O4 - GUIDELINES FOR TECHNOLOGY PROVIDERS & CLIENTS

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Recognition technologies best matches

From the analysis carried out in the Discussion Paper, we are proposing a set of technologies capable of covering desired and required scenarios as broadly as possible, including requirements and needs from the various stakeholders involved.

The present guidelines are intended for technical users, including designers / developers and for those who need to select a technology. Content of these guidelines has been incorporated as technological suggestions in the personas based interactive guidelines published on the project website.

Based on the conceptual framework proposed in O1 and in O4 Discussion Paper, we suggest that - while a wide range of technologies can be used for recognition - proper open recognition technologies are those offering a high portability rate, in two main senses:

1. they allow the output of a recognition process to be re-used as input of a new recognition process or directly re-evaluated based on the information it contains
2. they allow the output of a recognition process to be used in different contexts from those who generated it

Unfortunately a number of desired scenarios does not have a corresponding existing technology already available to digitally implement the scenario; also in many cases theoretically apt technologies exist but are hindered by a currently low adoption rate or a pioneering development status, that do not allow for immediate easy adoption - especially by non-technical entities. For this reason, technological suggestions are described as either immediate application or longer-term application, while “Missing technologies” are described in the last chapter, to highlight areas of potential development that should steer the growth of recognition technologies.

Recognizing a peer or mentor or public person or organization, also as a way to encourage learning by providing models

Scenario description

**Function/goal:** share opinion to improve recognized self esteem and/or public reputation. Can be referred to specific skills or domains or can be generally pertaining to the person/organization.

**How shareable it is:** often poorly re-shareable, its efficacy stops at the border of the chosen context (i.e. if recognition happens verbally within a company it might be heard beyond the original context, but the recognized person won't be able to leverage it intentionally). Often the domain of recognition would be multiple (a person is good at using specific soft skill in specific domain and is also competent in specific domain), so the piece of recognition is hardly re-usable out of context.
How to improve shareability: a digitized version will be more permanent and re-usable, as long as a referrable URL is available.

Required content of shareable recognition: how good specifically, at doing what, on what basis recognizant expresses this; evidence of connection between recognizant and recognized, evidence of said connection pertaining the domain of recognition, evidence of competency of recognizant on the domain of recognition, evidence of praised role / activity. References to skills or competencies taxonomies might make such recognition more machine-readable and re-usable. Specificity in the expression of recognition contributes to a greater sense of trustability.

How to make it open: this piece of recognition should be portable and reusable across (digital) systems without losing context and content.

Recognition technologies: social networks, written or spoken words, likes & follows, endorsement of existing recognition, open badges.

Technology guidelines

Immediate application: social networks are the most accessible place where digital recognition can have a wide resonance; also on behalf of an organization expressions of like and follow are actual endorsements towards individuals, projects or organizations. Be aware of accessibility and portability limitations, i.e. consider that what is written on a social network may only be accessible to subscribers of that network, and that it is to be expected that such an endorsement won’t ever be exportable outside the original network.

Longer term application: A social network reader capable of harvesting, reading and exposing “like” information coming from social networks would make it more openly accessible. An endorsement as designed in OB 2.0 would be a public and portable expression of recognition for a person or organization, both generally and related to a specific competency or context, but it needs to be connected to Open Badges that could be both third-party or self-issued. Bitsoftrust would allow for generic immediate expression of trust or appreciation, also easily shareable. Solid is also a viable platform for such an implementation.

Identify own skills

Scenario description

Function/goal: self-awareness is the first step towards more public recognition, but is in turn largely based on public recognition, and traditionally tends to be circumscribed to one’s own formal titles.

How shareable it is: when going beyond formal titles, it is shared as self declaration and often lacks in evidence / proof and in a common understanding of specific skills / domains and their levels

How to improve shareability: a shared format and reference frameworks.

Required content of shareable recognition: context, endorsers, evidence, clear (possibly shared) definition of skill / achievement.

