

Reinventing ePortfolio technology and Practice

White Paper

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This document is designed to inform future ePortfolio developments, practice and policies. It is one of the outcomes of the Europortfolio project, an initiative dedicated to the building of a European community of ePortfolio practitioners.

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Table of contents

Introduction	4
The rise of the blockchain	5
How could ledger-based ePortfolios solve existing ePortfolio issues?	7
<i>Ledger-based ePortfolio vs. current ePortfolios</i>	7
<i>ePortfolio for all?</i>	8
<i>ePortfolio process and product</i>	9
<i>ePortfolio supporting powerful reflection</i>	9
<i>ePortfolio authoring can be pleasurable and creative</i>	10
<i>ePortfolio interoperability</i>	11
<i>ePortfolio trustworthiness</i>	11
<i>ePortfolio governance and leadership</i>	11
Call for action	13
Annex	15
<i>From ePortfolios to OpenLedgers</i>	15
<i>Valuing human capital and social capital doesn't need "pretty pictures"</i>	18
<i>The 10 ePortfolio challenges</i>	20

Executive Summary

To inform future decisions related to ePortfolio technologies and practices, this White Paper aims at providing an understanding of the possible benefits of the adoption of the blockchain (*public, distributed ledgers*) a technology that is creating the conditions for an entirely new approach to creating, storing, sharing and exploiting ePortfolios.

The emergence of the ePortfolio at the beginning of the 21st century was the result of the encounter of established practices (portfolio and reflective learning) with emerging digital technologies (the Internet and the World Wide Web). This encounter has led to the emergence of new technologies (e.g. ePortfolio Management Systems) that in turn have influenced ePortfolio practice (e.g. authentic learning and assessment), that in turn...

We are now at the dawn of the emergence of a new technology, the blockchain (*a public, distributed ledger*) that has already demonstrated its transformative power in an expanding number of fields, from currencies to smart contracts and social networking. And it is possible that the encounter of ePortfolio practice with blockchain technologies might lead to changes of an order of magnitude even greater than the one experienced when (offline) ePortfolios moved online.

This White Paper is an invitation to explore the potential of a promising technology to build the next generation of ePortfolio technologies and imagine practices that were not possible before the rise of *public, distributed ledgers*, a candidate for next generation of ePortfolio artefacts repository that will allow the emergence of a whole new range of services.

Introduction

The creation of the Internet and the World Wide Web in the 90s created the conditions for the emergence of a competitor to the old mass media model resting on the asymmetry between broadcasters and publishers on the one hand, listeners and readers on the other. The flow of information mostly went one way, from the centre to the periphery — with narrow controlled back-channels; think of *Agony Aunt!* The Internet created the conditions for the emergence of *knowledge media*, a term coined by Marc Eisenstadt, from the Open University Knowledge Media Institute, to describe a media based on a network of knowledge nodes, with no centre and where everyone was a contributor.

As Peter Childers and Paul Delany wrote in *Wired World, Virtual Campus: Universities and the Political Economy of Cyberspace* ([link](#)):

"Just as the printing press spelled the demise of monastic institutions and ushered in the modern university, cyberspace may dissolve the bricks and mortar campuses of today into a de-centered knowledge culture, a networked "virtual" site of intellectual exchange that renders obsolete old ivied quadrangles as well as institutional and political borders, creating something akin to H.G. Wells's vision of a 'World Brain.'"

While the move from *mass media* to *knowledge media* created a more symmetrical media infrastructure, the World Wide Web was still the support for asymmetrical relationships, between individuals, institutions and authorities. This is going to change. Thanks to the emergence of blockchains, we are now in a position to create a world where there is no need for a designated "authority" for establishing trustworthy relationships within a community, local and worldwide.

As noted in *Blockchain & Beyond* ([link](#))

"Our current societal, economical and juridical systems rely heavily on those traditional, centralised and controlled mechanisms, and that's why the potential impact of Blockchain could be so important; for instance, disrupting industries like Uber, Airbnb and Paypal are doing today. Furthermore, those same and present disruptors could also be in danger, as these distributed architectures are opening the race to the need of always deeper, faster and innovative transformations."

The rise of the blockchain

ePortfolios emerged at the beginning of the 21st century from the encounter of portfolio practices and digital technologies. While initially using digital technologies to create “paperless portfolios,” i.e. the same kind of portfolios using a different medium, digital, ePortfolio technologies and practices have since evolved and influenced each other. Moving from offline publishing tools used by isolated individuals to the World Wide Web has changed the nature of ePortfolios. The ability to create one’s own (reflective) journal using services like Wordpress has provided a whole new audience and new ways to create and exploit its content. New platforms, ePortfolio management systems (ePMS) have provided organisations with the means to manage large quantities of ePortfolios facilitating the work of educators and the interaction with learners — while at the same time moving the centre of gravity of information systems from individuals in full control of their ePortfolios, to institutions in control of the processes and the structure.

Maturity	Context	Technology	Characteristics
Awareness	Individual and pioneers explore the power of digital technology to create the paperless ePortfolio.	The paperless portfolio: pdf files, spreadsheets, presentation software, databases, offline, mixed media, hypermedia	Stand alone, local
Exploring	The range of practices expands with the emergence of social media.	The online social portfolio, Internet, World Wide Web	Social, Internet
Developing	ePortfolio is adopted as institutional practice.	Rise of the ePortfolio Management Systems (ePMS)	Institutional, Intranet
Integrated	The need to make ePortfolio interact with other institutional system emerge.	Authentication, single sign on (SSO) for integration with other applications (e.g. LMS)	Interconnected with other systems
Transformative	The ePortfolio as <i>personal</i> and <i>community asset manager</i> , seamless interaction between individual, collective and institutional ePortfolios.	Open Badges, Open Credentials, public, distributed ledgers (blockchains)	Distributed under the full control of their authors

From offline to ledger-based ePortfolios

We are now at the edge of a technological revolution triggered by the emergence of *blockchains*. Initially designed to create a virtual currency (Bitcoin), this technology it is now used in an ever expanding number of fields, from healthcare to social networks, from private businesses to governments¹. Education is already using blockchains to provide a service similar to that of Open Badges, i.e. the ability to issue verifiable credentials².

What is a Blockchain?

