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Implementation of Digital Badges for the Multi-cultural Association of Porvoo

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This thesis studies the digital badges system and its technical requirements to be implemented within the Multicultural Association of Porvoo's gamification framework. The association intends to implement a system to improve its method to reward volunteers and collaborators. The goal of the thesis was to establish the technological resources necessary to run a pilot project and determine the digital badges feasibility for the association.

The pilot project consisted of awarding the volunteers and collaborators who participated in the "Naisten Päivä" (Women's International Day) event, co-organized by the association. The digital badges system was implemented based on the open badges documentation. The implementation applies linked data, JSON, JSON-LD, web development and the open badges' tools. The badges are hosted in the Multicultural Association of Porvoo's web hosting.

The pilot project was successfully implemented, having produced the design, criteria and the information contained in the digital badges. In total twenty-one people between event managers, lecturers, association's representatives, translators and volunteers were considered for awarding. The badges will be awarded by the end of May 2017, and an informative meeting will be held to explain the system's functionality.

It was concluded that the association has the necessary technological infrastructure to continue implementing the digital badges, although the badges visual design should be improved. The association's awarding system can have a positive impact in improving opportunities for people with foreign background integrating into Finnish society. With the digital badges, the association can acquire an important mean to get funds to keep developing their activities and expand further.

Keywords	Digital badges, linked data, JSON, web development

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Abbreviations and Terms

AI	Artificial Intelligence
Ajax	Asynchronous JavaScript And XML, a set of techniques for web development purposes
API	Application Programming Interface, a tool developed to build applications in a framework
App	Short for "application"
ASP.NET	An open source framework for web development
Bit	Basic unit in informatics, its size is of one binary value, either 0 or 1
CSS	Cascading Style Sheets, a web development tool to format web pages
CV	Curriculm Vitae
HTML	HyperText Markup Language, a web development programming language
IRI	Internationalized Resource Identifier
ISO	International Organization for Standardization
JavaSript	A web development programming language
jQuery	A JavaScript-based web development programming language
JSON	JavaScript Object Notation
JSON-LD	JavaScript Object Notation for Linked Data
MAP	Multicultural Association of Porvoo
MD5	Message Digest, 5 stands for the version
"Naisten Päivä"	In Finnish, "Women's International Day"
PHP	PHP: Hypertext Preprocessor
Pixel	Basic unit of a display device
PNG	Portable Network Graphics, an image file
Python	A high level, object-oriented programming language
Ruby	An object-oriented programming language
SHA	Secure Hash Algorithm
SVG	Scalable Vector Graphics, an image file
URL	Uniform Resource Locator, a web address
W3C	World Wide Web Consortium

1 Introduction

At present, the process to produce certifications, at a global stage, that people have acquired skills, donated time in the form of volunteering, passed courses or participated in activities is difficult. This applies especially to institutions with limited resources as it involves issuing a physical certificate (which generally is printed), and it represents increasing operations costs. A physical certificate has an ecological impact as it uses paper and ink among other resources.

After the certificates are issued, the people interested in showing them to improve their attractiveness on the job market must find a way to show them. The most common practices are to write a description in the CV, scan the certificates, or physically show them in the case a job interview is arranged, proving a lack of versatility. Besides that, the portability of the documents, and all the steps necessary for them to have credibility, give increased difficulty to the earners to gain benefit from the process.

With the introduction of the gamification concept to education, work life and productivity, some of the problems mentioned above can be solved in the form of digital badges. This solution gives the opportunity to companies, associations and education centres to modernize themselves, having in mind to become eco-friendly and to adapt to new technologies. And at the same time, save resources that can be invested in generating more benefits to the people involved in their activities. Part of the gamification concept is the introduction of competitive elements to promote increased or improved participation in the different activities of the institutions.

Digital badges, being backed by established and recognized institutions such as the Multicultural Association of Porvoo, help students, volunteers, members and event participants, from Finland and abroad, to easily prove their skills and participation. These badges can be displayed in social networks and websites, especially if they are dedicated to job search or business, as all the necessary information of the certification is contained within the badges and is displayed by request.

The goal of this thesis is to define the necessary infrastructure and structure for the association to implement a proof of concept of their digital badges system. Its implementation will start by issuing the digital badges creating the necessary files manually, and leaving the foundation for improvements based in their activities and necessities.

This thesis is divided into two parts, the first part will describe the gamification concept, the digital badges and the technologies involved in them, the process to build the system, and the tools needed by users. The second part will describe the context in which the association works, a case study description and the process to implement the digital badges solution.

2   Gamification

2.1   Description

Although the first reference to the term "gamification" comes from 2008, and its use became popular in 2010, a clear definition has not been established by now. Some definitions are even being contested by the community, mainly because some are misinterpreted or do not have a favourable meaning. [1, 1]

In general, the term can be defined based on the acceptance of games and their positive impact on the human behaviour, and the degree of motivation they cause making the users long-term interested in the activity of playing. This long-term interest possibility is useful when planning activities not related to games, as it helps to design services which can be useful and encouraging at the same time.

One definition of the term is: "Gamification is the use of game design elements in non-game contexts" [1, 2]. Other concept is: "to understand gamification as a set of techniques to regulate behaviour via game rules for strategic purposes" [2, 22]. According to these concepts, gamification can be defined as the way to promote human behaviour through strategic game design rules, methods and techniques. However, different authors agree that the sole act of awarding is not the implementation of gamification, as it is a more complex process where awarding is just one of its elements.

2.2   Game Elements Used in Gamification

The limit between defining a game and a gamified application is not clear, and as subjective as it is, generally is left to a personal perspective on the matter. It could be differentiated as the purpose of purely having fun while engaging in an activity, but it depends on whether the people involved would consider it a game or a serious endeavour. [1, 2]
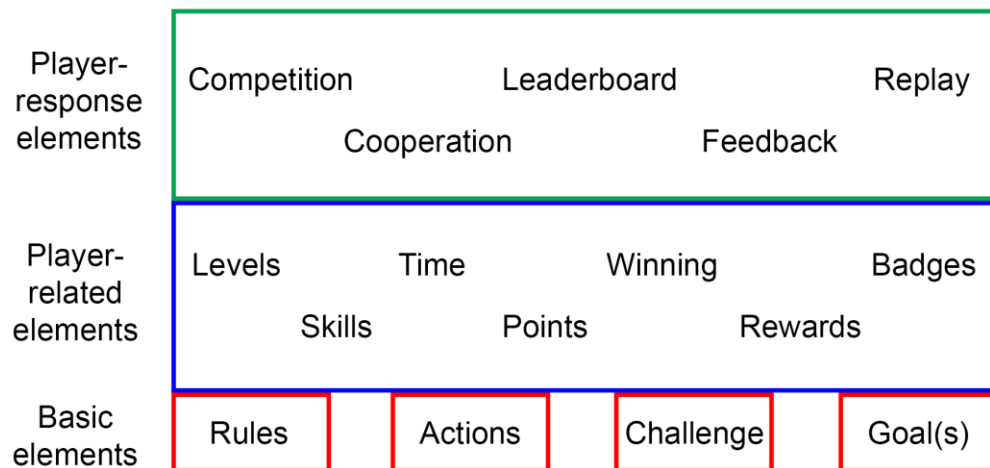
Figure 1. Game elements used in gamification sorted by application group. Figure based on the classification by different authors used as references. [3; 4; 5; 6; 7]