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How to make it open: improve visibility, readability, verifiability of connections between claimed skills and other entities (context, endorsers, evidence). This should also improve perceived relevance of recognition different from formal titles.

Recognition technologies: resumée formats, self-claiming Badges, badges allowing adding (further) evidence after issuing.

Technology guidelines

Immediate application: any self-reflection tool is useful - from an e-portfolio to curricula or an online professional profile - , but to boost self-reflection as a first step towards recognition the use of self-issued Open Badges is advised, so that they can later gather third-party endorsements.

A less portable but more easily applicable solution is again using social networks that allow describing own competencies (such as LinkedIn), being aware that such claims will remain enclosed in the chosen network and are poorly trustable and verifiable.

HR systems are also used to allow individuals to identify and declare own competencies.

Longer term application: Self-assessment tools - both as stand-alone e-assessment services or within LMSs - appear theoretically promising, nonetheless they rely heavily on domain-specific high quality content (how do you assess a specific skill?) which is usually lacking or requires a big effort to be created, confirmed and shared.

Open Badges can also be used in self-narration tools such as e-portfolios or various forms of electronic curricula, e.g. in the form of backpacks. Solid is also a viable platform for such an implementation.

Peer recognition

Scenario description

Function/goal: enhance the strength of self-assessment through peer endorsements.

How shareable it is: depends strictly from the tool used.

How to improve shareability: a shareable and content-rich format.

Required content of shareable recognition: content of recognized skill / activity, context, endorsers (possibly their profile). If peer recognition is to be considered as input of further recognition it needs to be clearly identifiable and provide elements for its evaluation. Both number and quality of endorsements need to be visible.

How to make it open: a digital portable format, capable of connecting to other content sources.


Technology guidelines

Immediate application: endorsing peer’s credentials and claims is a first easy step, be it on social networks, through likes or on more structured ad-hoc systems. Peer-issued Open Badges can also be easily introduced.
**Longer term application:** to guarantee long-term broad portability a specific distributed technology should be introduced as the underpinning layer for claims and endorsements: bitsoftrust and web of trust are the current candidates. In the “Missing technologies” section specific requirements for this application will be further expanded.

Recognition in communities, in the workplace and in learning

Scenario description

Recognition in communities

**Function/goal:** very close to peer recognition, it is slightly more structured as it mirrors the desired interaction mechanisms designed for / by a community. The community can be very flexible to very rigid, encompassing loosely organized groups up to companies.

**How shareable it is:** It might be meant mainly for internal purposes (e.g. improving self-awareness or internal career management) and therefore by design not shareable, or shareable only within a restricted context. In such cases a separate form of recognition meant to be exported outside the community is advised, possibly using different tools, and internal recognition may be used as evidence.

**How to improve shareability:** transparency, reference to common frameworks, widely used tools and formats.

**Required content of shareable recognition:** content of recognized skill / activity, context, conditions. The translation from internal to external needs and values should be done within the community to highlight as much as possible the value generated in the community, and to minimize effort required by external readers (e.g. employers) which might result in a failure of considering such recognition at all.

**How to make it open:** a digital portable format, capable of connecting to other content sources and of being imported in different contexts and tools. The use of separated tools for recognition meant for internal and external use also provides a modulable level of privacy.

**Recognition technologies:** very common social networks, community-specific social networks (i.e. within intranet), Open Badges and endorsements, Solid. Portfolio / backpack to show recognition and its network.

**Additional recognition output:** In the process of identifying valuable skills or achievements produced within the community, a (probably domain-specific) taxonomy or framework could be defined and expressed as output to policy makers. In this case a portable, easy to share taxonomy technology should be used, ideally with URIs.

Recognizing skills in the work/learn place

**Function/goal:** recognizing skills demonstrated by staff on the job. While the peer recognition happening on the job is covered by the Community recognition case - even when it is guided by the organization - this covers the top-down occurrence where an organization representative provides or validates recognition.