A blockchain is the historical record of all the transactions between the participants (nodes) of a network. This record is referred to as a *ledger*, the artefact accountants use for book keeping. Adding new entries to the ledger, or modifying existing ones, is done by adding a new block to the chain — previous blocks are the faithful representation of the ledger’s previous states.

Moreover, the blockchain technology makes ledgers unfalsifiable. How is this possible? By providing a copy of the full ledger to all members of the network and defining an ingenious protocol for adding new blocks to the chain so that even if someone tried to add an invalid block, the network would detect the fraud and reject the chain containing the invalid block.

One vital point about blockchain technology is privacy: while transactions are public, they can be verified without having to know the real identities of the participants. Identities remain masked.

¹ “Bitnation, the decentralised governance project which offers blockchain IDs and Bitcoin debit cards to refugees, has done a deal with Estonia to offer a Public Notary to e-Residents” ([link](#))

² “Earlier this year [2015], the MIT Media Lab started issuing digital certificates to groups of people in our broader community. We use certificates as a way to recognize contributions we value, or simply to signal membership in the Media Lab family. For example, in July we issued coins and certificates to all of the Media Lab [Director’s Fellows](#).”([link](#))

ePortfolio White Paper

The change which is being operated under our eyes is the move to an infrastructure where all the participants are equal and have full control over their own data. From an ePortfolio perspective it means that instead of storing its content in the private database of a platform, it is stored in a public space, called a *ledger*, which belongs to the author of the ePortfolio — someone using multiple ePortfolio platforms would have *one personal ledger* where all the data from the different platforms would be stored, providing therefore a simple and elegant solution to an old problem: interoperability³. The use of ledgers to store ePortfolio data is very much in line with the approach proposed by EIfEL since 2004: making individuals the host of their own data with something called a *Personal Data Store* (PDS) or *personal locker*. By storing ePortfolio data directly in the author's PDS, there is no need to export/import ePortfolios from one platform to the next. Moreover, the data collected by one ePortfolio application and placed within the personal data store could be re-used by other applications and services, that in turn could feed in the personal data store with data useful for the ePortfolio. It is precisely what the blockchain technology is offering, something that will be explored further in this White Paper.

It is interesting to note that the blockchain revolution is concomitant to the emergence of Open Badges, a 2011 initiative lead by the Mozilla Foundation and the MacArthur Foundation to address the lack of recognition of informal learning, a need that ePortfolio technology and practice had not been able to fulfil properly until then.

In doing so, Open Badges have contributed to the reinvention of ePortfolios by making it easy for anyone to create “micro-portfolios” baked into pictures and by collecting many of them be able to create a new kind of ePortfolio, a portfolio of Open Badges (c.f. the Open Badge Passport).

What is an Open Badge?

An Open Badge is a picture that contains a trustworthy online representation (metadata) of someone's competencies, interests, affiliations or achievements. What makes Open Badges particularly useful is that they are verifiable statements, in particular that the holder of the badge is the person who earned it and the issuer of the badge the person/organisation who delivered it.

As Open Badges are based on an open standard, multiple badges from different issuers can be combined to tell the complete story of one's achievements. A number of open source tools are available to collect and organise Open Badges into a portfolio — Open Badge Factory, Badgr, Credmos.

As an Open Badge contains the information related to the criteria for its delivery and a link to the evidence provided, it can be interpreted as a “micro-ePortfolio.”

The emergence of the blockchain technology is a great opportunity to address a number of the challenges ePortfolio technologies and practice have been facing for some time now⁴. It is also a response to a number of challenges raised by Open Badge technology and practice, something that will be discussed later in this paper.

³ The way chosen by the ePortfolio community to address this issue was the development of two (!) different standards (IMS-ePortfolio and Leap2A) designed to facilitate the import/export of ePortfolios from one platform to another. The main flaw of this approach was that it is of absolutely no use to the person having to maintain simultaneously more than one ePortfolio (e.g. in an educational institution and a professional body). The other flaw was that this kind of interoperability is solely valuable in the closed world of ePortfolio platforms.

⁴ c.f. the 10 ePortfolio challenges published in 2010 by EIfEL

How could ledger-based ePortfolios solve existing ePortfolio issues?

Ledger-based ePortfolio vs. current ePortfolios

A blockchain-based ePortfolio is an ePortfolio where all the changes are recorded in a public and write-only ledger. For example, when a new piece of evidence or a comment is added this information is recorded in a block which is added to the chain of previous blocks. Contrary to traditional storage methods, a *ledger* is not stored by its owner or a *trusted authority*, like an institution's database but by the network and each member of the network can have a copy of all the ledgers.

In the first versions of blockchain infrastructures, like the one developed for Bitcoins, there is one single ledger which can be stored by all Bitcoin users — in reality, only some of them store the whole ledger. In more recent blockchain infrastructures, there can be multiple blockchains that are distributed and replicated over the network — for example, my *personal ledger* could be stored in 10 or more nodes in the network, so if one node disappeared, there would still be copies available to verify the integrity of the information.

One model that seems more fit to the world of ePortfolios is an architecture with multiple distributed blockchains where every person involved in the community of ePortfolio authors would have their own ledger. Whether or not it is such a model that will be chosen by the ePortfolio community — a similar reflection is engaged by the Open Badges community — is secondary to this discussion. At this stage of the reflection on the application of a blockchain architecture to ePortfolios, it does not really matter whether the architecture chosen is the one that will eventually be implemented. Although highly improbable, if the ePortfolio community chose an architecture with a single ledge instead of distributed ledgers or personal ledgers, the demonstration of the benefits of blockchain technology developed in the following sections would not be invalidated. It would simply mean that blockchain engineers and user interface designers would have to create the *illusion* that a single blockchain architecture behaves like a multiple distributed ledger. The user experience could remain the same.

