WHITEPAPER ON OPEN BADGES AND MICRO-CREDENTIALS

SURF NET

CONTENTS

1. INTRODUCTION

Badges are digital pictograms or logos on a web page or in another online location. These icons show that someone gained a certain type of knowledge or acquired specific skills. People who successfully complete a course can show the badge they have obtained on their website or social media, such as LinkedIn. Around the world, educational institutes, training companies and ICT companies, such as Microsoft and the Security Academy, are now issuing digital badges to course participants.

Badges use technology that has many potential applications in higher education. Badges are also a tool that supports another trend in education: micro-credentials, which splits learning into smaller units, which are certified separately. Institutions providing accredited education currently only offer bachelor's or master's degrees, but students are also taking courses outside their regular curriculum, such as MOOCs. Students also want to see that type of education validated with credits or exemptions.

Various parties are interested in the development and (possible) application of badges and micro-credentials. The House of Representatives of the Netherlands passed a motion to explore the certification of smaller modules in December 2015. The Ministry of Education, Culture and Science has also shown an interest.

In 2016, SURFnet's 'Open and Online Education' project studied the possible opportunities offered by badges in Dutch higher education. The project considers how institutions would like to use badges and for which type of education, and how SURFnet could facilitate this. To create its list, SURFnet talked to representatives of eight higher education institutions and student organisations in 2016. There have also been conversations with representatives of the Ministry of Education, Culture and Science, the Education Executive Agency, internationalisation organisation EP-Nuffic and the commission on vocational education of employer organisation VNO-NCW. These conversations served as the foundation for this white paper about open badges and micro-credentials.

This white paper starts by introducing badges: what are they, what is their importance, who are the stakeholders and how are badges used (now already)? Then we discuss three scenarios: badges for micro-credentials, badges for extra-curricular education and badges as game elements. We consider the advantages and disadvantages for the stakeholders in every scenario. Finally, we show what needs to be done to actually introduce badges: this will have consequences for ICT infrastructure, personal data protection and cooperation between educational institutions. The white paper concludes with a summary.

2. WHY BADGES?

Badges are interesting in the context of students who gain knowledge and competencies from different sources, including outside their regular study programme. Students can sometimes obtain exemptions for parts of their study programme by completing a procedure for previously acquired competencies. The knowledge and competencies made visible through badges can also be interesting for potential employers. Students can make their skills visible with badges on their website or LinkedIn profile.

A badge links to the underlying proof that the student has acquired the knowledge or skills or obtained the certificate in question. The badge also contains information about the issuer and possibly an expiry date. Employers and educational institutions can therefore check online who issued the badge and what a student had to do to obtain it. This increases the trustworthiness of a badge.

Many institutions that issue badges use open standards, such as the Open Badge Infrastructure Open Badge Infrastructure. Badges based on open standards are referred to as open badges. Students can obtain open badges from various organisations and present them in a particular combination.[1] Commercial parties can develop software and offer services to create, issue, manage and show badges. In recent years, a large number of suppliers have been involved in the (further) development and use of open badges[2] on their online platforms.

Badges mainly play a part at the crossroads moments of someone's professional development. A badge can simplify the exemptions process when moving on to a programme of (further) study. Applicants can use badges in their application to show their knowledge and competencies. Employers can assess applicants' badges, but they can also issue badges themselves for company training courses, for example.