**How shareable it is:** when performed during the job (e.g. annual reviews), this is usually meant for internal uses; shareability - when existing - is limited to the same context and is of the “fleeting” kind, i.e. verbal and not meant to be shared or reused. Evaluation at the end of
a working relation is not a widespread use, it only exists in the form of reference letters, often posing obstacles to being both written and read. Evaluation in training is common but the tools used (paper or digital paper, attendance certificates) are hardly shareable in an effective way.

**How to improve shareability:** such evaluation is usually already made with the intention of being objective, obstacles to making it shareable are related to organizational privacy. A mentality change is needed, to accept that recognition belongs to the person and is a wealth the person should be able to leverage, given the proper organizational privacy constraints. Technically a digital recognition item should be issued; such a practice might be even more helpful if defining a standard format to substitute reference letters and simplify their issuing, thus improving the value of the output a worker gets out of a finished work relationship.

**Required content of shareable recognition:** recognized skill (possibly in relation to shared taxonomies), evidence, issuer, context (e.g. years of experience), endorsers.

**How to make it open:** the chosen digital format should be open and interoperable. Availability of a displayer of recognition within the organization would improve skills awareness, finding and sharing for the organization itself.

**Recognition technologies:** Open Badges, endorsements, taxonomies (maybe bottom-up), credentials displayer, e-learning and e-assessment systems for automatic issuing. Current practices include confirming competencies from year to year, so technologies should support that instead of providing a single issuing.

**Technology guidelines**

**Immediate application:** endorsing peer’s credentials and claims is a first easy step, be it on social networks, through likes or on more structured ad-hoc systems (e.g. HR systems that might also express different hierarchies and constraints). **Badges** issued by peers or by the organization following a proper verification hierarchy can be easily introduced. Other kinds of digital credentials (W3C Verifiable Claims, EDCI, Blockcerts) are advisable if stronger verifiability or a specific technological compatibility is required and in cases where recognition is managed by structured organizations capable of accessing such tools. It is always necessary to evaluate the need and appropriateness for a given recognition to be private, public within the organization or portable outside the organization.

**Longer term application:** to guarantee long-term broad portability a specific distributed technology should be introduced as the underpinning layer for claims and endorsements: bitsoftrust and web of trust are the current candidates; **Solid** has also been evaluated as a possible solution for this need. In the “Missing technologies” section specific requirements for this application will be further expanded.
Academic titles and formal credentials

Scenario description

**Function/goal:** provide a long-term verifiable credential as output of a structured learning path. Allow the learner to be recognized as holding a broad set of knowledge and competencies.

**How shareable it is:** being shared is its main purpose.

**How to improve shareability:** making it digital and digitally verifiable (and therefore quickly shareable without losing trust). Improve content readability.

**Required content of shareable recognition:** recognized knowledge competencies skills and achievements; issuer and its reputation; context (i.e. degree); evidence.

**How to make it open:** making it portable and independently and securely verifiable.

**Recognition technologies:** blockcerts, EDCI.

Technology guidelines

**Immediate application:** verifiable tamperproof digital credentials such as blockcerts are already applicable and guarantee a sufficient level of verifiability and durability. EDCI promises an analogue response; W3C Verifiable Credentials is also an option.

Human readers of credentials (such as HR professionals) would already be able to instantly verify this sort of credentials; they can also leverage their content for a deeper understanding of the competencies implied by the credential.

**Longer term application:** a further increase in functionality and durability would be the ability to connect a given credential to the set of authorization or accreditations for its issuing entity, and - as a different point - the possibility to evaluate its reputation based on computable user-driven criteria; in the “Missing technologies” section this will be further expanded.

From a reader's point of view a **displayer** capable of verifying, interpreting and connecting all available data would be key to a real day-by-day use and a substantial improvement of own work and efficacy.

Resume evaluation: experiences, evidence, assessment; Read and find skills

Scenario description

Resume evaluation: academic title and other formal titles

**Function/goal:** evaluating both contents and issuer of the credential.

**How shareable it is:** it is usually not meant to be shared, as it leverages starting points and goals that are specific to the single case.