In summary, a ledger-based ePortfolio has the following characteristics:

- Each individual has a *Personal Ledger* — which can be replicated in other nodes of the network for resilience and verification
- A *Personal Ledger* is public and write-only — it is also *pseudonymous*, i.e. their owner is only known to the network through an address⁵, not their real identity
- A *Personal Ledger* is a faithful record of all the transactions — recording of one's assets, artefacts, evidence, publications, reflections, etc.
- A *Personal Ledger* can record any type of data, automatically (by a programme) or manually (by the owner or a member of the network) under the control of its owner
- A *Personal Ledger* provides a basic structure for recording of data — just like an accounting book has multiple rubrics and sub-rubrics
- A *Personal Ledger* is resilient and is for life — one can have more than one ledger and move data from one to another (just like bitcoins move from one wallet to the next).
- A *Personal Ledger* is the repository from which the owner can build (manually or semi-automatically) a range of ePortfolios — to support learning, self-assessment, peer assessment, expert assessment, accreditation, employment, self-employment, etc.).
- A *Personal Ledger* is a relational object — the information contained in the blocks connects the participants in the network and qualifies their relationships, e.g. credentials, ownership, authorship, participation, belonging, etc.
- A *Personal Ledger* is public, it is therefore possible for a variety of services to exploit their contents and add to them — e.g. data analytics could allow service providers to notify the owner of a *Personal Ledger* of employment, business or learning opportunities.

⁵ A public key.

- A *Personal Ledger* is user-friendly, the user does not have to make decisions like “where to store my data?”; all that is required to have a ledger is a key pair (public-private), something can be generated at will, and the infrastructure will take care of the rest.

These characteristics will be explored into more details in the following sections.

About the blockchain “details”

We will not enter into the description of the different protocols involved writing and authenticating blockchains, for that we will refer the reader to the literature available on the web, for example the work done by Ethereum ([link](#)) and Bitnation ([link](#)). The blockchain technology is in full development and different models are emerging to address some of the shortcomings of earlier architectures.

We will not either enter into the details of identity and data protection: at this stage, suffice to say that as the data is encrypted, only those having the key can read the data stored in the blockchain and that there are different methods to keep the data within a group (for example, using multiple keys owned by the members of the group — just like having a door with multiple locks).

The details of data storage will not be explored either: at this stage suffice to imagine that the data is stored in the ledger. In reality, it is likely that the ledger will only contain an encrypted address of the data location and that the data itself will be stored using special protocol like Bittorent.

NB: when we write that at this stage of the discussion data protection and storage should be considered as mere details, it does not mean that they should be neglected. On the contrary, data protection and storage are at the heart of blockchain technology. What we simply say is that to understand the benefits of blockchain technologies, the public, distributed, open ledger, there is no need to enter into the details of the technology.

ePortfolio for all?

When one reads the literature on ePortfolios, the many benefits one could expect from them in education, employment and lifelong learning, one could wonder: why does not everybody have an ePortfolio? The expectations were so high that in 2004, at the second International ePortfolio conference in La Rochelle it was declared that "By 2010 every citizen will have an ePortfolio." We are now in 2015 and we are still far away from having fulfilled that prophecy.

While it is not possible to know how many people have an ePortfolio today, it is very unlikely that they are as numerous as those having an account on LinkedIn ([90+ millions in Europe](#)) or Facebook (307+ millions in Europe — Source: Search Engine Journal).

Unlike Facebook and LinkedIn, the main drivers for ePortfolio adoption are not the individuals but the institutions of formal education. Students do ePortfolios because... they have to, in order to get a grade, as a condition to obtain a diploma, a professional accreditation etc. The main driver for ePortfolio adoption is not primarily the learner’s intrinsic motivation, but the institutional requirements.

Benefits of the Personal Ledger

Is the Personal Ledger a means to achieve the goal of ePortfolio for all? A Personal Ledger is the means to make Facebook without Facebook and LinkedIn without LinkedIn. By extension, it is also the means to create ePortfolios without the need for an ePortfolio platform — it is already true with Wordpress and other Web services, but the ledger technology brings this ability several steps further.

With a Personal Ledger where all our assets are recorded it is possible to provide a much better service than the one currently offered by LinkedIn and Facebook. LinkedIn and Facebook hide the most valuable information in order to monetise it and make it difficult for innovators to create new services — it is not even possible to display Facebook content outside of Facebook!

By storing our information on a Personal Ledger instead of private silos, we create the conditions for innovators to invent the next LinkedIn, Facebook and ePortfolio platforms, but also, and more importantly, the very same Personal Ledger can be used by multiple applications and services that simultaneously feed-from and feed-in to the ledger, making it the hub for their exchanges.

So, if we might not fulfil the “ePortfolio for all” prophecy, we are more likely to fulfil “Personal Ledger for all”, something that might announce the demise of Facebook, LinkedIn and other siloed applications as we know them today.

ePortfolio process and product

The ePortfolio is a **product**; it is also the outcome and the starting point of a reflective **process**. It is the record of a journey and the plan for its continuation. ePortfolios are *narratives*, non-fictional. Evidence, like artefacts and testimonies, connect narratives to the real world and to other narrators. Our narratives are intertwined — e.g. the narrative of a candidate to an award is intertwined with the narratives of the assessors, the places where the artefacts were produced, etc.

Benefits of the Personal Ledger

Having a public ledger provides a single entry point to all the services (and people) who want/need to add data in the ePortfolio repository. Multiple applications and services, for example, a learning management system generates data that is directly recorded in the ledger where the ePortfolio authoring service will fetch the data to write a new entry in the reflective journal, add it to the ledger where an ePortfolio management system from an educational institution will collect it, assess it and publish the outcomes of the assessment in the learner’s personal ledger.

In this example, three different applications (LMS, ePortfolio authoring, ePortfolio management) have used the same ledger to fetch and publish information.

ePortfolio supporting powerful reflection

One of the most over-rated claim with ePortfolios is that they are the support to and product of reflective learning. The truth is that, within institutions of formal education, reflection is limited to what the institution finds “suitable.” Imagine for one second that the outcome of the reflection process of a group of students, based on scientific evidence, is that we need to get rid of a centralised curriculum, that exams and grades degrade education. What would the consequences be? Praise or outcasting? A note of the Vice-Chancellor congratulating the students for their good work accompanied with an invitation to create a working group to address the issue? It is more likely that the message received from the institution will be: *reflect, but not too much as it might have unforeseen (or too well foreseen!) consequences.*

If empowered learners can produce powerful reflection, conversely, disempowered learners are likely to produce weak reflections. The fragmentation of learners into their own spaces, digital and mental (this is *my* repository, *my* portfolio, *my* reflection, *my* ...) is reinforced by the current technology used by ePortfolios, in particular the siloed data storage and inadequate access management. The current technological

infrastructure (and mental superstructure) is an obstacle to collective expression, reflections and narratives (this is *our* repository, *our* portfolio, *our* reflection, *our* ...)