Stakeholders

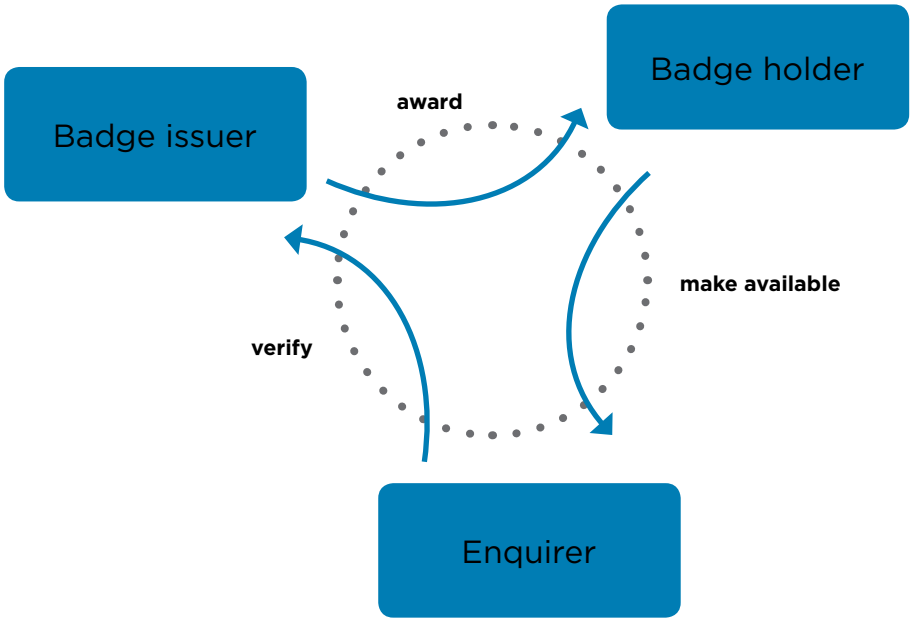
We can distinguish three badge stakeholder groups:
- The *badge holder* (student) who obtains the badge after mastering a skill or developing a competency. Lifelong learners, researchers, lecturers or other groups can also obtain badges, of course.
- The *badge issuer* (educational institution, sometimes also a company) who creates and issues the badges and is responsible for their authenticity and quality.
- The *enquirer* who assesses, verifies and appraises the badges' content. They may be employers or educational institutions. An educational institution may award credits or exemptions based on badges.

Every party has its own interests:

The *badge holder* has the following interests:
- simple, regulated online access to his or her own badges to be used in the digital world inside and outside the Netherlands;
- the possibility to verify the authenticity and value of digital badges online;
- protection of the badge holder's personal data;

[1] *Vladan Devedzic, Jelena Jovanovic (2015): Developing Open Badges: a comprehensive approach, found at http://link.springer.com/article/10.1007%2Fs11423-015-9388-3*
[2] *For an overview of platforms, see: http://www.badgealliance.org/badge-issuing-platforms/*

- a permanent link between the digital badges and an online identity, also after the study or programme has been concluded or completed;
- the option to show and combine digital badges on as many online platforms as possible using (open) standards;
- the option to store digital badges in a personal digital badge backpack to show them elsewhere;
- the option to selectively show digital badges to third parties;
- the option to trace who consulted the digital badges.



The *badge issuer* has the following interests:

- simple, regulated access to the digital badges by the badge holder and national and international third parties;
- the option to include certain skills and competencies in a badge, preferably in a way that ensures comparability (e.g. based on a competency framework);
- standardisation of the description of the results in a digital badge to ensure interchangeability between institutions;
- a permanent link between the digital badges and an online identity of the badge holder, also after the study has been concluded or completed;
- a simple management environment to create, manage and award badges to badge holders;
- version control of the digital badges to support updates to the curriculum / subject;
- the option to digitally sign or seal badges to demonstrate the authenticity of the badge issuer and the content;
- the option to withdraw badges in case of alleged unauthorised use or errors;
- a future-proof, supplier-independent platform for badges based on open standards;
- the option to link this platform to administrative and educational systems;
- the option to establish to what extent the badges are being consulted;
- increased brand awareness for the institution issuing the badges.

The *enquirer* has the following interests:
- simple, regulated access to the badge holder's digital badges;
- the option to easily establish the badge's authenticity online by validating the digital signature's authenticity, for example;
- the option to perform a specific search for certain skills and competencies or certain badge characteristics, such as the issue date;
- the option to quickly understand the badge's 'value' in terms of the level of the acquired knowledge and skills, the underlying evidence, the identity of the issuing party, etc. Based on this information, an institution can assess whether the badge will result in an exemption or credits, for example.

Vision and choices

Various domestic and foreign institutions are looking into the possibilities of badges. However, views on badges and micro-credentials vary significantly. The following questions reflect the choices faced by institutions:
- Do the institutions want to award badges to accredited or non-accredited education?
- Are institutions prepared to issue credits on the basis of a badge if the achievements resulted from (accredited or non-accredited) education at a different institution?
- Do the badges have an external function or do they have an internal focus?
- How detailed are the learning units for which badges are issued?
- Which risks do badges entail in terms of administration and management?