**How to improve shareability:** Being an evaluation of a piece of recognition which is already official, standard and shareable, its shareability would not particularly improve the general recognition process: on the contrary it risks propagating biases. What could be helpful and
shareable is a simple endorsement of the degree, but this would be more ex-post than a resume evaluation. Strong and secure verifiability of the credential used to submit the title is also key to keep a low (if none) rate of possible frauds.

**Required content of shareable recognition:** the endorsement should be contextualized and motivated. Its intended meaning should be: I recognize the value of this credentials as demonstrated by this person in this context in this way / for this reason.

**How to make it open:** the degree being endorsed should be in a digital format, verifiable and accessible online.

**Recognition technologies:** Badges and endorsements, Blockcerts, EDCI.

Resume evaluation: experiences, evidence, assessment

**Function/goal:** evaluating experiences declared by a person.

**How shareable it is:** it is usually not meant to be shared, as (1) it is not considered recognition but evaluation of existing evidence and claims, and (2) it is often very specific to the single case. This is often an end-of-cycle recognition step, not subject to further recursions. The openness of the previous steps and of their outputs results in making this step easier and with a safer result for the learner.

**How to improve shareability:** in this case the shareability of previous steps is relevant. Experiences should be evaluated based on shareable, shared, transparent, technologically open, adequately verifiable and well interconnected pieces of information.

**Required content of shareable recognition:** evidence, recognized skills, connected taxonomies, context, network, criteria when applicable.

**How to make it open:** The evaluator should be able and willing to evaluate and trust provided information. Recognition by other professionals should be accessible, verifiable, connected to implied skills and to shared taxonomies.

**Recognition technologies:** Badges, with evidence and endorsements, Solid, taxonomies. Portfolio / backpack to show recognition and its network. A credential reader might help in evaluating multiple credentials and their connected information, such as profiles of issuers and endorsers.

Read and find skills

**Function/goal:** this traditional HR / headhunter use case - understanding and identifying skills within a learner’s or job-seeker’s profile - could be dramatically improved by open recognition technologies.

**How shareable it is:** the plethora of recognition pieces held by each learner is hardly shareable because of different formats, contents and privacy. It is usually not machine readable nor verifiable and therefore each credential needs to be evaluated on its own, requiring a relevant effort.

**How to improve shareability:** recognition provided in open data-rich format can be quickly read and visualized by a recognition displayer (such as portfolios or backpacks or an evolution of those). A displayer should be able to interpret and show the recognition wealth of a community, or just focus on a single learner’s portfolio.

**Required content of shareable recognition:** evidence, recognized skills, connected taxonomies, context, network, criteria when applicable, recognizing agent and its network,
endorsers and its network, more metadata such as geographical data, EQF data, job match or competency profile data.

**How to make it open**: The use of open formats at every level might enable a displayer to show the network related to a piece of recognition, without the need to concentrate on single powerful and easily private platforms.

**Recognition technologies**: Badges (or other digital credentials) with machine-readable metadata, including references to taxonomies, links to network profiles of involved people and organization, geographical data, EQF data, job match / competency profile data. Needs to be open format so multiple displayers can be built leveraging different metadata.

**Technology guidelines**

**Immediate application**: operators of job agencies and employment offices as well as HR professionals should consider a broader range of credentials - be they macro or not - and leverage the possibilities provided by the digital format in verifying them, their issuer, their content (including endorsements) and context. This would currently be mostly manual work, where the operator needs to know how to verify and expand on any given digital credential format: Open Badges, Blockcerts, EDCI format, social network endorsements, etc. Social networks are also relevant, especially to find skills.

**Longer term application**: applications should be developed allowing readers of credentials (in particular within HR systems) to bulk analyze a number of them and provide the operator with an easy to navigate format of information, where the reader could directly express and modify his/her own criteria. More on this in the “Missing technologies” section about “Digital credential reader”.