Moreover, there is no tool facilitating the authoring of a *reflection*. Reflective writing (which is just one way to reflect) would be greatly improved if the technology was providing some kind of scaffolding, for example by providing a semantic editor, something that has been ignored by all ePortfolio platforms until now.

Benefits of the Personal Ledger

Making ledgers public creates the foundations for powerful reflection based on the data collected by a whole community, without having the constraint associated to usual groups (need to create a group, share data with this group, with the problems associated with data duplication and updates).

In the case of a *reflective rebel* who would have understood the deleterious effects of grades and centralised curriculum, a personal ledger is a means to publicise one's reflection and look for people sharing similar views, to transform reflection into action. One possible way would be the creation of an *aspirational credential*, e.g. "grade-free learning" by adding a new entry in his/her ledger.

As the credential (similar to an Open Badge without a mandatory picture) would make reference to "criteria" and evidence (research papers, advocacy groups, activists, etc.) this information could be analysed by a data-mining programme to connect to other people who have demonstrated some interest in those issues, search for similar "credentials" etc.

By moving the ePortfolio repository outside the silos of ePortfolio platforms, the *Personal Ledger* becomes a thread in the network of narratives from which is made our social fabric.

ePortfolio authoring can be pleasurable and creative

Building ePortfolios could be fun, pleasurable and creative. It sometimes is. But let's face it: most ePortfolios are boring. It starts with their lack of identity: in cohorts, there is nothing that looks more like an ePortfolio than another ePortfolio. ePortfolios are rarely the place for expressing independent spirit, innovation or creativity — nor a sense of aesthetics, humour or self-irony. It is surprising that *reflection*, which is based on self-observation, does not lead more often to narratives showing a sense of *detachment* from the observed situation.

There is the common idea in certain circles that as "learning is serious and hard work" one is unlikely to find it *fun* or, conversely, if someone takes great pleasure in doing something they believe is learning, it is probably not real or deep learning. As someone reluctant at the idea to mix learning and fun did put it: "stay away from the rhetoric of ease!"

Authoring an ePortfolio ranges from filling-in forms or templates (e.g. with an ePortfolio platform) to starting from a blank slate (e.g. with Wordpress). This is not really engaging, and the ability offered by certain platforms to select among a series of predefined templates does not do much to raise the excitement.

Authoring an ePortfolio is authoring a narrative, and there are many ways to write narratives and many different tools can scaffold that process without making it trivial. It is possible to create tools that automatically extract the data from an ePortfolio repository and create a draft of the narrative. A timeline of events is one of them. There are many more possible tools. Just recall the surprise at the end of a day taking photos with a smartphone, when it displayed the movie of the day it had created for you. Imagine if this technique was applied to the data recorded in an ePortfolio repository? It should be possible to automatically create a mindmap articulating the latest acquired concepts, a picture of the network of connections between achievements and the underpinning knowledge that led to them. This is precisely what a network of personal ledgers will render possible.

Benefits of the Personal Ledger

A Personal Ledger has the potential to free ePortfolio authors from the most tedious of tasks which is the collection of artefacts, while creating the foundations for the emergence of applications and services that will make the authoring of ePortfolios (and not just ePortfolios!) engaging and fun.

The resources required for this kind of development cannot be allocated by any of the small publishers of ePortfolio platforms. In order to reach a critical mass of potential users for these useful services, we need to break the silos of individual ePortfolio platforms by externalising the storage of the author's data into their Personal Ledgers.

We need the “boring” ledger to make ePortfolio authoring “fun” and deep!

ePortfolio interoperability

There are two main domains related to ePortfolio and interoperability:

- Interoperability between different ePortfolio platforms — and the interaction between a personal learning environment and institutional systems.
- Interoperability between ePortfolio platforms and the rest of the world — for example with human resources information systems (HRIS) for recruitment and promotion.

Until now, we have not been able to address either of them, notwithstanding that many ePortfolios do not use dedicated ePortfolio platforms but personal web authoring or blogging. The proper solution to interoperability is to make the person the hub of data storage and exchange, so it is the data and services that goes to/from the person rather than the person to/from the data and services.

Benefits of the Personal Ledger

By storing all personal information in a public, distributed, open and personal ledger, we put an end to the fragmentation of personal data to reach something that could be described as *digital integrity*, i.e. the personal control over personal data.

ePortfolio trustworthiness

Until now, the verification of the trustworthiness of an ePortfolio's content is not greater than that of a paper-based portfolio. ePortfolios are purely declarative and the verification of their content is a manual process that cannot be automatised. The introduction of Open Badges, that are like a *micro-portfolio*, has demonstrated the ability to create trustworthy pieces of information that could be verified by a computer. A scanned diploma is like a paper diploma, it needs human verification, while a diploma embedded into an Open Badge can be verified by a computer to check that the issuer and the earner are who they claim to be.

Benefits of the Personal Ledger

By using a *Personal Ledger* to collect and store all the content of an ePortfolio it will capture a number of pieces of information that will increase its trustworthiness. In particular, the mechanism of endorsement developed for the Open Badges can be extended to all the entries of the ledger so that every piece of evidence could be endorsed by a member of the community, a colleague, a peer, a client, etc.

This endorsement mechanism creates links between different ledgers (the candidate and the endorser) creating therefore the foundation for *intertwined narratives* — the endorsement of the endorser is part of the endorser narrative.

ePortfolio governance and leadership

We can identify different *leaderships* in the implementation of ePortfolios:

ePortfolio White Paper

- **Individual**-led ePortfolios: the ePortfolio is fully under the control of the individual
- **Institutional**-led ePortfolios: the ePortfolio system is controlled by an institution, generally an institution of formal education.
- **Community**-led ePortfolios: the ePortfolio is controlled by a community of practice, like a professional body (e.g. the Royal College of Physicians in the UK, c.f. <http://www.jrcptb.org.uk/eportfolio-information>).
- **Discipline**-led ePortfolios: the ePortfolio is relative to a discipline, like ICT skills or medicine to gain a qualification.
- **Territorial**-led ePortfolios: the ePortfolio is controlled by a regional or national authority (e.g. Lorfolio, the Région of Lorraine ePortfolio)

There is a tension between personal and institutional ePortfolios. While personal ePortfolios primarily rest on the intrinsic motivation of the author who has full control over the audience (who?) goals (why?), structure, content, tools used etc. (how?) an institutional ePortfolio primarily responds to the needs of an institution that decides whether it is for just one course or the whole curriculum, to support learning and/or assessment, to grade it or not, etc.