Interest in badges

In the Netherlands, Rotterdam University of Applied Sciences is enthusiastic about the possibilities of micro-credentialing learning modules in their part-time programme, for instance.. Other institutions are also interested in the possibilities. Outside of the Netherlands, various parties are exploring the possibilities of badges inside and outside education. Some educational institutions, ICT companies and training agencies are already awarding badges to participants. The Educause professional development programme also issues badges.[3]

The Ministry of Education, Culture and Science (Directorate for Higher Education and Student Funding)[4] is interested in badges based on the pilot for more flexible education and the experiments with regard to demand-driven funding in part-time and dual education. Demand-driven funding allows lifelong learners to take modules at different institutions and obtain their degree. Flexible education is no longer based on educational programmes with a fixed curriculum. It is now based on learning outcomes. Badges would fit this picture perfectly and could lead to shortened learning pathways, but arrangements on quality and trustworthiness must be made.

Badges are also interesting for the validation and recognition of previously acquired competencies, which will allow students to take a shortened study programme. The advisory committee for Flexible Higher Adult Education[5], which implemented the abovementioned pilots and experiments, discussed the issuing of (paper) certificates for smaller learning units. Those certificates currently do not yet have any civil effect similar to that of a degree. They could be transformed into badges. The examination board of the home institution decides whether the badge can then be converted into credits / exemptions within the study programme.

Micro-credential partnerships

In some cases, institutions make mutual arrangements about the recognition of each other's formal education (including MOOCs). In the 'Credits for MOOCs' initiative by TU Delft, for example, an international consortium of universities makes arrangements about awarding credits to each other's MOOCs.

One example of more flexible education is 'Kies op Maat', a partnership of universities of applied sciences that allows students to complete their minors with all participating partner institutions without any financial implications. The 4-TU federation (Delft, Eindhoven, Twente and Wageningen) and the partnership of the universities of Leiden, Delft and Rotterdam (CLE) also offer opportunities for micro-credentials. In both cases, education completed elsewhere can be recognised within a bachelor or master study programme at the home institution. This indicates that consistent organisation of flexible education at several institutions and the allocation of credentials in this respect is becoming more important. The use of badges may contribute to this process.

[3] *http://nextgenlearning.org/blog/digital-badging-rise-skillbuilding-recognition-educause*
[4] *This information comes from a conversation with Jolien van der Vegt, Ruud Nauts and Patrick Leushuis (Directorate for Higher Education and Student Funding)*
[5] *Adviesrapport Flexibel hoger onderwijs voor volwassenen, https://www.rijksoverheid.nl/documenten/rapporten/2014/03/12/flexibel-hoger-onderwijs-voor-volwassenen*

3. THREE SCENARIOS

Based on the input from the higher education institutions, three scenarios were drawn up for the ways in which badges can be used in Dutch higher education. We distinguish two variables in this regard:

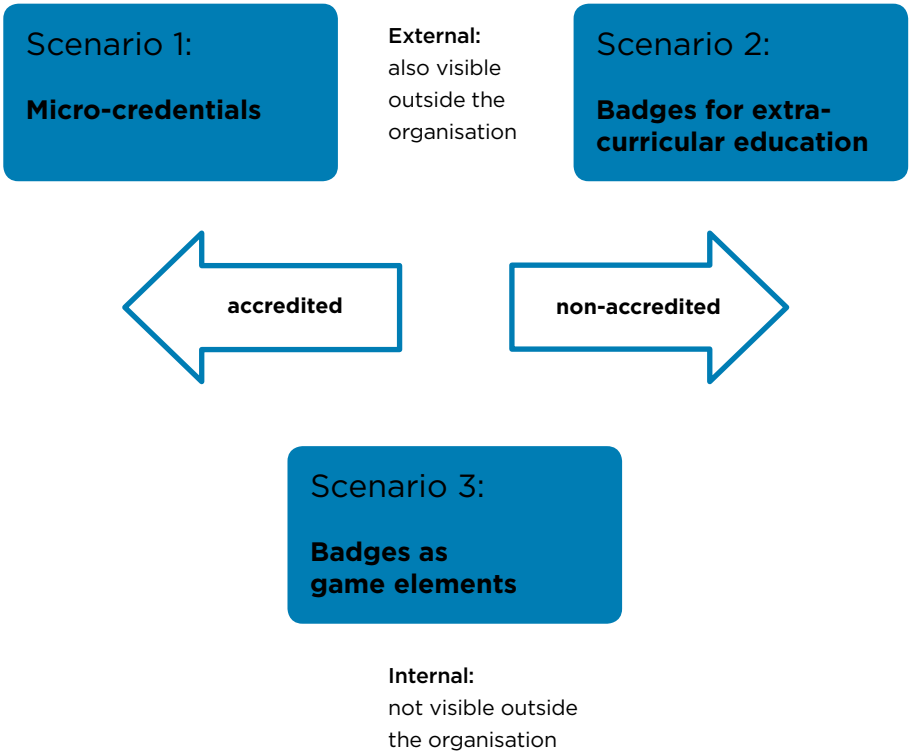
1. **Accreditation:** are the badges for accredited or non-accredited education?
2. **Visibility:** are the badges externally visible or visible only within the issuing organisation's learning environment?

