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E-Portfolio Interoperability Revisited: Position Paper

The issue of e-portfolio interoperability has been at the heart of e-portfolio technology discussions for more than 6 years now. Although a number of technical specifications have been published since 2003, yet none has been adopted beyond a limited number of e-portfolio platform providers, and when they have been implemented, the promises of interoperability, although limited in scope[1], have not materialized[2], yet.

One potential candidate for wider adoption in the UK is a (soon to be released) British Standard[3]: *Using e-Portfolios to Evidence Qualifications*[4]. While it is too early to draw any conclusion from this new official e-portfolio standard, what we would like to do in this position paper is:

1. Explore why many of past efforts to achieve e-portfolio interoperability have not been (and could not be) successful as long as the solution was searched within the limited circle or e-portfolio platform provision?

2. Recognize that e-portfolios belong to a more generic class of objects related to personal data[5] and that the solution to interoperability for this class of objects is to be found primarily in the systematic exploitation of identity and access management (IAM) technologies –data formats are ancillary, not central to that process.

3. Explain why a successful e-portfolio implementation policy, beyond the walls of individuals' institutions, will require a change in the architecture of information systems, moving from organisation-centred to person-centred architectures –most current e-portfolio implementations are still organisation-centred.

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1 So far, the main focus of e.portfolio standards has been the import/export of e-portfolio between e-portfolio platforms, so it has remained mainly an academic exercise with no real impact on any application or service that are in position to exploit ePortfolio data —e.g. recruitment, career planning, etc.

2 A number of plugfests and tests have demonstrated that two different platforms, while using the same set of IMS specifications, have a hard time to exchange data seamlessly.

3 This standard was designed in co-operation with and for awarding bodies, the UK organisations that have the responsibility to deliver millions of qualifications each year.

4 BS 8518: *Using ePortfolios to Evidence Qualifications: BSI Standard for the Transfer of Assessment Data & Evidence.*

5 E-portfolios are not fundamentally different from personal health records or any other type of personal data.

4. Establish the principles of an architecture based on the functional separation between personal data (distributed and unified) hosting from their exploitation.

1 Introduction

The first published e-portfolio specification was e-pix (www.epixspec.org). It was released in 2003 by e-portaro[6] Inc. (www.eportaro.com) in order "*to allow disparate e-portfolio systems to speak a common language for discovery, integration, and synchronization without regard to implementation specific technology choices.*" This first specification was never implemented beyond the platforms of its creators and we had to wait two more years to see the release of the first e-portfolio specification that would be introduced to more than one system. The *IMS e- Portfolio Best Practice and Implementation Guide Version 1.0 Final Specification* (www.imsglobal.org/ep/) published in 2005 was adopted only by a handful of e-portfolio providers, so far. Unfortunately, no applications or services, beyond e-portfolio platforms have implemented IMS specifications: it is not used for communication with job boards, registration services, awarding bodies, accreditation of prior learning services etc. So interoperability based on IMS specifications (when it works!) is limited to the communication between competitors providing more or less the same service.

Since, the UK community has been active on the standardization front with the work done on UK LeaP[7] and more recently LEAP2A[8] which first stable version was released at the beginning of 2009[9] and the release of another standard: BS 8518: Using ePortfolios to Evidence Qualifications. The philosophy and rationale of the two standards are rather different: with UK LEAP2A the objective is to create a *general specification* similar IMS, but "simpler" and adding some "Web 2.0" flavour, while the aim of BS 8518 is to solve a very specific business case: the Transfer of Assessment Data & Evidence from accredited centres to awarding bodies.

The business case for creating BS 8518 was the following:

1. Qualifications[10] are delivered by awarding bodies, many on the basis of portfolios (initially paper and now electronic) collected by accredited centres to be reviewed/verified by the awarding bodies.

2. Accredited centres want to choose their own e-portfolio systems.

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6   Latest news on e-Portaro website date March 20, 2006, indicating that this company is not active anymore.

7   http://www.bsi-global.com/en/Shop/Publication-Detail/?pid=000000000030098157

8   wiki.cetis.ac.uk/LEAP2A_specification. LeaP stands fo „Learner Profile"; drafted in 2004 it was proposed as British Standard. The initiative is led by JISC's Centre for Educational Technology and Interoperability Standards (CETIS)

9   http://wiki.cetis.ac.uk/2009-03/LEAP2A_specification

10   Several millions each year!

3. Awarding bodies do not want to
   - impose a unique platform to their accredited centres
   - learn the idiosyncrasies of each platform.