Although a game is not simply one element or a collection of elements, and their internal relationships cannot be established, gamification can take those same elements to give result to a non-game activity [1, 3; 3, 21]. However, it is clear that gamification takes some elements from games, and based on different authors descriptions in the references, these elements are categorized into three groups as seen in figure 1: basic elements, player-related elements and player-response elements. [3; 4; 5; 6; 7]

2.2.1   Basic Elements

Basic elements are the foundations of any game-related activity, and there is no game if even one of them is missing. The basic game elements are: rules, actions, challenges and goals. Rules define where the game is unfolding, what is possible to do inside the game and what is required to achieve the goals, thus making it the most basic and important of the game elements. [4, 144].

There are different set of rules covering different aspects of the game. There are operational rules, which tell the players what they can do inside the game and define what are the goals (intermediary and final) and how to achieve them. Foundational rules, which are the ones defining the game's structure, the mathematical rules or formulas involved in gameplay and how they affect the course of the game. Behavioural rules, which sets the right way in which the players should behave throughout the game. Some of these rules are not formally set, for example: "players shall not cheat", but they are commonly

known and recurrent in all kind of games. Written or official rules, which are the ones formally established by the game developers depending only in their view on how the game must be played. These rules have defined objectives which direct the players toward achieving the goal. [5, 30-31; 4, 146-146]

Actions in games can be defined as the verb in a sentence. Without it the sentence will be meaningless [4, 140]. Actions are directly defined and limited by the rules, and will always aim toward achieving the goal or goals. But not necessarily all actions performed or actions performed in any order will ensure the achievement of the goal. For example, in chess different pieces can do different movements, and doing all those movements randomly will not ensure victory, and that is because each move has different results and consequences.

A challenge causes improvement and exploits players' skills by motivating them to pursue goals that are not easy to achieve [5, 8]. A game which lacks a challenge will soon be considered boring and non-interesting, and even a waste of time, thus not worthy to be played. The same happens when a game is too hard to beat, as it could demotivate the players, and even make them feel frustrated or annoyed. Challenges should be designed within the game to make it possible to overcome them. That is, hard enough to keep the players both motivated and not frustrated about defeat.

Goals come along with the challenges, and introducing them to normal playing makes the latter to become a game. They give objectives and ensure the quality grade of playing as it makes easy to judge if there was or was not success in the activity [5, 28]. The definition of success must be clearly defined in the game rules, as "winning" is not always the meaning of achieving a goal. For example, in chess, reaching a stalemate is a success if one of the players is in a state where losing is a distinct possibility. The problem with goals is that the game ends immediately after the main goal is achieved. For that, secondary goals and other game elements should be added to the gameplay experience, such as rewards, leaderboards and levels. [5, 29]

2.2.2   Player-Related Elements

The player-related elements are the ones game designers use to interact with the players. These elements generally aim to engage the users to first test the game and try to

successfully motivate them to keep playing it. The player related elements described below are: levels, skills, time, points, winning, rewards and badges.

Games should offer different kinds of goals to keep the players interested, and for that different levels can be implemented [5, 39]. Levels can be comprised by either different scenarios or by one and only. For example, in chess there is only one board and two sets of pieces with defined unchangeable moves. Levels, in that case, can be defined as the difficulty to play against a rookie, intermediate or advanced contender. In other example, most videogames present variations in the scenarios to represent levels. They can also include different kinds of foes, and/or the same previously shown foes but with changed properties (movements, shooting, shields, etc.).

Levels can be introduced to show the players' progress through an activity, to acknowledge new abilities acquired, or for motivation purposes [3, 30]. Other possibility is to introduce levels to apply previously acquired knowledge and skills, and practice them [5, 37-38]. Levels can also be applied to the players, as they can progress by acquiring experience, or by locking access to certain recognition (or even game levels) if they do not meet certain mastery before [5, 40-41]. For example, "now you are wizard level 3, a new spell is available for use".

Skills are totally a players' feat. The game's function is to exploit those skills to make a real challenge and keep the players' interest. In general, games require the players to employ not only one, but different skills at a time. For that the designers should list which of those skills are intending to take in certain level or activity. [4, 150]

According to their implementation, the skills can be divided in three categories. Physical skills, which are related to tasks made by using the human body (as gross motor skills, fine motor skills, balancing, coordination, strength, etc.). Mental skills, which are related to the players' capacity to problem solving and experience, either previously acquired or acquired by solving the task at hand. Social skills, which are related to the way in which the players interact with others, either by collaborating or by competing, communicating, helping, etc. [4, 151]

Time is the factor that makes a human being to jump into action. It delimits the validity of an action given the context. Time can be applied in different ways. It can define a limit between which the players must accomplish an action (for example, in the Nintendo®

game, Mario™ has 200 seconds to reach the level's end). It can also limit the validity of certain characteristic that is given to the players (for example, the weapon's boost lasts 30 seconds). [5, 32-33]

Points are an essential game element, even if they are not shown during gameplay. In that case, points can be accounted by other means to make analysis on how the players are doing with the game. They also indicate if changes must be made to improve the game [6, 36]. There are different point systems applied to gamification, but the most relevant are: experience points, skills points and reputation points. Experience points relate on how the players are developing inside the game. This point system can be designed to allow looping by making them to expire depending on time and allow them to be renewable. Skill points are directed to motivate the players to use their skills throughout the game. Reputation points are related to the trust level raised by the players while participating in the game activities. [6, 38-39]

In a game, there is always the possibility to win or lose [4, 31], and it is in human nature the desire of competing and winning [3, 25]. When designing a game, players must be fully aware that winning is a possibility. But as players can be demotivated, winning should be neither too easy nor too hard [3, 25]. That is made by introducing reasonable challenge and level design. Depending on the game, players get to win against a human adversary (for example, tennis, table games, Clash of Clans), against the game itself (for example, solitaire card game, Doom) or both (that is, video games which include human players and AI players). All the different scenarios generate different degrees of achievement when the players win.

Reward systems are used in a broad spectrum. They can comprise from grading ranges at schools and universities to ranks and medals in the military forces. The trick with this system is that the motivation exists as long as the rewards do. In case there is no direct reward, people could find self-realization as an alternative. However, there are cases in which the reward is not exactly given, but there is a possibility to earn it, for example, in gambling [7, 1]. Rewards are introduced to any game as a motivating factor, both to incite the players to play the game and to encourage them to keep returning to play it. For example, in the mobile game industry, daily rewards for log into the game are given on a regular basis (for example, in-game currency, weapons, free experience, etc.), sometimes there is a possibility to lose cumulative rewards if one day is missed.