Combining these variables results in three scenarios:

1. **Micro-credentials** (accredited education, externally visible)
   In this scenario, an institution issues externally visible badges for parts of the accredited education, for example, for a subject or minor.

2. **Badges for extra-curricular (further) training**
   (non-accredited education, externally visible)
   In this scenario, educational institutions or the various players issue externally visible badges for non-accredited education, such as MOOCs, university council membership or a completed company study programme.

3. **Badges as a game element**
   (accredited or non-accredited education, not externally visible)
   In this scenario, only internally visible badges are issued as a tool to increase students' motivation within a subject, for example.



1. Micro-credentials scenario

In this scenario, educational institutions link badges to small, separate educational units (such as modules or subjects) within accredited education. This scenario is in line with developments towards more flexible, personalised higher education.

Institutions can present the education they offer in smaller units, primarily to their own students, but also to students enrolled at other institutions, and as contract education to other target groups. They issue externally visible badges for the successful completion of these smaller units.

In this scenario, the higher education institutions in the Netherlands recognise each other as reliable partners. The storage of the badges (how and where), metadata, (international) protocols and standards and the authentication of the issuing institutions are all considered under the auspices of SURF. Subjects such as privacy, expiry dates and the option to withdraw issued badges are also included. SURF supports an infrastructure that allows the secure, trustworthy and verifiable issue, management and exchange of badges. An Education Executive Agency register for badges is also a possibility.

In this scenario, students can use badges obtained elsewhere to request exemptions at their own institution based on a system of arrangements between the institutions issuing the badges.

Example:

Online, skills-focused courses in the United States

Five US universities and colleges established the University Learning Store together in 2015. The University Learning Store offers short, online courses aimed at specific skills that may offer an advantage on the job market. People who find they already master the skill can proceed to the test immediately. Once the test has been successfully completed, a digital badge and a printable certificate are created showing the university in question as the issuing institution.

What are the benefits for the institutions?

Educational institutions can 'reward' students for smaller educational units and give this learning path social value with the badges. The civil effect is another matter. Only government-approved degrees with an established content, value and level have a civil effect. Certificates issued by higher education institutions can only have a civil effect if they are included in the Law on higher education and scientific research. Other certificates (such as the NIMA-A marketing certificate) have social value, but do not have any civil value.

The combination of micro-credentials and open badges can also increase an institution's visibility. Badges increase the university's accessibility and the visibility of educational programmes they offer for new target groups. Institutions can improve their brand awareness with badges.

Institutions may also wish to use badges to establish whether students qualify for a shortened pathway. Institutions may have incoming students who have badges from

other institutions or organisations. The institutions have to assess these badges and determine whether the students qualify for a shortened pathway. Institutions must be confident that the badges are properly secured, trustworthy and authentic (that they are truly issued by the mentioned institution).

The downside of the large-scale, successful use of badges may be the devaluation of degrees. What is the value of a full degree from a research university or university of applied sciences if employers' demands can be met with a few badges? This could lead to fewer students completing a full degree.

What are the benefits for the students?