In the current context, where most ePortfolios used in institutions of formal education are authored on a system owned by the institution, the learner is confined to the services designed by the service provider, limited again by the services chosen by the system administrator, limited again even further by a teacher or a tutor.

Benefits of the Personal Ledger

By using a *Personal Ledger*, the very same ledger can store the information for/ from personal and institutional ePortfolios. While the applications used to author/ read one personal ePortfolio (to get a summer job) and one institutional ePortfolio (to demonstrate reflective learning), both applications operate on the same *Personal Ledger*.

Call for action

Through its short history, the ePortfolio has grown-up through different maturity stages, calling on different technologies and inviting different practices. A new technology, *public, distributed ledgers*, has emerged and is being adopted by a growing number of sectors, far beyond the field of cryptocurrencies for which it was initially developed.

One of the main benefits of *public, distributed ledgers* is the creation of an open infrastructure where there is no need for special “authorities” to create a trustworthy environment and where everybody can be in control of their personal data.

While it is too early to anticipate whether the move of ePortfolios from their current technologies to a ledger-based one is achievable from a social, economical, technical and educational point of view — this requires commitment, support, leaders, early adopters, etc. — it is clear that the promise offered by this new open and distributed architecture cannot be ignored by ePortfolio practitioners, researchers and engineers.

To help the ePortfolio community in our endeavour, we have the opportunity to benefit from a growing community of blockchain practitioners and technologists who have already had to address many of the questions and issues that have to be faced when such an innovation is in the process of transforming a whole sector. We can also count on other communities in the field of education and human resources development that will also be impacted by the growing adoption of *public, distributed ledgers*.

To move forward the reflection of the ePortfolio community on the benefits of the adoption of the *public, distributed ledgers* we suggest a blueprint of programme of action. This blueprint is not prescriptive, but a simple trigger for the definition of an actual programme of action for 2016-2017. It is based on a revised version of the *10 ePortfolio challenges* published in 2010 for the 7th ePortfolio conference (c.f. annex).

In the following blueprint, the word ePortfolio is placed between parentheses to indicate that the issue (and solution) is not just for ePortfolios and that solutions most likely already exist as blockchain engineers had to face similar problems.

1. Universal (ePortfolio) Repository —a unified view of all one’s assets

Context: Today, the digital assets used to create one ePortfolio are hosted in many different systems managed by many different organisations. Those systems are ePortfolio management systems, content management systems, learning management systems, etc.

Issue: How can we provide a unified view of all the assets belonging to one person, so she/he can seamlessly create ePortfolios without having to navigate through multiple sites?

Personal Ledger: provides each individual one (or more) *personal ledger(s)* as an ePortfolio repository used by all ePortfolio systems as well as other applications such as blogs, learning management systems, etc.

2. Social (ePortfolio) Network —sharing assets, knowledge and processes across communities

Context: The idea of using social computing for ePortfolios has grown 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, within the organisational silos that are institutional platforms.

Issue: how can we provide a simple way to store / represent shared assets, like a piece of work produced by a group of people, the achievements of a team (“we built that bridge together!”). etc.

Personal Ledger: the information collected in a personal ledger, like the record of a work experience or transaction generally connects the author of the record to other people (“I did this with x and y”). With a service having access to the personal ledgers, it would be possible to create a map of relationships and display all the participants at a particular event, having contributed to a specific outcome, being part of the same community of practice, etc.

3. Open (ePortfolio) services —let the user chose which services to use

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

Issue: How can we provide ePortfolio owners with an unlimited number of services without forcing service providers to develop multiple plug-ins for multiple applications? How can we

bypass the control of system administrators and be our own administrator? How can we make adding/removing services as easy as adding/removing apps on a smartphone or tablet?

Personal Ledger: *the personal ledger* is the collection of the digital representation of one's assets on top of which it is possible to build many different services that feed-in/out data under the control of their owners.

4. Open (ePortfolio) discovery mechanism – find people, competencies, resources

Context: Today, the discovery of people is dependent on search engines and the power of monopolistic organisations such as LinkedIn or Facebook. The ranking of individual ePortfolios ranges quite low in comparison.

Issue: How can we provide individuals with the means to control how they are being discovered? How can we give individuals a sense of agency on the Web, so that they are not dependent or overshadowed by powerful monopolies.

Personal Ledger: by storing personal data within *personal ledgers*, it is the ledger that becomes the prime source of information for being discovered, empowering people to render closed/siloed services like LinkedIn and Facebook to allow the generation of new services more respectful of individuals and their data.

More items could have been added to that list, but the goal of this White Papers was not to be exhaustive, nor imperative. The definition of an actual workplan is something that has to be worked out by the ePortfolio community, in conjunction with other communities, in particular the Open Badge and, of course, the blockchain communities.

This White Paper is an invitation by Europortfolio, the European network of ePortfolio experts and practitioners, to contribute to the definition and implementation of this workplan. The future of ePortfolio technology and practice is into our hands, your hands.

Join the conversation on www.europortfolio.org



Annex

The following articles from the author are related to the reflection on ePortfolio and blockchains and can be found on www.learningfutures.eu.

From ePortfolios to OpenLedgers

When I started exploring Open Badges a few years ago, I rapidly realised that not only were they a solution to several of the problems we had with ePortfolios, but they also had the potential to help us reinvent them — the Open Badge Passport initiative is our contribution to this. And now that I have started exploring the possible application of blockchains to Open Badges, I realise that not only were blockchains the perfect solution to a number of Open Badge problems, but they could also be a means to review our ideas on Open Badges altogether.

What is a blockchain?

A blockchain is the historical record of all the transactions between the participants (nodes) of a network. This record is referred to as a *ledger*, the artefact accountants use for book keeping. Adding new entries to the *ledger*, or modifying existing ones, is done by adding a new *block* to the chain — previous blocks are the faithful representation of the ledger's previous states.