Bitsoftrust and ORCA can also be applied to develop new processes for the evaluation of a candidate’s experience by leveraging her/his trust network, as highlighted in ORCA’s PoC paper. Solid is also a viable platform especially to implement systems for locating skills.

**Evaluating skills and job fitting**

**Scenario description**

**Function/goal**: evaluating skills declared by a person, in relation to a possible job position.

**How shareable it is**: if performed by the recruiter it is usually not meant to be shared, as it leverages starting points and goals that are specific to the single case; if performed by social services or NGOs it is precisely meant to be shared in order to ease the recruiter’s job, add an endorsement level to the person’s competencies and credentials and thus improve chances of job-finding for the person.

**How to improve shareability**: making this evaluation shareable would require a specific intention and reflection on behalf of the person performing the evaluation, in order to separate the general evaluation from the specific evaluation with reference to the job available. The input of this evaluation mostly includes self-declarations and evidence of past activities, which should be embedded in the recognition together with the evaluation of the
issuer. A more shareable and evidence-based peer-recognition would be a useful add-on as input to this process, if accepted by the operator performing the evaluation.

**Required content of shareable recognition:** input data (incl. previous peer recognition, credentials, achievements), evaluators, context. A format to transparently define a skill growth path would help in sharing an evaluation that is not necessarily on/off but considers possible evolutions.

**How to make it open:** express the independent part of the evaluation process in a digital shareable format. A critical point is the implicit public disclosure of evaluation principles used by the professional / organization issuing this piece of information. Skills should be clearly defined with reference to shared taxonomies: using a shared evaluation grid might also help.

**Recognition technologies:** Badges, with evidence and endorsements, Solid, taxonomies (even bottom-up), job profiles definitions, skill growth paths definitions. EU skills profile and other assessment tools. Ownership: it is extremely relevant that the recognized person is in full control of this kind of credentials and their availability. Portfolio / backpack / credentials displayer to show recognition and its connected network.

**Technology guidelines**

**Immediate application:** operators of job agencies and employment offices as well as HR professionals base such matches on their understanding of the domain. To open up recognition leveraging currently available digital tools, operators should be able to leverage a range of digital credentials in order to understand not only what skills they refer to - possibly with the support of referenced taxonomies - but also the skills they imply. This can be greatly supported by those designing the content of issued credentials.

This would currently be a mostly manual work, where the operator needs to know how to verify and expand on any given digital credential format: Open Badges, Blockcerts, EDCI format, social network endorsements, etc

**Longer term application:** applications should be developed (and integrated into HR systems) allowing readers of credentials to bulk analyze a number of them and provide the operator with an easy to navigate format of information, including browsable references to taxonomies. More on this in the “Missing technologies” section about “Digital credential reader”.

Bitsoftrust and ORCA can also be applied to develop new processes for the evaluation of a candidate’s experience by leveraging her/his trust network, as highlighted in ORCA’s PoC paper.

**Recognizing soft skills**

**Scenario description**

**Function/goal:** this is partly a special occurrence of the skills evaluation cases. Soft skills are peculiar because they are highly valuable and sought-after, but critical to evaluate from resumées or even interviews. The purpose of this case is to define a process to help identify and properly evaluate soft skills leveraging recognition.

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**How shareable it is:** recognition of soft skills is usually not expressed in a shareable way - but proper shareable recognition during long-term learning working or collaboration experiences can be a key element to improve next-step recognition where not as much time is available, such as job selections.

**How to improve shareability:** Soft skills recognition during long term learning working and collaboration experiences should be common practice and should output shareable recognition items.

**Required content of shareable recognition:** evidence, recognized skills, taxonomies, context, network, criteria when applicable, recognizing agent is especially relevant because trust given to the agent is likely to play a big role in evaluating such an evidence.

**How to make it open:** identify skills based on clear shared taxonomies, make it easy to follow up on recognizing agents, context and endorsers.

**Recognition technologies:** Badges, with evidence and endorsements, Solid, taxonomies supported by technologies such as AI or semantics. Portfolio / backpack / credentials displayer to show recognition and its network.