If the badges are set up to clearly show the level and content of the achieved learning outcomes, they are a valuable tool to show the learning outcomes within and outside the study programme. Badges on a CV may lead to contacts with potential employers. An applicant with several badges may meet an employer's specific requirements.

Badges support lifelong learning at several institutions. They allow students to develop by choosing which subjects they want to take at which institution. Badges can be exchanged for credits (exemption) in accredited education. They are a great tool for keeping a learning portfolio.

What are the benefits for the employers?

Employers are not always aware what exactly a certain study programme entails and what an applicant knows and is capable of. Badges allow students to show their competencies on their CV and make certain components of the study programme visible. This gives employers an understanding of specific skills they are looking for. Badges are more accessible than university transcripts/academic records, as these have to be individually requested (the current online register provided by the Education Executive Agency only contains the actual degrees, not the underlying transcripts). Employers must be confident that the badges are properly secured, trustworthy and authentic.

2. Scenario for badges for extra-curricular further training

In this scenario, educational institutions or commercial study programmes issue externally visible badges for activities that are *not part* of accredited education. Some examples are MOOCs not offering any certification, a leadership position in a student union, student council participation, coaching of foreign students, or helping to provide information to new students. Other examples outside the context of higher education are courses run by commercial institutions leading to a badge or badges for volunteer work. The knowledge and competencies these activities imply may play a part in accessing the job market, or serve as previously acquired competencies when joining shortened pathways for specific (further) study programmes.

In this scenario, students can redeem certain competencies with a badge, such as public speaking, collaboration with others or information skills. An example of this is the Grading Soft Skills (GRASS) project of the University of Belgrade.

Examples:

GRASS
Grading Soft Skills (GRASS) is a European lifelong learning project. In this project, eight educational institutions from four countries work together to award badges for soft skills. Students at the University of Belgrade who took a Java programming course on a voluntary basis could earn badges for collaboration and communication skills as well as hard skills such as programming in Java.

Illinois State University
Students admitted to the Illinois State University Honors Program can earn badges for academic components, extra-curricular activities (seminars) and attending Honors meetings (Welcome Week). The badges are externally visible. The university has used the Credly badge platform for this since 2014.
Parties outside higher education, such as a languages institute or training centre, can also issue badges. The government can issue badges to officials who have completed a certain study programme or students doing their internship there.

What are the benefits for the institutions?

Badges for extra-curricular activities allow institutions to reward students who acquired certain skills at the institution. However, in case of large numbers of students and activities, issuing badges may be a very significant administrative burden. Not all extra-curricular activities are relevant for a study programme: a leadership position with a student sports association, for example. The question is then what is driving the institution to reward such activities with a badge.
One motivation for using badges could be to improve people's awareness of the institution or to support the students as they gain experiences in different contexts, including outside the institution itself.

What are the benefits for the students?

Students can make visible the activities they engaged in outside regular education in a controlled way. If the badges are issued by an institution, their trustworthiness is clear to everyone.

What are the benefits for the employers?

The badges make it easier for employers to select applicants or employees with certain skills, even if the skills are not directly linked to a degree. If the badges are issued by an educational institution, employers can be certain that they come from trusted sources.

There is a risk that CVs will be flooded with badges of which only a few are relevant for the job. It is the applicant's responsibility to select only the badges that are relevant for the job in question.

3. Badges as game elements scenario

In this scenario, the badges are issued at a lower level of learning units: the attendance of a meeting or the completion of an assignment. Such badges can also be used as a game element: an educational tool to increase the motivation within a subject. Badges show how students perform compared to their other students. Badges acts as a type of 'trophy' in this respect.

In this scenario, the badges only have an internal function: to motivate participants to complete the education programme. A higher education institution shows these badges only within its own learning management system (LMS), or even only within the digital environment of the relevant subject. The badge may also be externally visible, but that is not its primary function in this context.

Because this is an internal application of the institution, we do not elaborate this scenario further here.

HOGESCHOOL ROTTERDAM

Rotterdam University of Applied Sciences
Students can obtain badges for the basic and optional modules of the Digital Teaching & New Media minor. They can earn two badges for every basic module (one per meeting), and one or two badges for optional modules depending on their weighting. The lecturers can view the students' list of badges. The badges are shown on the Moodle platform and are awarded by the course administrators.