Moreover, the blockchain technology makes ledgers unfalsifiable. How is this possible? By providing a copy of the full ledger to all members of the network and defining an ingenious protocol for adding new blocks to the chain so that even if someone tried to add an invalid block, the network would detect the fraud and reject the chain containing the invalid block.

One vital point about blockchain technology is privacy: while transactions are public, they can be verified without having to know the real identities of the participants. Identities remain masked.

What could the representation of an Open Badge in a blockchain be?

The first time a badge is issued, a block is created to record a set of metadata. In a sense, one could describe the first *block* as a *badge*: instead of being “baked” into a picture, the metadata is “baked” into a *ledger*. If the same badge was issued to 300 people, the first block of the ledger would record that piece of information — a block usually records several transactions.

At this stage, there is a first major difference with the current Open Badge Infrastructure (OBI): the information that a certain badge has been issued to 300 people is now accessible to all the members of the network (they all have a copy of the ledger). A piece of information that would normally be kept hidden behind the walls of issuing platforms is now accessible publicly — and it should be so for making the information verifiable.

This was my first approach to applying blockchains to badges : adding blocks representing badge transactions (issuing badges).

When I realised that issuing a badge was nothing more than adding an entry to a ledger, I wondered: if we forget for a moment that the ledger is used to record badge transactions (issuing, endorsing, revoking), what would a ledger allow us to do with/for/from Open Badges that we could not have done before?

One immediate example that came to my mind is connecting evidence to a badge:

- Each piece of evidence that will be submitted to get a badge is recorded in the ledger
- When all the criteria are covered by sufficient evidence (produced over time in a range of different contexts, etc.) the candidate claims the badge
- When the assessor is satisfied with the quality of the evidence produced, a new entry is added to the ledger (as representation of the badge).

The beauty of this solution is that the very same information recorded in the ledger could be used for many different purposes, for example to manage one's intellectual property: when I write an article or a blog post, a new entry is added to the ledger. When authors quote or make reference to the article or blog post, they can do it by using the entry in my ledger (each entry has a unique identifier). We can then imagine that each time a reference is made, a BitofTrust is added to the account by the author using a reference — c.f. [#Openbadges + #Blockchains = #bitoftrust ?](#)

Using a ledger for badges allows the following operations:

- issuing a badge: add an entry to the ledger
- endorsing a badge: add a BitofTrust to the account associated with the entry
- revoking a badge: erase an entry in the ledger

Revoking badges raises an important issue: how to enforce the right to be forgotten — it might not look good on one's profile to display lost badges? To preserve the right to re-inventing oneself, Bryan Mathers came up with an elegant solution: one's personal ledger could actually be wrapped up as the genesis block of a new personal ledger.

Thinking of badges through a ledger is also a means to de-dramatise the question of *self-issued-badges*. While I'm a firm believer that they should play a more central role in the badge ecosystem, the current Open Badge infrastructure has made it impossible for the average user to issue badges, notwithstanding the criticism on the “value” of such badges for (hypothetical) employers... Creating a self-issued badge is nothing more than adding an entry to a ledger. Once created, it is possible to start collecting evidence and later ask for endorsements from members of the community.

What I have started to describe here is a *Personal Ledger*, a lifelong and lifewide inventory of my assets where “badges” are just assets among other assets — with one characteristic, probably shared with other constructs, which is connecting / cross-referencing other assets.

Overall description of the Blockchain-based Open Badge Infrastructure (BOBI)

The picture above provides a simplified representation of what a blockchain-based Open Badge infrastructure might look like. The blockchains are the records of the changes in the *ledger*. A user interface provides a meaningful display of the content of the blockchain in relation to one's assets (e.g. a block will contain the book copyrights but not the book itself) and a number of services associated with the data contained in the ledger.

NB 1: while called a *Personal Ledger*, it does not mean that I can edit mine. Each change is done by adding a new block, an operation performed by other members (nodes) of the network — in the BitCoin world, the addition of new blocks to the chain is done by “miners” (most happens in China! — [link](#)).

NB 2: while in the bitcoin environment there is only one blockchain (for obvious reasons), there is no restriction to the number of blockchains that can run concurrently. So each *Personal Ledger*, could be represented by its own blockchain, each member of the network having a copy of all the blockchains — this could be optimised by distributing randomly “enough” copies of each blockchain, but that's another story. On the other hand, there would be one blockchain for the BitOfTrust “currency.”

The blockchain is the federation

One of the issues discussed in the Open Badge community was the need (or not) for a “federation” of Open Badge storage:

We pack a lot of meaning into [the] open badges federation, what we really mean is “distributed badge storage that gives users choice and opportunity to be discovered for their achievements.” Federation means more backpacks, more user choice and more user benefit.

(Chris McAvoy, 2014, [source](#))

Without a federation, when I get a badge from Credly and want to put it into my Open Badge Passport, I have first to configure my Credly account to make it aware of my backpack (so, if I don't have a backpack, I'm stuck), export my badges to the backpack, then go to my Open Badge Passport account to import them (with the hope that it will work). This is unwieldy and a federation of Open Badge storages would allow me to have one single view over all my badges.

The federation did not happen, and it is a good thing as there is a much better solution... which is... blockchains. When we will be using blockchains the Open Badge Factory, Credly and Badgr will have to use MY blockchain/ledger to issue the badges I have earned and when I am in my Open Badge Passport, Badgr of Credly account, I will have access to all my badges, disregarding which platform they were issued from. My blockchain is my *passport/backpack* and my *passport/backpack* is part of my *Personal Ledger* — the old backpack becomes a simple an entry in my *Personal Ledger* under which will be added everything that looks like a badge.

What other benefits?

Now that we have established that a *Personal Ledger* can be more than just an elegant solution to managing Open Badges, what else could we do with it?

One of the main benefits with blockchains is a clear separation between data (stored in the blockchains) and the applications serving/ exploiting the data. The blockchain contains all the data from the whole network, which is a radical difference with today's Open Badge infrastructure where the data is fragmented across the various badge issuing platforms (hosting assertions) and various storage platforms (hosting badges) — one of the consequences being the inability to know how exactly how many badges have been issued.