When rewards are not planned to be given forever, the skills learnt must be relevant for the users because rewarding could be perceived as the fact of learning them [9, 3]. There is even the possibility that people can feel rewarded by doing charity or volunteer work, making recognition from others enough reason to keep doing it.

Badges have existed in different forms since the dawn of mankind, from hunt trophies to military ranks and awards. As the Duke of Newcastle told to Prince Albert in 1855:

> The value attached by soldiers to a little bit of ribbon is such as to render any danger insignificant and any privation light if it can be attained. [8, 14]

The text emphasises the relevance of awarding badges as an effective way to motivate people to do the necessary actions to earn them.

There are several reasons why badges are attractive. They can signify status among a community, and they can compel people to a collecting frenzy (especially if a badge is rare). A good-looking badge can motivate people to do the necessary actions to have it and show it off. If badges appear as a possibility of self-improvement, they can be welcomed as a good surprise for those who are not expecting anything else for recognizing their work [6, 55]. To increase the players' interest in earning them, a system to identify if a badge has been earned or is still yet to be earn can be used, especially if there is a way to inform the players how to win them.

2.2.3 Player-response elements

The player-response elements are the ones that reinforce the created need or desire of the players to keep using the game. They are the last motivational boost that ensures that players will keep returning to use the game [3; 4; 5; 8; 9]. The player-response elements included in this category are: competition, cooperation, leaderboard, feedback and replay.

Gamified systems include competition, cooperation or both. Competition occurs when players are set to achieve goals having opposition from the game itself. It also applies when besides the game opposition, there are other players inside the game trying to achieve the same goals. This is the case with multiplayer games where all players are trying to win, doing it before other does, because either there is only one who can achieve

it, or there is a point system which grant more points to the first who accomplish the goal. This occurs especially if there is a leaderboard present which inspires the players to be the one accumulating more points than the rest. [7, 14]

Cooperation occurs when players are trying to achieve goals by helping and cooperating with others inside their group. It could happen that players know each other beforehand making easy the logistics process [7, 14]. There are multiplayer games where each member is assigned a task, and the outcome depends on the overall effectiveness of the players assigned to the tasks.

When competition and cooperation are combined, it generally involves two or more groups which cooperate between team members and compete against other groups. Such is the case in team sports (for example, football, hockey, basketball, etc.), and in videogame multiplayers (for example, DotA, League of Legends, Overwatch, etc.). Differences in effectiveness are notorious when there are matches between an organized team against one composed by players who have never played together before. No matter how good an individual player is, his or her actions will not be enough to win against antagonists working together.

Leaderboards exists with the sole purpose of making comparisons. Although in general they include several other players (for example, Olympic games, videogame multiplayers, etc.), it could be also just a comparison of one single player trying to beat previously set records by himself/herself. Challenge comes implied by the presentation of the list, either if there are several players ("Can you beat XX and be the best player, the leader of this game?"), or if there is only one player ("Do you have what is needed to beat your previous record?").

If playing a game for entertainment was not enough, leaderboards add the competition motivation to improve scoring as to be on the top of them [5, 33]. This motivation comes almost instantly when the players run into a table which presents names and numbers beside them, as it is instantly identified as a leaderboard [6, 50].

Figure 2. Example of a leaderboard in the multiplayer mobile game "Boom Beach".

Figure 2 is an example of a leaderboard which includes three different tabs as categories based on the players' location and social network. This leaderboard also shows different game elements such as: points represented by medals, players' level represented by the number inside the circle, and, badges represented by the ornaments present in players 1, 5 and 6, making them stand out from the rest of the players in the leaderboard.

Besides the option to know where the players are standing compared to others, they constantly need to be notified about their status inside the game. They must know the points collected, the remaining goals to be achieved, the time they have remaining, in which level they are and to which they are heading, etc. All this information is called feedback, and is very important as it is the information the players have on how they are doing inside the game. [5, 36; 6,77]

Other form of feedback is when the players are informed about how their actions are right or wrong oriented toward the goal. If they are doing wrong they could get help from the game as information on how they should do without telling them exactly what they must do. Game designers often use the term "juiciness" to refer the degree of feedback the game gives to the players. It involves a range of visual and auditory effects aimed to clearly represent the information needed by the player. [5, 36]

Failure is a reality in games, and for that there should be an option for the player to try again [5, 48]. Failure in games can be defined by different circumstances: it could be

failure to finish a level, to achieve a goal (not necessarily the ultimate one), to collect all the badges or the points available in the level, etc. Based on that, failure can promote learning and thus making the player to return to the game for another try and apply what learned [5, 48]. Or, the player will replay one particular level (or even the entire game) just to get that badge missing from the first try, gaining status. Failure is important as it adds meaningfulness to winning, as being victorious after several defeats makes the players enjoy more the gaming experience [5, 49].

2.3   Gamification Effects and Benefits

Gamification, in general, seeks to increase the collaborators interest to the activities planned inside a company or organisation. It does it by applying the game elements described above expecting the following improvements:

- Engagement can be increased among users. Different elements (as rewarding, badges, leaderboards) can motivate people when doing an activity.
- Learning is promoted by replaying, and skills are get by overcoming challenges and achieving goals. Gamification allows errors to be made in a safe environment, being better to fail there than in a real-life event.
- If well designed, gamification can reduce stress when learning a new skill or practicing. As in replay, failure is admitted, making people to feel safe about failing, knowing that in the end something good will come up about it.
- Feedback gives people the opportunity to be objectively judged based on their actions inside the gamified system, promoting improvement.
- Recognition makes people feel appreciated inside the work or studies environment. If this recognition includes the mastery degree for a skill, that makes it even better as someone can be considered an expert in that skill.

Another relevant characteristic when applying playing games in real life is "thinking outside the box". Sometimes people are overcome by obstacles until they find the solution by revolutionizing their view of the problem, and finding solutions that are not considered as "canon" [5, 240-241].

Gamification benefits also depends on the interests of the users. A gamified system can be designed with the objective of motivating people to do activities within an entity, company or association. The system relies on the premise that those people are already eager to start playing and getting all the benefits from the game. But the effectiveness of it amongst people who did not show interest in the first place is yet to be proved.

2.4   Example of Applied Gamification

Badgeville is a company that offers enterprise gamification and analysis especially designed for the organization that hires them. According to their website, they have developed an API (Application Programming Interface) to easy the gamification process, allowing tracking and awarding of actions performed within the environment.

Figure 3. Badgeville proposed gamification platform. [9].

Figure 3 shows the main screen with the employee profile, her achievements, skills and mastery in the form of badges. It also shows the actions that the employee can do to gain more rewards and their completion percentage, all the above related to her role inside the company. According to the website, the overall results are "41% increase in Community Engagement, 50% increase in Course Completion and 40% decrease in Ticket Response Time" [9]. These improvements can make appealing to hire the service for a company, education service or association to improve their performance and the motivation of the people working with them.