4. Awarding bodies and accredited centres want to ensure that all data is securely transferred back and forth.

The solution proposed by BS 8518 is to constrain the transfer of data currently stored on a variety of e-portfolio systems onto a single review system based on:

- XML schema for describing the relationship between components, options and exam specifications
- API (Application Programming Interface) for the transfer of assessment data between centres and awarding body systems

Although it is too early to measure the real impact of this new standard, it is possible to state that it represents a first and significant contribution to the functional separation between e-portfolio construction and consumption (in that case, for assessment), between what we referred to as e-portfolio *manager* and *organiser* in a previous *position paper*[11]. There is still more work to be done (like the separation between the storage of personal data and the services exploiting them) but this is definitely a move into the right direction.

The business case for LEAP2A is rather different. This is how the *LEAP2A specification for portability and interoperability of e-portfolio information* describes itself:

This specification is intended to cover the representation of several kinds of information, centred around individuals, who collect, create and use their own information. Much of this plays a part in the individuals' learning, but rather than being learning materials authored by an educator, the information is typically authored, or collected, by the individuals themselves: what they have done, made, achieved, written, or are proud of; what or who helps or has helped them; what they aspire to; what they are good at; evidence for and reflections on any of these; and perhaps input from other people.

It is not the purpose of this specification to cover information gathered by others about an individual, over which that individual has no easy access or control.

Although, this last sentence (highlighted by me) sounds perfectly reasonable (*do not specify what you cannot control*) it is far from a benign statement. It contains an idiosyncratic vision of the e-portfolio, its underlying architecture and a model for interoperability that we intend to question and challenge.

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11   www.eife-l.org/publications/eportfolio/documentation/positionpaper/

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So, what we will explore next is a vision where the "*specification to cover information gathered by others about an individual*" is not treated as a *problem* that can be discarded but as one of the central elements of a *conversational e-portfolio* architecture, i.e. where e-portfolios (repositories) are not treated as silos of information but as condensation points of conversations with peers, tutors, mentors, colleagues etc. How to treat the e-portfolio as a social object, not as an independent silo of personal data?

2 What interoperability?

It is possible to define two main classes of interoperability problems:

- **Diachronic interoperability:** how can we make a set of data accessible to different organisations in a succession of time periods? It addresses the issue of the record of a pupil moving from school to high school, a worker changing job, a patient changing doctor. While it is possible to have records transferred from one institution to another, what happens to the set of data that is not relevant to the new organisation? Should it store it[12] or ignore it? And if it ignores it, should it remain in the previous organisation storage? Should we put on the shoulders of a kindergarten the burden of keeping lifelong records of all their pupils? *Or should personal data be stored on a personal data repository owned by the individual?*

- **Synchronic interoperability:** how can we make a set of data accessible to different organisations during the same time period? It addresses the issue of a student learning at different institutions during the same period of time or a job seeker interacting with a number of institutions such as job board, career advisory, employers, etc. or a patient dealing with a laboratory, a generalist, a specialist and the hospital. While it is possible to have different records in different institutions, how should we deal with common data? Should we define a *master storage* for each set of data and a mechanism of replication across multiple repositories? *Or should personal data be stored on a personal data repository owned by the individual?*

So far, LEAP2A has decided to work on four main interoperability scenarios:

- Scenario I: Transfer of complete portfolio information
- ‚Scenario II: Transfer of specific information supporting transition
- Scenario III: Intra-institutional services
- (candidate) Scenario IV: Distributed content

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12 For example, Giunti Lean eXact ePortfolio, when an import do not recognize specific fields, store them as textual information.

The description of Scenario III is:

> An institution has a MIS, VLE and separate portfolio system. Each system has defined areas in which it keeps the student's personal information. The student-owned information is mostly held in the portfolio system, but some information common to portfolio and administrative use is held principally in the MIS (or Student Records System) and transferred from there to the portfolio system as required. When one system is required to access or display portfolio-related or common information belonging to another system, it issues a request to that other system and information is returned in the format of this specification.

This is a typical synchronic interoperability problem and the description of the solution sounds reasonable. Nevertheless, there is an alternative description of Scenario III:

> An institution has a MIS, VLE and separate portfolio system. Each system has defined areas in which it produces/consumes student's personal information. The student-personal information is held in his/her personal data repository. When one system is required to produce/consume personal data, it issues a request to the personal data repository and information is stored / returned in the specified format.