Having the data in a blockchain frees innovation, the same way the opening of public data does: the blockchain is the solution to opening up personal data while keeping full control over its exploitation. The blockchain is an invitation to create new applications and services from the wealth of data they contain. It is a serious threat to established trusts — watch out LinkedIn! Watch out Facebook!

A *Personal Ledger* is the record of the trust bonds we have established within the community. I can endorse a plumber or an electrician who can endorse me as a *good client*. *Personal Ledgers* could be used by the self-employed and voluntary workers to build their professional and social reputation.

Service and goods providers could use the information contained in *Personal Ledgers* to gain business in a novel way. Let us say that one of the services provided on top of the *Personal Ledger* is a mailing service. I could decide to only receive mail from people or entities I trust. So, if I trust ACME Ltd, I could *endorse* ACME Ltd who then creates an entry in its *Organisational Ledger*. When ACME Ltd wants to send information to its contacts it does it through the mailing service I trust that will check that I am in the ACME Ltd *Organisational Ledger*. When I don't trust ACME Ltd anymore, I just withdraw my endorsement and no more mail will arrive.

The *Personal Ledger* is also a powerful metaphor for scaffolding learning: a learning plan could be translated into a series of entries in the ledger that have to be filled-in with evidence / proof of work. ePortfolio and personal learning environments (PLE) applications could be built on top of the blockchain. Learners would be fully autonomous from the information systems of institutions of formal education. A new generation of learning management systems could emerge, where learners would be in full control over their work and data.

What follows is an additional list of ideas rendered possible with blockchains / *Personal Ledgers*:

The blockchain is the taxonomy: each time a badge is issued, it makes reference to criteria. Now imagine that when a new badge is created, through the user interface, the creator has access to all the vocabulary already used in previous blockchains. This could seriously reduce the number of redundant criteria and badges by displaying all the existing badges using a particular criterion group of criteria.

The blockchain is open knowledge: imagine that someone creates a new badge describing emerging competencies related to new knowledge, e.g. data scientist, this could be valuable information for training bodies and employers.

From search to discovery: with blockchains it should be easy to find all the people sharing the same badge (or collection of badges) while ensuring full anonymity. For example, someone willing to quit drinking could claim an AA badge in order to be discovered by the local chapter or another local AA badge holder.

ePortfolio White Paper

Of course, what is described above is probably not optimal in terms of resources and processes. They are just intended as illustrations of things that could not be done before (with the current Open Badge Infrastructure) and are now made possible with the use of blockchains.

Summary and further questions

The objective of this post was to explore how blockchains could be used to implement Open Badges. I have tried to demonstrate that blockchains would not only be an elegant solution, but would allow the resolution of existing problems and open many opportunities.

If, for a moment, we accept the idea that blockchains are *the* solution to Open Badges Implementation, this raises a number of further questions:

What body should be responsible for creating and maintaining this new infrastructure? The Badge Alliance is fit to maintain a *standard*, which is about documentation. With a blockchain infrastructure the business model would have to include software development and maintenance, scalable servers deployment etc. A whole new ballgame!

What will happen to the legacy system? It should not be too difficult to write a programme transforming “pictures with metadata” into “Personal Ledger entries”...

What consequences for existing businesses (issuing platforms) and what new businesses could emerge?

Valuing human capital and social capital doesn't need "pretty pictures"

In 2016, Open Badges will encounter blockchains and this will most likely change the way we issue, store and exploit Open Badges and open credentials. This change will also affect Open Badges themselves, or more precisely, we will have a chance to get rid of the dictatorship of the "pretty picture" and move beyond the narratives of the girl and boy scouts' merit badges.

Open Badges are wonderful and it was a brilliant idea to store metadata within a picture, but let's face it, there is a time, in fact many of them, where designing a "pretty picture" to recognise one's achievements or competencies is simply a waste of time or a hindrance — and the use of pre-digested graphics often an insult to our sense of aesthetics! We have now reached the situation where it is *the tail wagging the dog*: the "pretty picture" is the "need to have" in order to issue any credential in the happy world of Open Badges. No "pretty picture", no credential! Does it have to be so?

Moving the Open Badge movement from infancy to adulthood needs new metaphors and narratives — the *badge* for the girl and boy scouts. It is precisely what the blockchain technology is offering. The metaphor on which the blockchain narrative is constructed is the *ledger*, a word everybody can understand.

A general ledger account is an account or record used to sort and store balance sheet and income statement transactions. Examples of general ledger accounts include the asset accounts such as Cash, Accounts Receivable, Inventory, Investments, Land, and Equipment.

Source: www.accountingcoach.com/blog/what-is-a-general-ledger-account

A Personal Ledger is a means to account for one's assets, credits and debts. In the context of open credentials, the credentials received can be considered as debts (one is *indebted* to someone for the trust received) and the credentials given as credits (the recipient of our trust is indebted to us). A ledger can be further subdivided into multiple accounts, so each entry could store the information contained today in various Open Badges.

And there is no reason to limit the entries of a ledger to represent Open Badges: the ledger is a faithful and trustworthy accounting of all our assets, and our assets are not limited to badges. Recording the evidence used to get credentials might be even more beneficial to an open credential process than the recording of the credentials themselves. In fact, the recording of evidence and associated endorsements (without having to issue a badge or a formal credential) might be just enough in many situations.

Moving the recording of credentials from "pretty pictures" to a *ledger* would also benefit the fight against Obesity — a possible outcome to OB addiction! Once we are fully able to issue credentials without the need for a picture, we could then refocus our attention for Open Badges to things that really deserve a picture.

But more importantly, moving credentials to a *ledger* would be an opportunity to establish the foundations for a better representation of human and social capital.

Open Badges, ledgers, human and social capital

When addressing the issue of Open Badges and employment, the discussion is generally limited to *using badges to get a job* (my response: currently "spray and pray") or to demonstrate *continuing professional development*. One area that has not yet been explored, is the use of Open Badges as a means for an organisation to account for its human capital. And the reason for this situation is probably due to the very concept of Open Badges, the lack of a holistic concept that would bring all of them together — and the Backpack was probably not the best metaphor to address human resource managers...

By moving our focus from "pretty pictures" to a *ledger*, we might have a chance to establish a line of communication with human resource managers and the executive management.