3   Open Badges System

3.1   Digital Badges

Digital badges are visual representations of skills, experience, knowledge or accomplishments, which are available in virtual platforms. These badges store information in form of metadata about the institution or company issuing them, the person receiving the badge and what the badge is related. Their conception comes from the badging system used in the videogame industry. [10, 3]
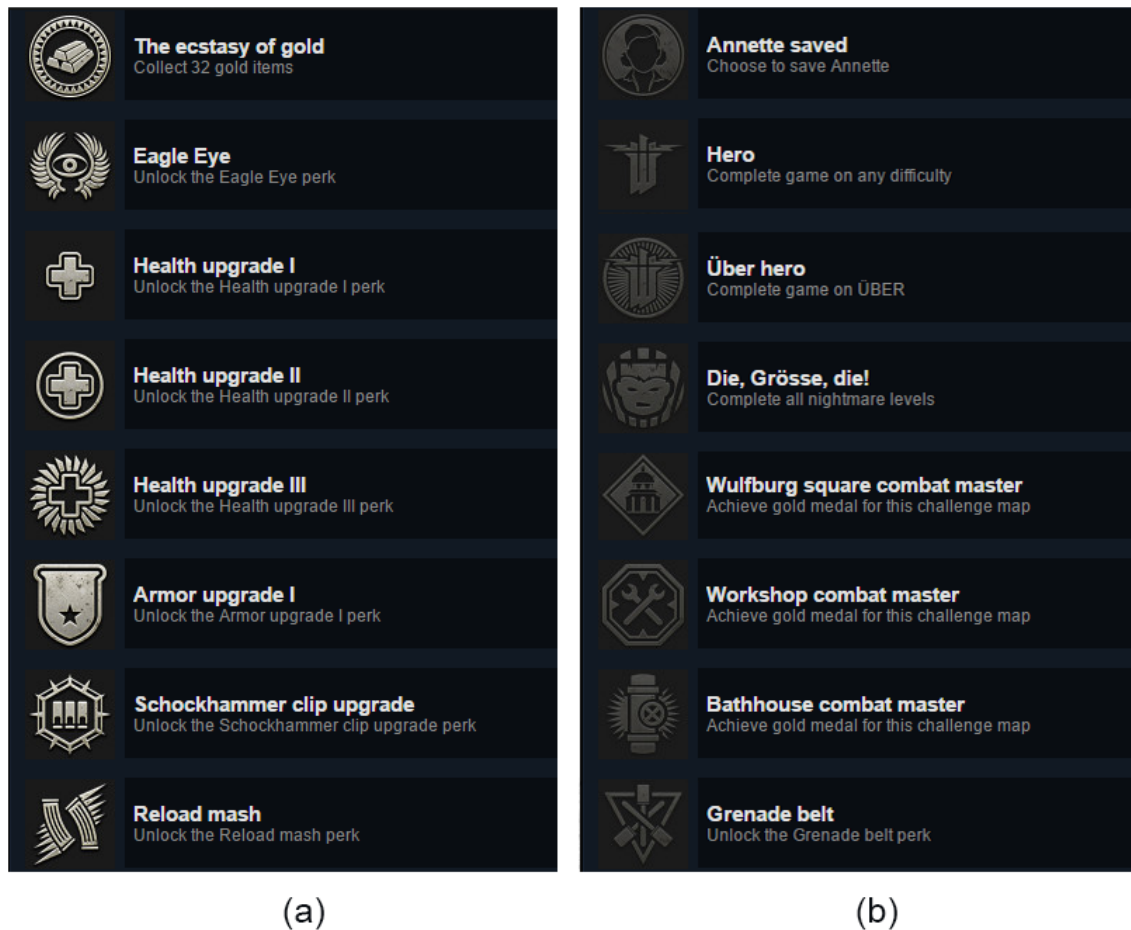

Figure 4. Examples of badges given in videogames. Notice the different shapes that badges have (circle, hexagon, diamond, octagon, triangle and free-shaped) and how the solid and grey colours distinguish (a) earned badges, from (b) not earned badges. Screenshot composed by images taken from [11].

Figure 4 shows an example of how digital badges are used in videogames. The set of badges are distinguished by the appearance of solid and grey filling indicating which are the earned badges and the badges the players have yet to earn. In both cases, there is a description of the action or actions necessary to gain the badges. There are some that are one-of-a-kind (for example, "Reload mash"), and others that are given by levels (for example, "Health upgrade II"). In this last case, the players are motivated by the level's number to keep looking for the next one, and at the same time it shows the players' level inside the game. For example, someone with level III can be considered more experienced than other with level I.

Digital badges act as a compelling mechanism inside a gamified system. Badges can represent expertise in a particular skill or set of skills, players' level (especially if it is in a leaderboard context), recognition and progress of goals achieved. If there is present a system in which the badges yet to be earned are shown (no matter if the description and the means to achieve them are or are not showed in detail), it can be a strong motivating factor even if the game is finished. That is because it can make players to return to the game and earn the missing badges. [10]

3.2   Open Badges Description

Open Badges is an open source initiative started in 2010 by Mozilla and funded by the MacArthur Foundation with the main objective of recognizing learning acquired in diverse environments. The project started with the technical specifications defining what the badges are and what they represent. In 2013, Mozilla started to offer the version 1.0 of the system, and in 2014 badges started to be widespread used, including corporate environments. Since 2015 to date, digital badges proved to be a reliable way to award and recognize skills, and it started to get more support. Starting in January 2017, the IMS Global Learning Consortium (IMS stands for Instructional Management Systems) is managing the evolution of the badges, creating a global skills recognition system. [12]

Open Badges Peeled by Bryan Mathers (Used under CC-BY-ND
License). See more of Bryan's badges work on #OB101

Figure 5. Digital badges are more than an image. Reprinted from [13].