What is the difference between the two descriptions: on the one hand it (LEAP2A vision) implicitly accepts an architecture where personal data is fragmented and that part of it is not under the control of the individual. On the other hand the new version of the scenario provides a solution to intra-institutional as well as to inter-institutional services. This is achieved by moving the issue of interoperability from fragmented data sets to unified personal data repositories. This is at the heart of the new information system architecture that we are going to explore next.

Of course, making applications work with personal data repositories is not an easy task, but there is no realistic alternative if the objective is to create seamless interoperability with personal data, in education and beyond.

3 E-portfolio services: integration or aggregation?

Today's e-portfolio platforms tightly integrate three different functions:

- **managing organisational processes:** an e-Portfolio Management System (ePMS) is used by an organisation (its representatives, such as teachers, assessors, managers) to manage a process during which e-portfolios parts are consumed, produced, assessed, verified, etc.
- **managing individual processes:** an e-Portfolio Organizer is used by an individual to collect, connect, reflect and publish a narrative based on the selection of artefacts.

- **storage of personal data:** personal data produced/consumed during the different processes need to be stored somewhere – today in an organisational database, tomorrow in a unified personal data repository.

Let's take the example of an e-PMS dedicated to assessment of prior experience. When registering for assessment, the candidate might submit an embryonic or a complete e-portfolio; then an assessor might plan activities to complete the e-portfolio with more evidence, collect feedback from appropriate sources, make her own observation and then judge the quality of the evidence against a set of occupational standards. Once the final judgement has been made, assessment records, certificates, where appropriate, and the final e-portfolio can be returned to the candidate who will be able to use this evidence to find a job, to obtain a pay rise or register to a university course.

The set of tools used by the assessor is of different nature from the set of tools used by the candidate. There is no need to have the two sets of tools on the same platform. On the contrary, a clear separation between the tools used to manage assessment and those used to create and manage the e-portfolios would contribute to interoperability. This is the direction taken by BS 8518[13].

An alternative to the integration of e-portfolio services within a single platform is the aggregation of independent services around one's personal data. This is achievable with the right architectural principles.

4 What architecture for the aggregation of e-portfolio services?

The current architecture of information systems is the result of an infrastructure that was mainly built at a time where computing power, data storage and bandwidth were expensive. At such a time, in order to reduce transactions costs, it made sense to centralize personal data into large databases and tightly integrate the different elements of the architecture –calling a procedure within a program using data stored in a disk within a mainframe was less expensive and time-consuming than making a call through a web service exploiting data stored at a distance.

	Yesterday	Today
Computing power	Expensive and centralized	Inexpensive and distributed (virtualized)
Data storage	Expensive and centralized	Inexpensive and distributed (virtualized)
Bandwidth	Expensive	Inexpensive
Architecture	Integration	Aggregation
Services	Integrated applications	Distributed web services
Data model	Organisation centric	Person centric

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13 Using ePortfolios to Evidence Qualifications: BSI Standard for the Transfer of Assessment Data & Evidence

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But while centralization led to costs reduction, this also created the conditions for making systems vulnerable to malicious hackers and incompetent staff. While a lot of work has been done to improve the security of information systems, experience shows that with higher and thicker walls, it is just a matter of time and ingenuity for hackers to discover a system's flaws, or for some incompetent staff to violate security procedures by putting at risk millions of people.

As result of yesterday's legacy, the current Internet architecture is still dominated by highly centralized organisation-centric systems (and current social networks are not more than organisation-centric systems masquerading as person-centric). Personal data are still aggregated around organisational / business information systems – Facebook, MySpace, Ning and other so-called social networks are probably the most powerful controllers of personal data today (with Google).

But the complexity of transactions over the Internet is growing exponentially and the economics of data management is also changing. What was seen as a reasonable solution to reduce processing costs in a relatively simple digital world exploiting expensive technologies might become a problem in a world of ever increasing complexity based on inexpensive and rapidly changing technologies.

A measure of this complexity is the fragmentation of personal data over the Internet and our inability to cope with it – each transaction on the Internet creates records, and it is almost impossible to keep track of all of them.

The solution to reducing this complexity is to create an architecture where there is **a clear separation between personal data hosting and the services creating/exploiting those personal data**. This rule should become the first principle of any system dealing with personal data, from systems used in education to those used for business. Personal data should be kept in a personal data repository, under the control of individuals, and every service producing/consuming personal data should store/modify/retrieve them to/from personal data repository. Services should be able to be fully functional keeping only a pointer (a URL or URI – Unique Resource Identifier) to the personal data repository of the individuals – e.g. instead of storing locally the address of the name of the person, use the URI to retrieve the name when necessary.