4. WORKING WITH BADGES

This chapter explains what is required to actually introduce digital badges. We discuss a number of aspects related to the introduction of digital badges: online proof and trust, storage, privacy and access, the architecture for an ecosystem for digital badges, the open badge standard and the information contained by badges.

Online proof and trust

Digital badges prove that someone has a certain skill or knowledge. Employers or educational institutions must be able to permanently validate the trustworthiness of the digital badge's underlying claim. The badge should therefore contain a security feature. Such a security feature is created by adding a digital signature to the content. This avoids any updates to the badge going unnoticed, and therefore guarantees the badge's integrity. It is also certain who signed the digital badge; there is certainty about the authenticity of the source. Ideally, the badge issuer places the signature using a certificate issued within a trustworthy Public Key Infrastructure (PKI).

So-called non-baked badges are another solution. These badges do not include a digital signature, and the check is performed at the source with the issuing platform. In that case, a student can add supporting evidence to a badge at a later stage.

The badge can be made more trustworthy by presenting it in a recognisable, trustworthy online environment. This allows the enquirer to verify the organisation's authenticity. This occurs on a secure website.

In order to establish who the badge belongs to, the badge needs to be linked to the badge holder's identity. Micro-credentials in particular require a strong link between the badge and the student's identity. However, there is currently no national or international solution to establish digital identities online in a highly reliable way and to link them to a unique personal number. The Netherlands has a citizen service number (BSN), but its use is regulated rather strictly. Educational institutions therefore link students to an internal administrative number.

Of course, badge issuers can link badges to individuals by using the email address the institution provided. That solution has the disadvantage that the link is lost when the person graduates or the educational institution changes its name. This also applies to the link with an educational institution's internal administrative number. Some solutions, such as Open Badge Passport, allow students to receive badges at several email addresses and to add an email address at a later date. In that case, badges linked to an institution email address can be transferred to another address.

Storage

It is important to ask how digital badges are made available and stored. Various organisations that are currently already issuing digital badges leave it up to the student to save them online and to make them available to third parties. This is possible with a digital badges backpack, such as Mozilla Backpack or Credly, which badge holders themselves fill with the badges they have achieved. This type of storage entails risks with regard to privacy and the continuity of these companies.

Educational institutions can also offer the digital badges online themselves, release them for third parties and archive them. This is comparable to the way in which they are now keeping their exam results and degrees. A digital storage system will ensure the good management of the digital badges and their accessibility. The principle is that the management of this storage system is arranged adequately and permanently. This is particularly the case for the technical infrastructure behind the security feature.

A more permanent solution is that a public body such as the Education Executive Agency plays a part in the central storage and provision of badges, as is the case for the current degree register. In that case, badges have to be released based on the social security number, because that is what the Education Executive Agency uses to identify students.

The Education Executive Agency currently already offers an online degree register, which stores eight million obtained degrees online. The holder of the degree can share these online degrees with third parties. Screening agencies can have a degree checked on behalf of an employer after the diploma holder has given his or her consent to the Education Executive Agency. The Education Executive Agency is examining whether it is possible and useful to also include the diploma supplement in addition to the degree itself, possibly in the form of a badge.

Personal data protection and access

Showing badges online also results in personal data protection issues. Badges contain data on the student's identity, achieved results or developed competencies. This imposes requirements on the releasing or shielding of badges and the data contained by the badges.

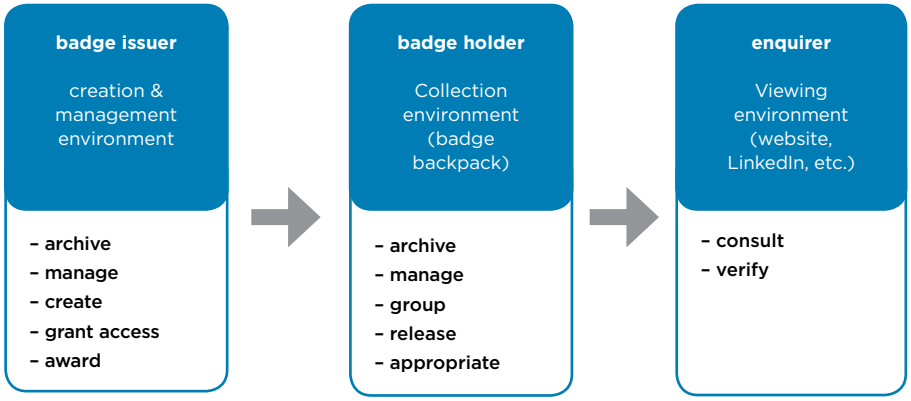
Badge access can be controlled with a central facility at an educational institution or with a student's backpack. When badges are offered via an educational institution, technical and organisational access control must be considered carefully. This concerns the authorisation of both the issue and the consultation of the badges (by the badge holder and other parties).