Digital badges contain information related to the issuer (educational institutes, non-profit associations, companies, etc.), the recipient (generally identified by an e-mail), and the criteria used to issue the badge (that is, what the recipient had to do to get it). The badges are uploaded by the recipient in a displaying repository, and then can be shown in social networks and online portfolios as a proof of their skills and knowledge [14]. Figure 5 shows how digital badges work. The image representation has embedded data with the basic information about the issuer, the recipient and the criteria. All the data contained in the badge is metadata stored as a JSON object. In the specification version 1.1, linked data was introduced to give more versatility to the information. [15]

3.3 Digital Badges Specifications

Badges' information must be formatted according to specifications to be formally validated. Current version of the active specifications is 1.1 released on May 1st 2015, in December 31st 2016 a recommendatory version 2.0 was released but is still in pre-implementation phase without any set date for final implementation [16; 17]. There are three mandatory objects containing all the linked data contained in the badges, and each object has its own mandatory data which should be included for the badge to be validated:

- Issuer includes all the description of the institution or company awarding the badge. The mandatory information contained is: the connection to the validator

information, the unique identification of the issuer, the object type (Issuer), the name of the organization and the organization's unique web address. The optional information is: description of the organization, the link to the organization's logo and the organization's e-mail. [15]

- BadgeClass is the description of what the badge is and what is awarding. The mandatory information contained is: the connection to the validator information, the badge identification, the object type (BadgeClass), the name of the achievement or skill, a short description of the badge, the link to the badge image, the URL of the criteria and the link to the issuer information. The optional information is: the link to internal or external objects (generally to educational standards) and tags. [15]

- Assertion is the information related to the recipient and links it to the badge. The mandatory information contained is: the connection to the validator information, the object type (Assertion), the unique local identifier for the awarded badge, the recipient's identification, the link to the badge information, the instructions to verify the badge and the date in which the badge was awarded. The optional information is: the expiration date and the link to the evidence which awarded the badge (what the recipient did to earn the badge, generally a web page). [15]

Digital badges take advantage of some web-related technologies to contain and share their information in different platforms. The most relevant ones are related to information management in metadata format.

3.4   Technologies Involved in the Digital Badges System

3.4.1   Linked Data

Linked data makes the World Wide Web a huge database. It includes data that could be read and reused, and especially, contain data that could be read both by humans and computers [18, 4]. Linked data is a specification on how to publish data in a structured way to allow it to be reused by different platforms, and for that it should be "linked" to

other data available [18, 26]. According to the availability and format, linked data is clas-
sified in a scoring system from 1 to 5, with the following criteria by the World Wide Web
Consortium (W3C):

1. 1 star: data exists in any format, for example, music or image file.
2. 2 stars: data exists in a machine-readable format, for example, spreadsheet,
   text document.
3. 3 stars: data exists in a non-proprietary format, in other words, data without being
   processed but publicly available, for example, tab-separated or comma-sepa-
   rated values.
4. 4 stars: data exists and is published as open data.
5. 5 stars: data exists as all previous criteria and is linked to other data.

Linked data follows the RDF (Resource Description Framework), which is a data model
that includes the description of two or more elements and the relationship they have
between them. It can also include the relationship with other objects outside their de-
scription [18, 27]. For the specific case of digital badges, the linked data is formatted in
JSON (JavaScript Object Notation).

3.4.2   Metadata

Basically, metadata is "machine understandable information for the web" [19]. Its name
means "data about data", as its function is to give information about existing data. All
metadata has three intrinsic features. Content describes the object as is, context de-
scribes aspects related to the object, and structure which makes the association of the
object and the possibly relation to other objects. [20, 2]

Figure 6. Example of metadata contained in Wikipedia. [21]

Currently, metadata is contained in every object, for example, physical libraries and stores indexes, web pages, devices, etc. One common example of metadata (and of linked data) is Wikipedia. In every information page, it shows an area with data relevant information about the query made by the user. Figure 6 shows the location of the area related to the information shown in the website. This area contains the main information of the query in metadata format, which is linked to other information inside Wikipedia and to outside web sources. [22, 2]

3.4.3 JSON

JSON is an acronym for "JavaScript Object Notation", as its origins are in the JavaScript language. It is easy to use for humans because it is written and read in user language, and is easy for machines to analyse it and generate it. JSON is formatted in pairs objects, one to name the object and the other to assign it a value. [23]

JSON format is very useful when sending data, because the exchange between the server and the browser is using exclusively text. As it is easy to store a string into an object and vice versa, is a versatile way to share and exchange information. And as it is text only, it can be read by any programming language. [24]

```
{
  "example": true,
  "name": "example",
  "number": 1,
  "description": "this is a JSON example"
}
```

Listing 1. JSON example.

Listing 1 shows an example of the JSON pairing format. Data stored in a JSON can be strings, numbers, another object (included other JSON), arrays and Boolean values (true or false values). But it is limited when including functions (as the function will be read as text and will not be executed), dates (unless they are timestamps) or undefined objects. [24]

3.4.4 JSON-LD

JSON-LD stands for "JavaScript Object Notation for Linked Data". As its name suggests, it is a JSON dedicated to linked data. The difference with "pure" linked data is that takes the easiness of user-reading/writing format from JSON. At the same time, by using the linked data characteristics, makes JSON widely available for sharing information. [25]

```
{
  "@context": "http://schema.org",
  "@type": "Organization",
  "email": "organization@organization.org",
  "location": "Planet Earth",
  "logo"": "http://organization.org/logo.png"
}
```

Listing 2. JSON-LD example.

In listing 2 can be noted that the notation is the same as in a normal JSON. All the data written in the object will be linked to other objects (and to their own data) using the "@context" and "@type" properties. This format is important for web developers, as the contents of an object can be easily created (manually or automatically) to be shared. And while the content is displayed in "human format", the machine can read the information and link it to and retrieve it from other objects hosted in different websites when necessary. [16]

3.4.5 Timestamp

Timestamp is based in Unix and tracks the time in seconds from the date 1 January 1970 to the referenced one. It is intended for computer use to resolve information containing dates, especially in web applications. [26]

It is important to note that this standard will become obsolete by 19 January 2038, as a 32-bit overflow will occur at that time. For that, all timestamps should be changed, or adapted to a 64-bit format [26]. Currently it is possible to use a format based on "year-month-day hours:minutes:seconds" which is based on ISO-8601 standards.

3.4.6   Web Development

Web development is the process of designing and programming websites or web applications to be hosted in the internet (or sometimes in intranets). It has two main areas: front-end and back-end. Front-end refers to client-side coding, that is, what the user sees and interacts when enters a web site through a web browser. Back-end refers to server-side coding, that is, the code executed by the web server which in general the user cannot notice but manages all the information displayed and entered in the web page.

For front-end development programmers use languages or frameworks such as HTML, CSS, Ajax, JavaScript, jQuery, Bootstrap, etc. For back-end the languages used are PHP, Java, Python, Ruby, ASP.NET, etc.

3.4.7   Hashing

Hashing is a cryptographic method that changes a string or file using a key. The process of adding a key to the text is called "salting", thus, the key is referred as "salt". Hashing can use two algorithms, MD5 ("Message Digest") and SHA ("Secure Hash Algorithm"). Both organize the text into blocks that are mixed with the salt, the blocks size and numbers depend upon the size of the hash. Usually MD5 uses a 128-bit value, while SHA depends on the identifier, being SHA-256 (256-bit) the most commonly used at present [27, 65]. Figure 7 shows an example of hashing a text using salt and SHA-256 algorithm.

```
>>> import hashlib
>>> salt = "test1"
>>> email = "someone@somewhere.com"
>>> eHashed = hashlib.sha256(salt.encode() + email.encode()).hexdigest()
>>> print eHashed
c985a845162879e7928d18ece483741b2a836c66c4e50b28823564dda202d81b
>>>
```

Figure 7. Example of hashing a text using Python with SHA-256 method.