Such an architecture would also seriously contribute to reducing the risks created by large farms of personal data that have and will continue to be hacked or victim of incompetent or malicious staff (the National Health Service in the UK has disclosed millions of personal records, so have hundreds of large public and private organisations like Monster of Landesbank Berlin (LBB). Solution to personal data security is not to be found within higher and thicker walls but in dismantling current data farms and distributing their contents over personal repositories. By disaggregating those monumental centralized databanks and re-aggregating them around individuals, this would not only empower people but also give them a chance to choose the level of security they want (or can afford) to protect and exploit them.

5 Personal data storage as e-portfolio repository

The repository is a pivotal component of any e-portfolio architecture. It is where artefacts are being stored and retrieved to be presented into an e-portfolio. This repository must fully belong to the individual, even if it is provided by an institution, so the owner can decide what to do with its data. As it is likely that such repository will be distributed over a number of different hosts (for security as well as practical reasons), we need to define a unified personal data repository (UPDR) as the repository of all a person's assets, a sort of large (distributed) virtual disk where data can be organized by tags, date, size, access rights, etc. While the view of the repository is global, there is no central repository as such and each action on personal data takes place within each PDR (e.g. within an institution), respecting its security level and policies.

As a UPDR is distributed over a number of PDR, it is possible for the data hosted by a particular PDR to implement policies specific to an organisation, e.g. in order for employers to enforce their own policies in relation to the external disclosure of private or confidential information.

> Mary works at a company and teaches at a university. The company has a strict policy for not sharing any data created internally. When Mary is at work she can see all the contents of her UPDR, but when she is at the university she has only access to her University PDR.

A PDR is also divided into two main parts: *all **by** me* and *all **about** me*. This division allows the cross-referencing of different UPDR to encourage and capture the conversation between individuals. For example, a review by John of a document produced by Mary would in John's *By Me* section and Mary's *About Me*. This is also a structure that can be found a many social networks (me / friends) and applications like Tweeter (author / followers) or blogs (author / commentator). This would allow the capture and exploitation of the conversations between individuals and organisations –organisations and network also having their own identity they could have their own UPDR.

	Personal	Organisational
By Me	All the digital assets produced by me and on which I have full control *(read, write, share)*	All the assets produced by me in the context of an organisation and on which the organisation has rights *(a firewall controls access)*
About Me	All the digital assets produced about me, such as comments, reviews of my work, etc. and on which I can attach usage policies *(read, share, define policies)*	All the digital assets produced about me in the context of an organisation

If the UPDR is the means for the existence of a personal identity on the Internet and organisations having their own identity, how could the concept of UPDR apply to them? Is it relevant to define a 'unified organisational data repository' (UODR)?

If there is such a thing as a UODR, it is probably not the mere aggregation of all the UPDRs of all the employees of an organisation. It might also include a whole set of data that are from employees that have left the organisation (organisational memory) and data that are solely related to the organisation (e.g. what customers say about the products or services, a quality label, a customers list). And the organisation exists in a number of different contexts, such as a chamber of commerce, consortia, etc. so it should have multiple ODRs –hence the need for an UODR.

	Organisational	Inter-organisational
By Us	All the digital assets produced by the staff and on which the organisation has full control *(read, write, share)*	All the assets produced by the organisation in the context of another organisation and on which the other organisation has rights *(a firewall controls access)*
About Us	All the digital assets produced about us, such as comments, reviews of our work, etc. and on which the organisation can attach usage policies *(read, share, define policies)*	All the digital produced about the organisation in the context of another organisation (e.g. chamber of commerce)

A UPDR-based architecture should allow the interweaving of multiple layers of identities, from individuals to organisations and networks. This architecture should be 'fractal-like' i.e. the structure should be replicable at different levels of grouping, from individuals to small and larger groups.

There are a number of benefits to individuals as well as organisations and service providers. The main benefit for individuals is a unified space through which they can interact with other individuals and organisations. But also through which different organisations and services can co-operate. For example, a person looking for a job might interact with a number of different institutions, each of them keeping a personal file. By putting this file into the UPDR, i.e. in a PDR that is federated to the other PDRs of the person, it is possible for the job-seeker to make the different files available to the different parties supporting his/her job search. The person becomes an inter-organisational interoperability enabler.