**Technology guidelines**

**Immediate application:** the practice of recognizing soft skills as they develop in learning, working and community experiences could be boosted by the simple introduction of **Open Badges** on a platform allowing issuing by peers; other digital credentials such as **W3C Verifiable Credentials** or **Blockcerts** can be a viable option if specific requirements exist. Finally, considering and recognizing soft skills developed or demonstrated in **LMSs** and in e-assessment systems is a good practice.

The content of recognition should consider what will be useful by readers to evaluate the specific soft skill, and therefore include description, verification, references if applicable, evidence and examples. **Endorsements** on issued Badges is also a valuable addition for this use case.

**Longer term application:** a shared understanding of possible definitions and patterns to identify soft skills would be a great support to the introduction of this practice in more contexts. This however concerns the content of **taxonomies** more than the technicality, which is solvable using alignment and reading it. **Bitsoftrust** and **ORCA** can also be applied to claim soft skills and have one’s own trust network endorse those claims.

**Stackable microcredentials**

**Scenario description**

**Function/goal:** allow the learner to get learning and recognition from different providers while still building a broader path that can be recognised as a whole. Use cases within a single institution (e.g. credit recognition for external activities) work as first trials of this system.

**How shareable it is:** being shared is its main purpose.
How to improve shareability: improve the automation of correct recognition based on the rules defined by the organizations involved to enhance trust and credibility.

Required content of shareable recognition: recognized knowledge competencies and abilities; issuer; context; evidence; shared metrics (i.e. degree, credits...).

How to make it open: making it portable and independently verifiable.

Recognition technologies: permissioned blockchain with smart contracts (also allowing the definition and change of the recognition rules at the required granularity) using a decentralized digital identity. Blockchain makes a permanent, secure student record infrastructure possible and offers reliable management for the development of lifelong learning by offering students direct access and control over their achievements. The smart contract allows an authorizing agent to receive micro-credential validation requests from end users. Open Badges can also be used, but lack a system to share and automate recognition.

Technology guidelines

Immediate application: the practice of recognizing existing credentials in view of awarding a further credential is already applied, but every institution or group of institutions needs to define its own requirements and evaluate them each time. The use of verifiable digital credentials (Open Badges, Blockcerts) is an already available improvement, capable of speeding up and in specific contexts even automating the recognition process.

Longer term application: for a complete implementation of the stackable credentials use case, a shared infrastructure is needed, where credentials can be verified in one or more digital format, and recognized according to criteria and assigned a role or value by an institution in the frame of its own activities. Candidate technologies for such an implementation are Open Badges, Blockcerts or EDCI as credentialing standards, and Blockchain or a similarly distributed architecture as automated recognition infrastructure. Both sets of technologies would need to be expanded in order to support information needed to evaluate and perform credentials recognition, such as alignment to frameworks, verification of issuer.

Highlight skills deemed valuable by an organization

Scenario description

Function/goal: encourage members of an organization or community to develop and show specific skills by highlighting them with recognition. It is different from the Community case and from the workplace skills evaluation case in the fact that here the mechanism is defined at an organizational level and does not necessarily go through a representative person / evaluator.

How shareable it is: being public is its main purpose.

How to improve shareability: use digital format, issue recognition which can be meaningful outside the original context. Encourage the creation of communities around recognized items through communication tools embedded in recognition elements and their displayers.

Required content of shareable recognition: recognized skills; issuer; context; evidence.

How to make it open: use portable formats.
Recognition technologies: badges with evidence and endorsements, communication based display.

Technology guidelines

Immediate application: an organization can design and publish Open Badge classes to highlight valuable skills and let learners claim them and demonstrate to deserve them, or endorse existing Badges or items in Social Networks. If the organization can also support the development of such skills, using an LMS to provide learning is an index of treasuring the skill.