Hashing using a salt gives the benefit of rendering hackers attempts of deciphering almost useless as the hashing occurs randomly. If the salt changes each time the user must send information, and each user has different salt simultaneously, it makes almost impossible to decipher or to attempt to construct a list of possible salting. Developers

only must take care on not using common words as salt because they could be included in automated attacks. [28, 223]

3.5   Example of Commercial Digital Badges Systems

As well as in the gamification system, badging is offered both as an applied solution or as a service provided by a company, tailored for another company or institution. The commercial platforms offer the same service as the open source ones. The difference is that the commercial platforms do all the process of hosting, designing and linking all the badges' information. When a user earns a badge, the platform gives support with detailed instructions on how to claim and show the badge in external platforms. For that, the user must have an account in the commercial platform, with the risk of losing the badges if the platform closes.

Figure 8. A commercial offering of badges. Screenshot taken from [29].

Figure 8 shows an example of both a company offering the badging services (in this case Acclaim), and a company that uses the service (in this case VMWare). It can be noticed how the badge is shown alongside the information of the skills represented by it, the requirements to earn it, in which social networks it can be linked and its endorser. In this case, Acclaim works as the badge's issuer as it is the service provider, but VMWare is the organization endorsing the skills learnt. That is, Acclaim only designs, hosts, stores and awards the badge, but VMWare sets the badge's criteria and endorses the skills.

4 Implementation of the Digital Badges for the Multicultural Association of Porvoo

4.1 Description of the Association

The Multicultural Association of Porvoo is a non-profit organization with the objective of helping people with a foreign background to integrate into the Finnish society and promote networking amongst its members [30]. It is composed of members from Finland and abroad, and started to officially function in March 2013, although it participated in several events before that date.

The association organizes, promotes and participates in different multicultural events and integration activities. The participants of those events are members and volunteers who take advantage of the opportunities to apply, learn and acquire new skills. The association also partners with other organizations and institutions to organize major events, courses and broaden opportunities for the people and institutions.

4.2 Description of the Project

As part of their constant evolution, the association is starting to include a gamified system to motivate people to increase their participation in courses, events and volunteering. Part of that system is the badging, which they decided to implement as a digital option. They consider the digital badges to be more versatile than giving paper diplomas, or to give rewards not related to the activity developed by the participants, or that have no relevance in their lives. Besides, they consider that a badging system could boost people's opportunities as they can add it to their social networks and online portfolios and show them during job search.

As a non-profit organization, the association has limited resources to develop its activities. When the board members decided to implement the digital badges, their first option was to hire a company to manage the service. Due to the limitation addressed before, they were concerned in losing the service and all the data belonging to the awarded if by some circumstance the service could not be afforded. For that, the board members decided that an open source option could be better suited for their needs.

The badging project consists of three phases:

1. Phase 1: proof of concept of the badging system. It will have the study case with the "Naisten Päivä" event held on 11 March 2017. It will define if the association has the necessary resources to implement the project. The badges will be manually configured and awarded in order to know the process and documentation.

2. Phase 2: plan, define and design long-term badges.

3. Phase 3: implement long-term badges. Automate the system for minimal human intervention.

This thesis focuses on phase 1, meaning that it is a pilot project with the objective of establishing the feasibility of the digital badges and determining if the association has the necessary infrastructure and resources for its proper operation. For that, it will be implemented step-by-step to document the process and serve as a basis for the following phases.

4.3   Methodology

The first action towards defining the feasibility of the project was to read the online documentation from the open badges website [31]. With that, all the specifications, technologies involved and requirements were defined. Knowing that the information is stored in JSON format, the next step was to contact the web hosting company to ask them if their servers have support for those objects. This was necessary because there are companies that do not have installed JSON support on their servers and may not want to install it, or charge extra if asked for it. In this case, the web hosting already had support for JSON, and no further action had to be taken. In a case the web hosting did not have support, the alternative was to configure a Linux server for the association.

After ensuring the web hosting had the necessary support, a first test was made by awarding a badge to the association as a badge issuer. It was a badge with basic design and having as contents the association's information. The criteria were defined as being able to host badges and award them to people involved in their activities.

After the "Naisten Päivä" event was held, the association had to discuss the criteria to award badges to the volunteers who helped in the event. With that information, a second test was made with only a general description and a basic design. The association representatives observed that although the badging was an excellent idea, the badges design could be an issue as they must look attractive to people.

With the final data of the criteria and the people to be awarded, a final test and implementation was made. In this final stage, encryption of the recipients' information was added to ensure privacy protection. Because of that privacy protection, in the sections where the steps to implement the badges are described will be used dummy data, as the objective is to show the process of implementing the digital badges from scratch.

4.4   Case Study: Rewarding the "Naisten Päivä" Event Participants

The event was held on 11 March 2017, and it was organized by the Multicultural Association of Porvoo, the Borgå svenska kvinnoförbund (Porvoo's Swedish Women's Association) and the Borgå svenska marthadistrikt (Porvoo's Swedish Martha District). The event included activities about women's health, women's rights, gender equality, advising on language learning, challenges for immigrant women to integrate into the Finnish society, services to which they are entitled by the Finnish law and others.

It was held in the facilities of Haaga-Helia in Porvoo with the participation of women from different nationalities. The people involved in the organization and logistics during the event included students from the "Event Management" course taught in Haaga-Helia, who were the focus of the study case. Later it was decided that everyone with an important role in the event should be awarded.

Table 1. List of the badges to be awarded by task and number of people.

Task	# people to be awarded
Event manager	1
Guest speaker	6
MAP representative	3
Translator	4
Volunteers from Haaga-Helia course	7
Total	**21**

Table 1 shows the general criteria used to define the quantity of badges to be awarded after the event. It is noticeable that it was the first time the event was held, and it had many people involved in the organization and logistics. The organization made the event attractive for the participants, prove of that was the final attendance. For more information about the event there is a publication in the MAP website [32] and a report in a local e-newspaper, in Swedish [33].

4.5   Steps to Implement Digital Badges from Scratch

4.5.1   Badge Design

Criteria and Image

All the information contained in the badge must be related to the criteria applied to award it. Because of that, it is the most important step towards awarding a skill or accomplishment. In a formal implementation, a document containing detail information about the people involved in the process is necessary (as seen in appendix 1). It should include: the badge's contents, the badge's information, and the badge's technology and infrastructure. To illustrate this implementation, the "event manager" badge will be used.