A UPDR-based architecture also makes is easy for the user to combine a number of services exploiting his/her own personal data. Let's say that a learner using particular e-portfolio system that is good at supporting self-directed learning would like to add a new service supporting job application. The way it can be done today is either wait for the platform publisher to add a new service or export/import personal data into the new service. With a UPDR, there is no need to wait for the publisher or a third party to create a plug-in, nor to export any data: it is just sufficient for the learner to invite a new service provider (that does not have to know anything about the other applications used by the learner) into her personal circle of trust, and grant access to all or part of a specific PDR. And when tomorrow a better service is going to be available, she can easily switch to it.

From the point of view of a tool publisher, open source or commercial, there are similar benefits. E-portfolios are created out of data generated by many different ap-

plications including learning management systems, virtual learning environments (VLE) or personal learning environments (PLE). With the current architecture, in order for a learner to create a portfolio, learning outcomes produced within a VLE must generally be exported and then imported into the e-portfolio platform. The problem, however, is not only the duplication of data but the barriers to implement mechanisms where data are seamlessly exchanged back and forth between the VLE and the e-portfolio: artefacts produced within the VLE are added to a portfolio which is reviewed by an external assessor, whose review is made accessible in VLE for the tutor. If all personal data / artefacts are stored on the PDR, this mechanism can be implemented seamlessly; there is no need to exchange data across applications or services. Data do not have to *migrate, in order* to be exploitable by services.

6 Interoperability revised

Despite claims of moving towards Web 2.0 models, the dominant vision of the e-portfolio remains that of the paperless portfolio, i.e. the transposition onto digital media of a paper (or mixed-media) portfolio: a repository is used to collect digital artefacts that can then be selected by the e-portfolio author to create a digital document, his/her e-portfolio. It is this document that has been the main focus of attention for interoperability, not the repository. One of the consequences of this focus on documents rather than repositories has been to keep the e-portfolio within the old architecture paradigm whereas personal data remain fragmented and out of control of the user.

The key issue for e-portfolio interoperability are not data structures or formats but identity and access management (IAM) i.e. the ability for the owner of a repository containing personal data to have a fine grained control over who has access to what, when and for how long, be able to attach policies to his/her personal data, whether they are *by* or *about* her.

The choice of *repository interoperability* is more elegant (also simpler in terms of architecture) and more promising than *document interoperability*: the first one contains the second while the second forces system designers to built complicated architectures and policy management systems; the first one allows the expression of complexity of social relationships, while the second condones impoverished expression of one's self identity; the first one leads to greater control over one's digital identity while the second leaves the door open to personal data abuse.

To the definition of a data model for interoperability, we suggest an alternative approach based on the systematic use of identity and access management (IAM) technologies to create *conversational e-portfolios*, e-portfolios of intertwined narratives – i.e. where e-portfolios elements are shared, validated, recognized, commented by other parties (peers, mentors, clients, etc.) and distributed over a number of personal repositories. The objective of this global interoperability approach is not to be limited by the personal data of *one* person, but with all the data *by* and *about* a person, i.e. the data produced by a community to capture the threads of all the conversations.

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For example, a review of John's work by Mary will lead to a record in John's repository (the artefact) and in Mary's repository (Mary's review), the two being joined by a link in John's 'about me' repository. Mary could also have attached policies to her review data that John would have to enforce. Scenarios can be imagined where evidence presented by a person are wiki-like and shared by several people, so a piece of evidence would connect several people (and stories).
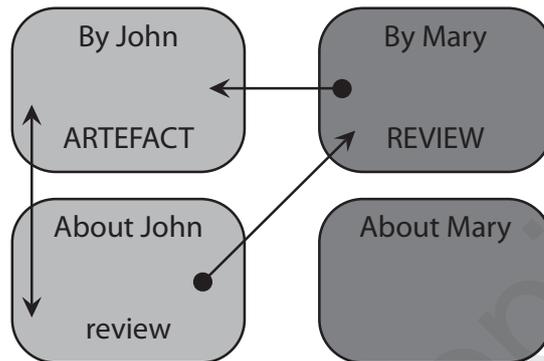
The systematization of this distribution of conversational e-portfolios could contribute to the increased trustworthiness of each individual e-portfolio by eliciting the social dimension of an individual: for example, an employer reading a portfolio, by following the thread of the story and the people who have contributed to it, will have a more holistic view of the candidate. Conversational portfolios would also require interactive services to dynamically adjust access rights during a conversation[14] with peers, colleagues, potential employers, etc.