Access control assumes that the identities of the badge issuer and enquirer can be established. Lecturers issuing badges can use the institution's identity management system. This solution does not work for employers and other enquirers outside education. To arrange structural access for employers or other educational institutions, eHerkenning, Idensys or iDIN can be used within the Netherlands to establish someone's identity, for example. An international standard will take a lot more time. There is no solution yet for securely viewing digital badges.

It is much easier to use a personal digital backpack, managed by the badge holder himself or herself. The badge holder can decide which badges he or she shares with whom, by using a link in their CV or application letter, for example. In order to prevent any cheating with badges, this way of sharing also has to meet certain requirements in terms of the badge's authenticity and integrity.

An ecosystem for digital badges

A good technical infrastructure is absolutely necessary to use digital badges. The badge issuer wants to create, award, issue, store, manage, release and endorse badges (validating other parties' badges). The badge holder wants to be able to receive his or her badges, link them to an identity and manage and show them. This allows the enquirer to view the badges and verify their contents and authenticity in an online environment. The following figure shows the badge activities per stakeholder.



The designs of open badge ecosystems such as the Open Badges Infrastructure (OBI) are based on architecture that is set up in a decentralised way. This architecture splits the system into separate sections for badge issuers, badge holders and badge enquirers.

The Open Badge Standard

Badges are small digital files. But what does such a digital file contain? What is the anatomy of an open badge? The description of the open badge standard clarifies this. The Open Badges Standard is a group of specifications and open technical standards. This standard was developed by Mozilla in 2012 and has been maintained by the Badge Alliance since 2014. IMS Global will be responsible for this standard from 2017.

An open badge consists of two parts. The first part is a metadata description according to the open badge specification in the form of a 'statement' about an achieved result. The statement clarifies to whom a badge is allocated, what the badge represents and who issued the badge. This statement is made up of a number of information fields.[6] The metadata are signed, so that any manipulation will not go unnoticed. To make sure the statement can be exchanged and transported easily, the data is linked to an image. When this PNG or SVG file is passed on or exchanged, the data will automatically go with it. The process placing the data in the image is called *baking*.

[6] *These fields can be broken down further into information objects, which are beyond the scope of this document. The complete description can be found at: https://github.com/mozilla/openbadges-specification/blob/master/Assertion/latest.md*

When an enquirer views a digital badge on a web page, he can automatically extract the claims from the image with software that can process open badges. This software performs the necessary checks to establish the badge's authenticity and determine who the badge was awarded to. There are different platforms that offer open badges.

To gain an impression of the data in a digital badge, we explain a number of fields from the standard:

- **badge holder:** the identity of the person whom the badge is awarded to.
- **badge name:** a short name indicating what the digital badge stands for.
- **badge description:** a brief description of the achieved result.
- **badge criteria:** the reference to a URL where the criteria can be found that were used to earn the digital badge (a type of assessment criteria).
- **badge issuer:** the issuer of the badge with contact information. The classification that must be used acts as a unique identifier of the badge issuers.[7]
- **evidence behind the badge:** the reference to a URL showing what the badge holder has done to deserve the badge.
- **date** when the badge was issued.
- **expiry date** that can be used to indicate when a badge is no longer valid.
- **standards:** the badge can offer insight into the achieved results, for example the achieved learning outcome. A national set of standards do not yet exist.
- **tags of the badge:** a set of short keywords classifying the digital badges.

[7] You can do this by using or referring to the names mentioned in the Central Register of Higher Education Study Programmes, for example. This register is maintained by the Education Executive Agency.