Longer term application: Badge Classes could be valuable pieces of information on their own, where the relevance would be on the Badge content, its reference to dictionaries or taxonomies, and - most relevant - its issuer as a declaration of interest for a specific skill or quality. Digital Credentials host platform could provide functionalities allowing interactions among Badge owners or Badge claimers, or between Badge designers and Badge owners/claimers.

Recognize organizations

Scenario description

Recognition by an individual

Function/goal: help others in evaluating an organization, implicitly recognize pieces of recognition expressed by organization.
How shareable it is: often poorly re-shareable, its efficacy stops at the border of the chosen context
How to improve shareability: a digitized version will be more permanent and re-usable, as long as a reference URL is available.
Required content of shareable recognition: how good specifically, at doing what, on what basis recognizant expresses this; evidence of connection between recognizant and recognized, evidence of said connection pertaining the domain of recognition, evidence of competency of recognizant on the domain of recognition, evidence of praised activity. Specificity in the expression of recognition contributes to a greater sense of trustability.
How to make it open: this piece of recognition should be digital portable and reusable across systems without losing context and content.
Recognition technologies: social networks, written or spoken words, likes & follows.

Recognition by an organization

Function/goal: It should be possible to evaluate organizations in the same way an individual is evaluated for trust. “Accreditation” usually has this purpose, mirroring the fact that the issuer reputation is key to the recognition process; however the accessibility of such information may be strongly improved.


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How shareable it is: being public is its main purpose, but such information is often hard to read and verify.

How to improve shareability: use digital verifiable secure formats to express trust between organizations so that the whole trust chain can be read. The trust chain can be more or less formal according to characteristics and requirements of organizations and their domains.

Required content of shareable recognition: recognizing, recognized, context, proof.

How to make it open: use decentralized architecture.

Recognition technologies: blockchain, EDCI

Technology guidelines

Immediate application: Currently, individuals can recognize organizations through public connectors - not verifiable and rarely portable. Organizations usually recognize other organizations implicitly by working with them, or explicitly through organizations partnership networks. Institutions recognize organizations through off-line activities defined by law. The immediate application of Open Recognition to organizations only covers the first two cases, where recognition could be performed through open pieces of recognition issued to organizations (Open Badges).

Longer term application: Open Badges could better support this use case by providing a standard way to address an entity instead of an individual. The accreditation use case needs a stronger implementation with a shared repository of accreditation information that should be easily accessible by both organizations and individuals: this could be implemented through digital credentials (e.g. Open Badges) + a distributed network such as Blockchain. A secure and verifiable implementation of accreditation chains could leverage Blockchain technology, by securely writing an accreditation with all its details and later allowing any citizen to read and simultaneously verify the whole accreditation chain starting from any point (i.e. any organization), thanks to smart contracts.

Bitsoftrust and ORCA can also be applied to express trust between organizations and within a domain - particularly for the case of mutual recognition (as opposed to proper accreditation, which might need stronger security), as highlighted in ORCA’s PoC paper.

Missing technologies

Digital credentials displayer

People and organizations need to make many kinds of claims as part of their activities and decisions about job applications, collaboration, and professional development will depend on filtering and analyzing growing amounts of data that it is essential could be verifiable.

In addition to collecting credentials in personal repositories (backpacks or wallets), earners need effective tools to share and present the specific credentials for a particular need in a structured form. So tools that can collect, organize, combine and show credentials of different types and formats would be useful.
Digital credentials reader

Recruiting professionals need to collect, view, analyze and verify a large number of credentials received from job applications. The need arises for tools in HR systems capable of organizing and interpreting credentials of different formats, separating them, ordering them based on multiple search criteria and capable of suggesting a match with the hiring requests.

The following features have emerged as required in the analyzed scenarios, but couldn’t be found in existing applications.