In such a perspective, the about me part is not accessory, and even less a 'problem', but the essential link eliciting the social fabric where the stories are being told and read. We should focus our work on the most difficult problems that might eventually lead to the transformation of the infrastructure, rather on the solutions that simply take the current architecture as granted.

7 Pathway to e-Portfolio interoperability

As the number of e-portfolio implementations grows, it will become more likely that the same person will have to deal with a number of different e-portfolio platforms. For example, a member of the Institute for Learning (IfL), the professional body for further education teachers in the UK, might have to use PebblePad™[15] to record his/her Continuing Professional Development, then eXact™[16] Portfolio at

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14 This interactive mechanism partially exists in Kantara's specifications.

15 www.pebblepad.co.uk/

16 www.giuntilabs.com/

the college where she teaches, and Multi-Port™[17] to support the delivery of NVQs (national vocational qualifications) with an accredited centre –and use elements from the different e-Portfolios systems to put in the IfL portfolio to make her learning visible. Would it be not better if this teacher could choose her favourite e-portfolio platform to interact with the different institutions instead of having to deal with the idiosyncrasies of each system and that of their next releases?

One way to frontally address the issue of e-portfolio interoperability within an organisation like a school or university could be the bold decision to allow every student to select his or her own favourite e-portfolio system. If BS 8518 allows an accredited centre to choose its own e-portfolio, while the awarding bodies can do their job without having to deal with the idiosyncrasies of the different e-portfolio platforms, why should learners be deprived of a similar choice?

Of course, this is not an easy decision and for the organisations that already have an e-portfolio, a graduated approach might be necessary. This is why we invite you to explore through the description of five levels of interoperability.

1. Today, at the initial stage as e-portfolio platforms do not know how to deal with independent personal data repositories (PDR) the focus on interoperability should be placed on the ability to publish e portfolios using RSS/Atom feeds such as defined by LEAP2A, packaging e-portfolios for archiving and verification (quality assurance) and sharing references. One type of data that could be easily shared across e-portfolio platforms is competency definitions[18]: this could be achieved by the systematic exploitation of unique resource identifiers (URI) to competency definitions hosted in shared repositories of occupational standards, so definitions will be independent from e-portfolio platforms and could also be used for many different purposes, e.g. to post a job definition, organize a 360° assessment, etc.

2. A second stage of interoperability could be the provision of e-portfolio readers independent from the idiosyncrasies of the different platforms (in line with the work done with BS 8518) so a reader/reviewer will be able to browse multiple e-portfolios created on multiple systems, while having the same navigational and informational interface. This will be particularly relevant in specific processes such as the accreditation of prior learning (APL) when an assessor needs to review evidence against a number of occupational standards of competence or when an employer needs to review a large number of candidates. HR-XML and Europass specifications should be useful at this stage.

3. The third stage of integration (aggregation) could be the implementation of single sign on mechanisms (SSO) across the different platforms used by the learners. Open ID is a standard now supported by a number of applications, so

17   www.myknowledgemap.com/advanced-learning/multi-port.aspx
18   This is the idea of a *competency wiki*, using the URL as URI and enrich the contents with RDFa

it would not be unreasonable to restrict the choice of e-portfolio platforms to those supporting some form of SSO in order to provide seamless access to e-portfolio for reviewers, peers or institutional management systems. Infocard, SAML2 (Shibboleth, Kantara) and CAS are other options for managing SSO.

4. A fourth stage could be the implementation of circle of trusts for attribute sharing. Up to stage 3, the granularity of access is the whole e-portfolio, while at stage 4 single elements of e-portfolios can be shared with other members of the community –and beyond. This is very convenient when members work together on a project and want to share evidence from their respective e-portfolios. Sharing evidence is one of the means to increase the trustworthiness of individual e-portfolios. This can be achieved by implementing SAML2 specifications (Kantara, Shibboleth).

5. The fifth stage of interoperability will be the ability to create a seamless space between the different components of one's digital identity in an Internet where individuals exist as autonomous and empowered entities, lifelong and lifewide. This will be possible once all the systems dealing with personal data will do it through unified personal data repositories (UPDR).