Are people an asset or a liability? For decades, accountants have categorised employees as a liability due to their salaries and future pensions. But in an era where more companies offer services instead of goods, and CEOs often talk about employees as their greatest asset, it is time for the **21st century ledger** to match current rhetoric. [...] Determining the actual value of this intangible asset is a difficult nut to crack. In 1978, 80% of a company's value was easy to enumerate because it was mostly tangible assets such as factories and equipment. But now 80% of a company's value is comprised of intangible assets such as brand value, intellectual property and, of course, people.

Source: Leon Kaye, in [the Guardian](#)

How could this *21st century ledger* look like? What elements should it take into account? For example, how could a company account for the benefits gained from the interaction of its employees with the people that are not on its payroll, like the members of the communities of practices where staff members find support to solve business problems and promote the image of their company?

Brilliant system engineers can be dodgy social engineers!

One could imagine that the people who came up with the concept of *ledger* for blockchains (or the other way around!) would have worked on some kind of *21st century ledger* in the sense discussed in the article quoted above. Unfortunately, after doing a bit of research with Google on blockchains, human resource and human capital I must confess that I was not able to find anything worth reporting, except my surprise that conversations related to organisations in the "blockchain milieu" did not seem to show any interest for the *human factor*, or when they did, it was to place it on the liability side of the "ledger," just like with a 19th century ledger! I felt like I was reading a sequel of "Player Piano", the Kurt Vonnegut's novel where human work is considered as the main source of non-quality! Brilliant system engineers can be dodgy social engineers! The lessons learned from the Open Badges experience could certainly benefit the design of that *21st century, blockchain-based, ledger!*

Another area that has not yet been explored is the use of Open Badges as a means to represent and value social capital — while Cities of Learning and the more recent [LRNG initiative](#) certainly contribute to the development of social capital, we are still far away from building any kind of *representation* of that social capital.

Social capital is defined by the OECD as: "**networks together with shared norms, values and understandings that facilitate co-operation within or among groups**". In this definition, we can think of networks as real-world links between groups or individuals.

ePortfolio White Paper

Think of networks of friends, family networks, networks of former colleagues, and so on. [...] **Put together, these networks and understandings engender trust and so enable people to work together.**

Source: <http://www.oecd.org/insights/37966934.pdf>

It is interesting to note that in the OECD definition, *trust* is the main engine for the creation of social capital. Is there a way to represent *trust*, and *trust networks*? Well, Open Badges are precisely a means to represent trust between an issuer and an earner, so the analysis of trust relationships through collections of Open Badges might be a solution. Yet, as we have seen, not every *trust relationship* needs to be represented by a “pretty picture.” For example, I can decide that I trust someone or an organisation for something specific (honesty, good cook, brilliant data scientist) without having to lose any time finding or designing a “pretty picture” to represent it.

My (provisional) conclusions out of this short journey in the world of ledgers, human and social capital are:

- Trust is the engine and the currency of human and social capital.
- *Personal Ledgers* are a means to keep an accurate record of all personal assets: talents, competencies (skills, knowledge, attitudes and values) people, sharable resources, etc.
- Ledgers can be combined, so Personal Ledgers, or part of them can be aggregated to create community ledgers, organisational ledgers or a territorial ledgers (e.g. build a representation of a learning city)
- Personal Ledgers are the building blocks for establishing a representation of human and social capital!

Open Badge Passport and Personal Open Ledger.

Moving the storage of Open Credentials (Open Badges being part of them) to a Personal Open Ledger is an extension of the original ideas behind the development of the [Open Badge Passport](#), one of the laureates of the [DML Trust Challenge](#).

The Open Badge Passport enables the seamless sending, receipt, organisation, display, and search of digital badges. By establishing and nurturing networks of trust, it encourages the emergence of a new generation of services supporting learning, employment (including self-employment), social inclusion, and citizenship.

By introducing the Personal Open Ledger as the means for storing one's personal assets, of all types, not just Open Badges, the Open (Badge) Passport will act as a kind of *Personal Assets manager*. Moreover, as the participants in the Personal Open Ledgers / Open Passports ecosystem would be connected through trust bonds (credits and debts of Bitof Trust, BoT) we would have the foundations for achieving the building of a dynamic, ever changing bottom-up trust network, something that will be discussed in a following post.

The 10 ePortfolio challenges

For the 7th ePortfolio conference [London, 2010], and in order to give directions to our work towards our 2010 goal (ePortfolio for all), EIFEL has decided to address a number of challenges to the ePortfolio community and beyond — many of the problems the ePortfolio community faces today will not be resolved if they are not addressed beyond the ePortfolio silo. The goal of these challenges is to move beyond the current state of ePortfolio 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 ePortfolios.

Our main objective is to create the conditions for the emergence of *MultiPortfolio organisations* (one organisation can interact with many different ePortfolio platforms) and *MultiOrganisation ePortfolios* (have one ePortfolio 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 ePortfolio 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 ePortfolios 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 ePortfolio 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 ePortfolio 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. ePortfolio social — share assets, knowledge and processes across communities

Context: The idea of using social computing for ePortfolios 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 ePortfolios 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 ePortfolios.

4. ePortfolio semantic editors — make sense of what I write, connect, etc.

Context: In 2003, during the first international ePortfolio 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 ePortfolio tools has included any form of semantic annotation.

Issue: We need ePortfolio 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 ePortfolio 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. ePortfolio Readers — read any ePortfolio through consistent and multiple views

Context: There are a number of ePortfolio platforms, each one with their own user interfaces and some people create ePortfolios without using any dedicated ePortfolio 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 ePortfolio 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 ePortfolio could have different views generated by different tools. Such tools could be used by ePortfolio authors as tools to verify that their ePortfolio is properly structured and contains all the relevant semantic information.

6. Open & Trusted Service Architecture

Context: Today each ePortfolio 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 ePortfolio 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 TAS³.

7. ePortfolio based performance support system — make the ePortfolio part of my work

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

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

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

8. ePortfolio 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 ePortfolios on the Internet, each individual relying on ad-hoc services.

Issue: How can we easily find an ePortfolio or a resource contained in an ePortfolio?

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

9. URIs as tags

Context: Tag is a popular form to connect things together. within an ePortfolio. 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 (an 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: ePortfolio 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 bookmarking.