Figure 9 shows the web page linked to the badge to display the criteria used to award it. The web page was created based on the information gathered in the criteria form, and is permanently hosted in the association's domain. It was coded in HTML5 with the Bootstrap framework and formatted with CSS3. The code is included in appendix 3.
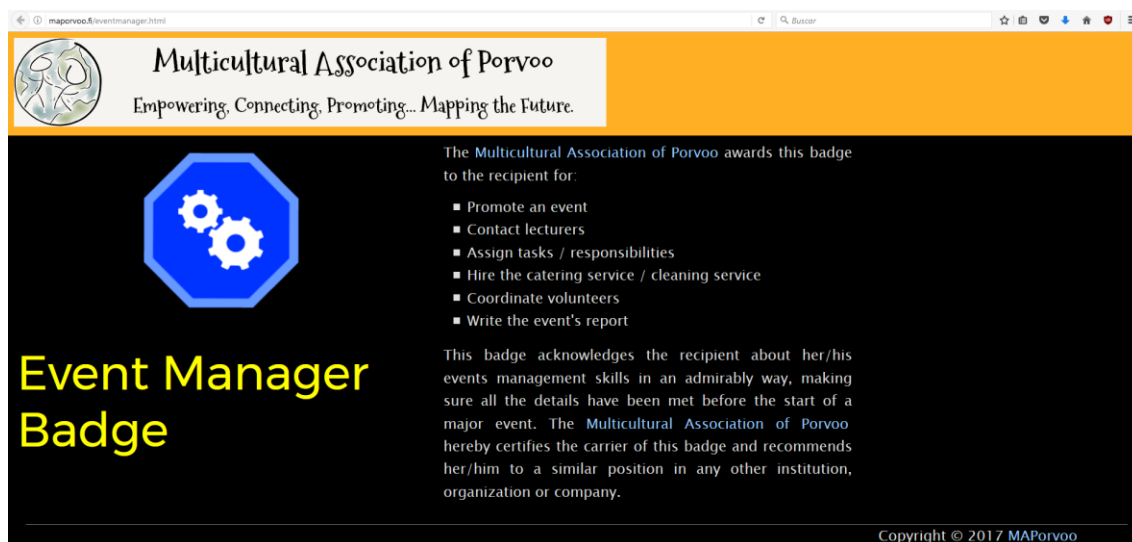
Figure 9. Web page with the badge criteria. [34]

When people link the badge to their digital CVs, the criteria work as a way to prove the skills the recipient has. It could be checked by anyone wanting to know if the person showing the badge has the necessary qualities or to corroborate what is shown in the CV. It works as an online certificate and recommendation letter, and for that the criteria should be easily accessed.

Figure 10. "Event Manager" badge created with an online designer.

The image must be a PNG or SVG file, 90 x 90 pixels in minimum size, and it is recommended that the badge could still be legible if the image is shrunk to 50 x 50 pixels (especially if text is included). For this implementation, an online badge designer available in the Open Badges designer web page [35] was used. As figure 10 shows (also see appendix 2), the designs available are limited. Thus, for future implementation a better way to design badges should be found.

4.5.2   Badge Creation

Badge Class

The badge class describes the badge to be awarded. It must contain and link all the information related to the badge itself, the issuer and the criteria to award it. Listing 3 shows the JSON with the information for the "Event Manager" badge.

```
{
  "@context": "https://w3id.org/openbadges/v1",
  "id": "http://maporvoo.fi/event-manager-badge.json",
  "type": "BadgeClass",
  "name": "Event Manager Badge",
  "description": "For managing an event in behalf of the
Multicultural Association of Porvoo.",
  "image": "http://maporvoo.fi/event-manager.png",
  "criteria": "http://maporvoo.fi/eventmanager.html",
  "issuer": "http://www.maporvoo.fi/maporvoo.json",
  "alignment": [
    { "name": "Collaboration",
      "url": "https://learning.mozilla.org/en-US/web-liter-
acy/skills#collaboration",
      "description": "Being audience and culturally aware,
resolving conflicts appropriately, using technology tools
effectively, and taking responsibility for personal and
group productivity."
    }
  ],
  "tags": ["manager", "events"]
}
```

Listing 3. JSON-LD with the badge's information.

In listing 3 it can be identified that the linked data as the "@context" is relating the information to "https://w3id.org/openbadges/v1". It serves both to verify if the badge's information is in the format required to validate the badge, in this case version 1.1 standards, and to link the data to other objects that might use the information contained in it. It links the information from another source in the "alignment" section to a Mozilla linked data repository. It can be displayed and reviewed by someone interested in verifying if the information contained in the badge is relevant to an organization.

Issuer

Issuer is the organization or company distributing and endorsing the badges. For that, the minimum requirement is that the issuer must have its own verifiable domain, which is present in all the metadata included in the badge. As digital badges are open-source resources, anyone can start issuing badges. The key for this is the "endorsing", as well-founded and recognized companies or organizations, with credentials easily found and corroborated, will be more trustworthy than some random name appearing on stage.

```
{
  "@context": "https://w3id.org/openbadges/v1",
  "id": "http://maporvoo.fi/maporvoo.json",
  "type": "Issuer",
  "name": "Multicultural Association of Porvoo",
  "url": "http://maporvoo.fi/",
  "description":  "Multicultural  association  located  in
Porvoo, Uusimaa, Finland. It organizes events to promote in-
tegration and multiculturalism.",
  "image": "http://maporvoo.fi/logo-long.jpg",
  "email": "info@maporvoo.fi"
}
```

Listing 4. JSON-LD with the organization's information.

Listing 4 shows the code for identifying the organization. Again, it is noted that the infor-mation is being linked to the standard and trough the web by the "`@context`" identifier. The "`id`" identifier provides a unique IRI (Internationalized Resource Identifier) for the organization, making it easy to corroborate its existence and credentials.

4.5.3   Badge Award

Assertion

The assertion describes the badge recipient and links the information to the badge being awarded and to the issuer. The identifier for the recipient is the e-mail, if for some reason someone else than the intended recipient tries to claim the badge, the display service (for example, Mozilla Backpack) will verify the user's e-mail with the one included in the badge. If they do not match, the badge will not be awarded.

```
{
  "@context": "https://w3id.org/openbadges/v1",
  "id":            "http://maporvoo.fi/event-manager-badge-
award.json",
  "type": "Assertion",
  "uid": "b0em042017a1",
  "recipient": {
    "type": "email",
    "hashed": true,
    "salt": "test1",
    "identity":
"sha256$3B31F3481AAC03CFC2DF5637197F7D7CAE10E288DCCBB1BB76
FEDA8591AD2FF9"
  },
  "badge": "http://maporvoo.fi/event-manager-badge.json",
  "verify": {
    "type": "hosted",
    "url":           "http://maporvoo.fi/event-manager-badge-
award.json"
  },
  "issuedOn": "2017-04-15T15:30:00Z",
  "expires": "2017-06-15T15:30:00Z"
}
```

Listing 5. JSON-LD with the awarding information.

As seen in listing 5, for security reasons it is recommended to hash the recipient's infor-
mation. It includes the salt, for the system to verify that the data was not tampered from
the badge's creation to its claiming. The issuer can decide about the time in which the
badge will be valid. It could be a life-long badge or one that must be renewed every
certain time fixed by the organization, for that the "expires" property can be present in
the assertion. In this example, it has an expiration date in June 2017. The "hosted"
property indicates that the badge is hosted at the location specified in "url".