In parallel, while we have to take into account legacy systems, such as current social networks, it is possible today, using existing standards and technologies, to start developing a personal data repository unifying all our personal data. This can be done at different levels:

1. Create a unified view of the aggregation of all our existing personal data stores –e.g. each 'store' is seen as a directory –this could include accounts on blog systems, Flickr, Facebook, LinkedIn etc. The fragmentation is still visible (directories) but within a global view.
2. Create a unified view of all the assets across the different data stores –e.g. all the photos with a specific tag, the files with a specific date stamp, etc. At this level, the fragmentation is less visible as data sharing the same attributes can be unified across heterogeneous stores.
3. Move data across data repositories –e.g. copy and paste across services. At this level, access to data do not depend on a specific address (URL) but can be retrieved through a URI, independently from the address of the store.
4. Manage fine grain access and attach policies to data –e.g. share one specific document with one person, a group or a service.
5. All service providers now use personal data repositories, under the control of individuals, for the management of the personal data needed for their service.

While stage 5 might seem a long way ahead, there are a number of business and organisational drivers that should accelerate its coming. This will be addressed in another document.

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8 What next?

For the 7th e-portfolio conference, in order to give directions to our work towards our 2010 goal (e-portfolio for all!), EIfEL decided to address a number of challenges to the e-portfolio community and beyond, as many of the problems the e-portfolio community faces today will not be resolved if they are not addressed beyond the e-portfolio *silo*. The goal of these challenges is to move beyond the current state of e-portfolio development, in particular in the field of interoperability as interoperability is not just a technical issue, but a means to enable new practices and the emergence of truly lifelong and life wide e-portfolios.

While the very first challenge is the Universal e-Portfolio Repository, i.e. a unified view of all a person's assets across all the different stores where personal data are being stored all the other challenges, if properly addressed, will bring us closer to e-portfolio interoperability. This should also create the conditions where we will be encouraged to use the thread our digital stories to weave together the social fabric supporting the growth of our individual and collective identities.

9 E-Portfolio challenges

For the 7th e-Portfolio conference, and in order to give directions to our work towards our 2010 goal (*e-Portfolio for* all), EIfEL has decided to address a number of challenges to the e-Portfolio community and beyond –many of the problems the e-Portfolio community faces today will not be resolved if they are not addressed beyond the e-Portfolio *silo*. The goal of these challenges is to move beyond the current state of e-Portfolio development, in particular in the field of interoperability as interoperability is not just a technical issue, but a means to enable new practices and the emergence of truly lifelong and life wide e-Portfolios.

Our main objective is to create the conditions for the emergence of MultiPortfolio organisations (one organisation can interact with many different e-Portfolio platforms) and *MultiOrganisation e-Portfolios* (have one e-Portfolio to interact with many different institutions with their own platform).

1. **Universal ePortfolio Repository –a unified view of all my assets**

   Context: Today, the digital assets used to create an e-Portfolio can be hosted in many different systems managed by many different organisations.

   Issue: How can we provide a unified view of all the assets belonging to one person, so she/he can seamlessly create e-Portfolios without having to navigate through multiple sites? *How can I reunite my digital identity?*

   Direction: Identity and access management (IAM) technologies, such as federation of identities and services need to be fully explored by the e-Portfolio community.

NB: a *universal repository* is not equivalent to a *unique repository*; it can be universal while being distributed over a number of loosely connected and heterogeneous systems.

2. **Universal Competency Identifiers –share competency definitions across systems**

Context: A number of e-Portfolio platforms, and other applications in the field of education, employment, accreditation and human resource use competency frameworks. Today, the dominant delivery format of competency frameworks is a PDF file, forcing each system to import or recreate them from scratch.

Issue: How can we share competency definitions across systems and applications? How can we elicit emerging competencies through interactive technologies?

Direction: The creation of a *competency wiki* providing shared, distributed, multilingual URIs (Unique Resource Identifiers) to competency definitions. The solution to unique resource identifiers for competency definition has already been discussed by Simon Grant (Representing frameworks of skill and competence for interoperability). We have the technology required, what is missing is the political impetus and commitment.

3. **e-Portfolio social –share assets, knowledge and processes across communities**

Context: The idea of using social computing for e-Portfolios is growing and a number of platforms have integrated such features. Nevertheless, the current implementation of social networking technology is mainly limited to connecting individuals as silos of information.

Issue: Let's imagine a group of 100 people belonging to the same community (company, school, etc.) among which 10 are writing their own CV. Can we design a technology that will make it possible that at the end of the process, each of the 100 people will have (part of) their own CV written? How can we automatically generate and updated e-Portfolios and CVs through social interaction?