- A reader (not owner of the digital credentials) should be able to
  - Bulk upload digital credentials
  - Bulk verify digital credentials (integrity, authenticity, ownership)
  - Extract information from a set of digital credentials
    - Sets of competencies covered
    - Timeframe information (issuing time, validity limit)
    - Issuers
    - Owners
    - Geographical locations
    - Number of endorsements per credential
    - Number of learners per competency
    - Number of credentials per competency
  - Further interpret information extracted from digital credentials
    - map competencies over a framework (or multiple frameworks)
    - map relationships between competencies referring to a chosen dataset (framework, taxonomy or other)
    - explore issuer profiles
      - verify issuer identity
      - credentials issued
      - other information about issuer (website, social profiles)
    - explore endorsers profiles and aggregate information
      - endorsers’ competencies
      - endorsers’ reputation
      - endorsers’ network
      - endorsers’ credibility based on user set of criteria

One key concept for tools meant to help interpreting recognition data is that interpreting criteria should be open and user-defined as much as possible: a tool should not embed a specific way to evaluate trust, credibility or value of a credential, it should on the contrary allow the user to express his/her own way to define trust credibility or value.

For instance, a user should be able to express that he/she would like to consider highly trustable credentials or recognition pieces where at least 2 of the following are true

- the credential covers a competence that is among the main competencies of the issuer

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- the credential is issued to over x learners
- the credential hold min x endorsements by endorsers being recognized for the same competence.
- the credential has at least one evidence that the user should mark as trustable

Another relevant scenario is that of matching a set of credentials or recognition pieces against a set of requirements, such as for a job: in this case job requirements should be expressed in such a way that it is possible to translate them into queries for credentials sets, for instance to find learners having
- at least one credential in a soft skill among team work, communication and creativity
- a credential in Java programming
- a credential with evidence by an enterprise issuer
For each of the chosen credentials, the user might then apply the required level or criteria of trustability.

It is quite apparent that such queries would require to browse a deep and nested tree of facts, whose ownership, location (in terms of storage) and accessibility (in terms of permissions) can and should vary. Only a distributed standard-based and diffused architecture could enable such a scenario - or a closed and monopolistic one.

In the current technological scenario, subsets of the expressed features should be considered by developers working on tools to enable recognition. **Tools at the hand of readers, capable of harnessing the richness of metadata included in standards such as Open Badge 2.0, are still missing and appear key to actually activate an open - or more open - recognition process** as identified and analyzed in MIRVA’s work.

**Flexible, peer to peer, trust-based recognition digital tools**

Collected scenarios, especially in the individual and community cases, highlight quite frequently the need for a quick way to express recognition and trust among individuals. Main requirements look as follows:

**Content**

Peer to peer recognition needs the possibility to be very lightweight, allowing for the easiest recognition of pure “trust” or generic appreciation. Starting from this all other content may be added but mustn’t be mandatory: skills, activities, outcomes, context.

**Process**

The issuing process too needs the capability of being very lightweight, allowing for light identification of issuer and recipient with the possibility of opting for more secure options. A core feature for peer to peer recognition is ease of use and lack of pre-requisites like owning an account or multiple verifications (such as to verify identity): a corresponding decrease in security and verifiability is deemed acceptable in the more dynamic and community-based
contexts, where it can act as start-up process later possibly followed by a more structured and secure one designed to be shared with external actors.

Living Badges

While the analysis of the recognition process revolves around the recognition act, the identification and telling of one's own skills would benefit from leveraging previous recognition, while existing pieces of recognition would be maintained meaningful if attached to new evidence. This is only partially supported by existing technology and would represent a relevant evolution, allowing a user to attach new evidence to existing recognition or credentials.

Badges as reference letters

This particular evolution of the “Recognizing skills in the work/learn place” scenario would likely solve a current real-world issue for many employers (i.e. easily writing reference letters which are complete, meaningful and useful to the receiver), but would require a digital tool offering

- a set of pre-compiled open badges
- easy review and modification of badges templates
- creation of one’s own issuer with reasonable authentication
- issuing of said Badge to deserving worker

Of course a relevant value in such technology would be constituted not by technology itself but by the set of pre-compiled badges: this could leverage a community wiki-style work, involving supporting organizations.