5. ISSUES FOR DISCUSSION

The scenarios and themes discussed in the previous chapters raise questions. We need to answer these questions if we want to give badges and / or micro-credentials a proper place in education. In the coming period, SURFnet will work with the educational institutions to resolve a number of these questions.

Micro-credentials scenario

- The Higher Education and Scientific Research Act gives institutions / study programmes the freedom to determine their own education units and their scope in terms of a number of study credits.[8] What is the most sensible way to split a study programme into smaller permanent, recognisable educational units that can be linked to badges?
- How does a system of badges fit into the regular education quality system?
- How can you validate badges, i.e.: how can you verify a badge's authenticity and assess its value (to have a badge endorsed by another educational institution, for example)?
- How can you filter your badges by relevance and is a label useful in this respect?
- What is the impact of issuing badges on the institutions in terms of communication, administration and expiry dates?

Scenario for badges for extra-curricular further training

- What motivates an institution to validate extra-curricular activities and issue a badge for them? What type of badges should educational institutions issue and what type should they not issue?
- How do you assess whether students have sufficiently acquired certain skills (soft skills, for example) or competencies?
- How reliable are the results of extra-curricular training? If they are rewarded with badges, does this not require a quality assurance system?
- Can institutions use their funding for badges not primarily focusing on issues that are relevant for a study programme?
- Which risks are there in terms of the institution's administrative burden?

Working with badges

- Which standards (such as learning objectives / learning outcomes) should the digital badge meet and who determines these?
- How can the digital badge's authenticity be assessed and permanently assured?
- How can the student's identity be permanently linked to the obtained badge? Can and should the social security number be used for this?
- How are digital badges permanently released and archived?
- Does the educational institution play a part in sharing badges with third parties or do they only make them available to the badge holder?

[8] *The learning outcomes experiment (pilots on more flexible education) is based on learning outcome units rather than educational units. These learning outcome units are then linked to credits (max. 30 EC per unit).*

- What are the roles of the educational institution and the government in terms of the archiving of digital badges?
- Who can and should have access or no access to the badges? How can we enable the badge holder to decide this individually?
- How will the identity of national and international companies and private individuals be established and how can detailed authorisation occur?
- What will be the national standard for badge criteria (LRMI or a different standard)?
- How will the badge issuer be uniquely identified on a national level (by using the name from the Central Register of Higher Education Study Programmes, for example)?

6. SUMMARY

More and more educational institutions, training agencies and ICT companies are awarding digital badges to course participants worldwide. This development is in line with lifelong learning and more flexible education. More and more students have already acquired competencies and knowledge relevant to their studies previously or elsewhere. They want recognition or exemption in this regard within their study programme. Digital badges are possible tools to meet this need. Open badges (created according to an open standard) are particularly useful in this respect. The open standard allows badge holders to collect and present a combination of digital badges.

Based on the input of the higher education institutions, this white paper distinguishes three scenarios for digital badges in education: micro-credentials, badges for extra-curricular education and badges as game elements. Arrangements between institutions are extremely important, particularly for the micro-credentials scenario. This scenario also requires a coherent infrastructure for badges, in which SURF may have a role to play. This white paper therefore mainly focuses on the micro-credentials scenario, but also considers the role of badges in extra-curricular education.

Digital badges based on an open standard can be used as tools in support of a more flexible education system. Badges are not a goal as such in this respect. They are a means to make education more flexible, and thus to meet the needs of the students, educational institutions and employers.

The introduction of badges offers opportunities for the student and the educational institution, but also raises ethical and technical questions: questions in terms of online proof, trust, archiving and privacy. The architecture of a badges ecosystem also requires further investigation. It is also important to consider the standardisation of information released with digital badges.

Where do we go from here?

There is not much practical experience with digital badges for micro-credentials in Dutch education. This is why experiments are indispensable. Higher education can become more experienced in dealing with the issues raised in this white paper through well-coordinated experiments. It is important to think about issues such as the storage of the badges, metadata, protocols and standards and the authentication of issuing institutions.

In the coming period, SURFnet wishes to meet with the educational institutions to establish which experiments could benefit the sector. If you are you interested in the introduction of badges and would you like to participate in such an experiment, we look forward to hearing your ideas.

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