Direction: Imagine that each time a person writes an elementary entry into their CV describing a professional experience, they have to name the people that shared the same experience; then for each person named, the entry is added to their 'CV', with the ability to edit it and share it back with the original author or create their own edited version of the entry. This way, each CV would be thread weaving a collective story. For the reader, being able to judge how an individual CV is connected to other stories, could even be an indicator of trustworthiness. The same reasoning could of course apply to e-Portfolios.

4. **e-Portfolio semantic editors – make sense of what I write, connect, etc.**

Context: In 2003, during the first international e-Portfolio conference in Poitiers, Christopher Tan presented Knowledge Community, a platform scaffolding learners reflection through semantic annotation, i.e. identifying key words and labelling them with semantic value, e.g. evidence, theory, example, etc. Since then, not a single editor of e-Portfolio tools has included any form of semantic annotation.

Issue: We need e-Portfolio editors that scaffold reflective thinking, not just enrich text with bolds, italics and 'pink on purple' effects. We need proper, simple semantic editors, as semantic annotation is a way to structure reflection, connect ideas, facts and people.

Direction: RDFa editors provide the blueprint for e-Portfolio editors that fully support the components of a reflective process. At minima, be able to tag parts of texts/images, not just the whole document.

5. **e-Portfolio Readers – read any ePortfolio through consistent and multiple views**

Context: There are a number of e-Portfolio platforms, each one with their own user interfaces and some people create e-Portfolios without using any dedicated e-Portfolio platform (e.g. content management system). And people want to be free to express their identity without being kept in the straightjacket of predefined templates.

Issue: How can we leave total freedom to e-Portfolio author's creativity, while providing readers with their own view through a consistent navigational interface, e.g. evidence on the left, competency framework on the right, etc.?

Direction: We might have to define different readers, depending on the process being involved, so the same e-Portfolio could have different views generated by different tools. Such tools could be used by e-Portfolio authors as tools to verify that their e-Portfolio is properly structured and contains all the relevant semantic information.

6. **Open & Trusted Service Architecture**

Context: Today each e-Portfolio platform provides a limited number of services and adding new services require the development of idiosyncratic plug-ins, when this possibility is offered.

Issue: How can we provide e-Portfolio owners with an unlimited number of services without forcing service providers to develop multiple plug-ins for multiple applications? How can we trust the usage made by services of our personal data?

Direction: This is connected to the idea of Universal Repository, exploited and enriched by service providers. Schools, universities, employers, professional bodies etc. need to provide conversational systems through trusted web services –a technology currently under development by different initiatives, such as TAS[3].

7. **e-Portfolio based performance support system –make the ePortfolio part of my work**

Context: One of the current problems with e-Portfolio adoption at the workplace is the fact that e-Portfolios can be seen as something either nice to have or adding to the regular work. Moreover, the current level of integration of e-Portfolios with other information systems is still low.

Issue: How can we make e-Portfolio construction part of everyday activities? How can we demonstrate e-Portfolio benefits through business benefits?

Direction: Use e-Portfolio technology and methods to develop next generation electronic performance support systems, integrate reflection as part of routine work processes, so the e-Portfolio is built through naturally occurring business activities.

8. **e-Portfolio discovery mechanism –find people, competencies, resources**

Context: While there are a number of methods for learning resources discovery (c.f. the learning resources exchange (LRE) repository of European Schoolnet) there are not yet universal mechanism to discover e-Portfolios on the Internet, each individual relying on ad-hoc services.

Issue: How can we easily find an e-Portfolio or a resource contained in an e-Portfolio?

Direction: OAI-PMH (Open Archives Initiative's Protocol for Metadata Harvesting) is a possible method to create large indexes of e-Portfolios per organisation, sector or even territory. Other methods could be the publication of e-Portfolios in trusted parties' indexes.

9. URIs as tags

Context: Tag is a popular form to connect things together, within an e-Portfolio. Unfortunately the meaning of tags is context dependent, and different tags can share the same meaning.

Issue: How can we create tags that are not context dependent?

Direction: make tags RDF triplets: name (what is displayed as 'tag'); URI to definition (a hidden hypertext link); link type (is, is part of, etc.). NB: this is an extension of challenge #2. Two tags are *close* if they share the same URI and *identical* if they are identical triplets.

10. Universal Metadata

Context: e-Portfolio construction is about connecting data together. Metadata are not just 'comments' about data, but links between all the data sharing the same metadata. If data are assimilated to neurones, metadata can be seen as the synapses connecting neurones together.

Issue: How can we enrich distributed data with 'personal/social metadata repositories`.

Direction: keep metadata repositories apart from data, on the model of social book marking.