worten, Radio Popular and their competitors in Portugal about one specific product: the Roomba. These examples consisted in this product information provided on the web by each retailer, pointing out the differences in that information between all of them. We also resorted to information about the Roomba presented in some second-hand sales websites, to better demonstrate the lack of consistency that is hosted all over the web about the information on the same product.

The participants, mainly the high specialized ones, liked very much the idea of having a standard and vendor independent descriptor for products, their main reasons were:

- **Cost issues associated with the obtainment of products information**
- **The globalization of the electronic market supply-chain**
- **Product characterization is a big problem: time loss, too many parameters, very large catalogues, etc.**
- **Identical products all over the market that are distinguished only by its technical features**
- **Heterogeneity of product descriptions used by different retailers**
- **Benefits of virtual catalogues in the exchange of information between manufacturers and retailers**
- **Restrictions on the number of characters that can be used in products descriptions by IT**
- **Lack of standardization in the product terminology used between retailers and suppliers**
- **Difficulty that brands and retailers have in proper people and customer management**
- **Problems linked to the retail systems architecture**

Worten was keen to make clear that all the problems mentioned, problems that Convergence could solve in a near future, are the real problems retailers are facing nowadays and a major concern for them. They even are planning a few projects that aim to resolve some of these problems in the next few years.

At least 3 interesting quotes from user answers:

"Since everyone will be able to use this, what will be the distinguish factors between retailers?"

"Product description is a big problem for retail, there are many different products that do exactly the same thing and only differ by its price."

"There is a big lack in the translation of products technical characteristics into real benefits for the consumers."

TRIAL SCENARIO:

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

Each phase of the retail trial scenario that we are planning to execute was fully explained to the participants. The trial scenario in general was very well received; some participants identified possible solutions for many of the problems they face nowadays in the retail area:

- **Radio Popular works with the JFK company to obtain products information. JFK offers a proprietary solution which contemplates a platform with a unique database that works with product's EAN. In this context Worten already has considered adopting this type of solution too, paying a company like JFK in exchange of products information. The disadvantages of this solution are the associated costs that the platform utilization brings to these retailers and the limitation of the automatic data integration with the ERP that will only work with this platform. With the standard and vendor-independent descriptor of products that Convergence will provide, there's no need for this kind of platform because the products information will be always available all over the internet. And being that information not only reliable but also universal the data integration with any ERP will be facilitated, interacting with all Convergence-enabled platforms.**

- **Due to the aggressive competition in this market is very important for the retailers to be able to satisfy the needs of the customers entering their stores. They need features with real benefits for the sales perspective and today the**

difference in the number of the sales is in the information provided in the store. The customers in addition of being more and more informed, they also want more and more access to products information. In this context Convergence will help the retailers providing more and also better in-store information to their customers, resorting to smart-phones applications that will provide customers the access to products information through barcode reading.

- **By enabling the use of digital warranties, Convergence will bring numerous benefits, not only for consumers but also for retailers. One of these benefits is to give a solution to the eternal problem of customers constantly losing their receipts that causes too much trouble for the retailers in the identification of the customer and also the historic associated with him in case of a product return for example. On the other hand there is also the issue of the thermal paper used for the receipts, a type of paper which overtime becomes increasingly unreadable, with digital warranties this would not occur. Radio Popular also referred their urgent need for tools or mechanisms to help them fight against the fraud risk associated with product returns. This type of fraud presents itself as a very common problem against electronic retailers, which often occurs by the customer exchanging the receipts between two identical products. Digital warranties could also work as mechanism with advantages for the retailer on this field.**

- **At this moment it is very difficult for retailers to know or obtain the serial number of the products they sell. Register a product serial number has a high cost associated with, connected to the fact that not all the products have serial numbers and there isn't yet any legislation to cover this issue. This limitation can be seen as a significant problem because it would be a huge improvement for retailers if they could keep track of the serial number of the products they sell and the ones they still have in the store too. In this situation the serial number would work as a unique identifier of the product, helping retailers improve their inventory management. With Convergence this problem will be easily addressed, since the serial number could be associated to the standard descriptor of each product.**

- **One of the retailers' main concerns is to better serve and help their customers, but in the present day they don't possess the best mechanism to do so. How can they identify all their customers without compromising their anonymity? Convergence could provide the retailers with better and more efficient tools or mechanisms to help them in the relationship with their customers. Better**

identifying who they are, what their needs are and possible trends.

During the presentation of the retail trial scenario the participants pointed out some interesting remarks about it, that we think should be taken into account for a better integration of Convergence with real world situations:

- **There must be some kind of legislation that covers the products bar code reading by customers' smartphones from the stores shelves. Many retailers have the common practice of not to allow customers to take photographs inside stores or shopping centers.**

- **Do not complicate the act of purchase is a fundamental aspect in retail, this should be simplified as much as possible without creating any obstacles to the customer. It should be ensured that the collection of data for the generation of digital warranties, at the moment of checkout, does not become a very time consuming process causing the customer to withdraw from the purchase.**

- **There will always be customers who will not want to be identified or at least will be very reluctant about that process. In this context it is necessary to define how Convergence will deal with this kind of situations.**

At least 3 interesting quotes from user answers:

"The price remains the main decision factor for consumers in this business."

"We (Worten) lost a lot of money due to the problem of serial numbers."

"We (Radio Popular) can't add any new mechanisms that delay the sale process!"

IMPROVING CONVERGENCE:

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

Many of the comments made during this focus group session could be considered as improvements for Convergence. Here we point out the ones that seemed more relevant to us and that also add new ideas for the project:

- **Nowadays more and more customers adopt the option of buying warranties extensions for their electronic products. This issue could be very well addressed by Convergence through the development of tools or mechanisms that facilitate the purchase of these warranties extensions for the customers.**

- **The sale of items that are not included in the retailers' product range is a very common practice in this sector, but the major part of the customers do so by consulting catalogues with references for the brands they seek. With Convergence retailers could take advantage of this situation by just subscribing the products they don't have in stock yet from the manufacturers, allowing customers to consult and order all the products from their digital catalogues.**

- **One of retailers' major concerns is the high level of fraud they are exposed to, due to their type of business and operation mode. Therefore Convergence would be very well accepted by retailers if it helps them prevent fraud situations, so any improvement of Convergence must take into consideration this crucial aspect for retailers as a way for its acceptance and persistence in the real world.**

- **Repairing is not a business and responsibility of the retailer, but could create problems for him if a defective product hasn't a good assistance network. Convergence could permit the improvement of assistance networks, helping in a better organization of its process, with advantages for retailers and consumers.**

- **If Convergence allows the easy comparison of prices between retailers that will become a huge challenge for them. Retailers struggle everyday to differentiate themselves from each other in order to build competitive advantages that enable them to attract more customers. And once they gain these competitive advantages the last thing they want is to give them up. Convergence should take this issue into consideration, since it's imperative to the success of the project that it doesn't pull away the retailers.**

At least 3 interesting quotes from user answers:

"Becomes very complicated for us (Radio Popular) when customers return defective products, only a few days later after they bought them, wanting answers about what happened, when we are not the ones to blame for that kind of situations."

"Undress the price is a big problem, for us as retailers at the moment it just doesn't make any sense to do so."

"Will Convergence vulgarize what distinguishes brands nowadays?"

THE FOCUS GROUP

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways

This Focus Group was a very enriching experience, because it allowed us to share our ideas on the retail aspects of the project with very knowledge people in the area. It was very important for us to get feedback from two big electronic retailers like Worten and Radio Popular, who are characterized as potential stakeholders of Convergence.

At the beginning we were a little reluctant about explaining the Convergence concept to the participants, mainly because of their profile, we didn't know if they would have difficulties understanding it or not and also if they would embrace our ideas for the retail trial scenario. Despite our initial hesitation, the overall feedback of the Focus Group was very good. The participants didn't have too much difficulties understanding the concept of the project, they shared with us their satisfaction about the potential of Convergence for the retail industry and also approved all our main ideas for the trial scenario. They also showed their huge interest in knowing more about the outcomes and conclusions of the project, because in their opinion the future of retail will invariably pass by many of the ideas Convergence aims to implement.

The only aspect they didn't care so much was about the second-hand market applied to Convergence. This is easily explained because second-hand sales is not a concern for Radio Popular, they are not aware of the potential impact on the evolution of second-hand market. Today they usually buy second-hand electronics for customers when selling new ones and then they end up send all of those second-hand products to be recycled.

On the other hand they really like the idea of a product's descriptor containing information about other products (compatibles, peripheral, accessories, etc.) which will allow cross-buying and cross-marketing without the retailers spending any more money. This idea would be a great improvement for this sector because presently that information isn't available anywhere and the cost to create that information into the retail information systems is very high.

WRAPPING UP

Summary of user answers - where there were differences of opinion make these clear and give the numbers who reply in different ways