INSTITUTION

type: Issuer   **description**
id   **name**
url   **logo**

can be linked,
public
information

BADGE

type: BadgeClass   **tagas**
id   **criteria**
name   **issuer**
desctiption   **alignment**
image

RECIPIENT

type: Assertion   **recipient:**
id   **type**
issuedOn   **hashed**
expires   **salt**
badge   **identity**
verification

shared as a
web page

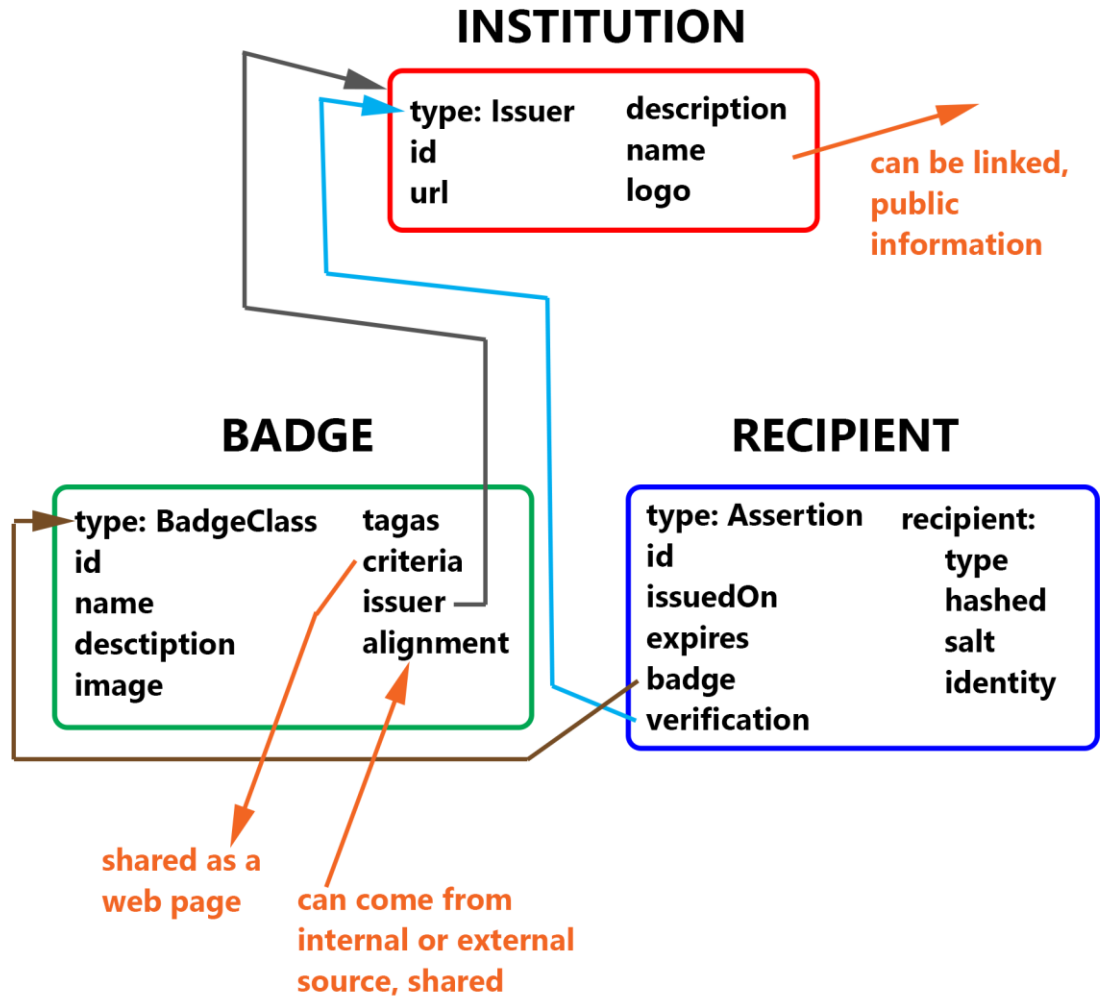can come from
internal or external
source, shared

Figure 11. Interrelations between the objects composing a digital badge by using linked data. Based on the information contained in the open badges specifications. [16]

Figure 11 shows an interrelation diagram with the information connected between the objects composing the badge and the connection with external sources. Note that by using linked data, each badge functions as an independent database table with information stored in JSON format. Linking the information between objects makes it more versatile than having it only in a stored database. Installing a database manager in the server is not mandatory as the whole internet can work as a global resources database.

4.5.4   Validation

Before creating the digital badge, all the information must be verified to check if it is formatted according to standards. This step is especially important since the introduction of the linked data format. If some information is not well formatted and another object is

linked to it, that object will share invalid data. This can cause a chain reaction of invalid information, making part of the global linked data inaccessible. To manually validate the data contained in the badge, Mozilla has an online service found in the validator web page [36]. If some data is not formatted according to standards, the tool shows the error and what should be changed to be validated. To correct the error, the issuer should visit the documentation as the validator does not show detailed information on the correction that has to be made.

```
Valid

Spec Version: 1.1.0

{
  "status": "valid",
  "info": {
    "raw": {
      "input": "http://maporvoo.fi/event-manager-badge-award.json"
    },
    "parse": {
      "version": "1.1.0",
      "type": "hosted",
      "scheme": "1.1.0-hosted",
      "assertion": {
        "@context": "https://w3id.org/openbadges/v1",
        "id": "http://maporvoo.fi/event-manager-badge-award.json",
        "type": "Assertion",
        "uid": "h6yugh78",
        "recipient": {
          "type": "email",
          "hashed": true,
          "salt": "test1",
          "identity": "sha256$3B31F3481AAC03CFC2DF5637197F7D7CAE10E288DCCBB1BB76FEDA8591AD2FF9"
        },
        "badge": "http://maporvoo.fi/event-manager-badge.json",
        "verify": {
          "type": "hosted",
```

Figure 12. OpenBadges Metadata Validator. Screenshot taken from [36].

To validate the badge, the assertion URL must be entered in a text box, then click on "Check Validity" and the result will be displayed. In a case it is valid, the version of the specifications will be shown. Figure 12 shows validated information for the example badge with the metadata linked to it.

4.5.5   Badge Baking

"Baking" is the digital badges community slang to identify the process of integrating all the badge's information to the image representing it. This relates to the description of the

digital badges in section 3.2 and figure 5, where it is established that these badges are more than a visual representation of a skill, activity or knowledge acquired, as it contains information integrated to it. To integrate all the information contained in the badge, Mozilla offers a web page identified as the "bakery" [37]. If the validation step was skipped and the badge information has errors, the procedure will fail and no concise information will be displayed. For that reason is advised to first validate the badge and then bake it.
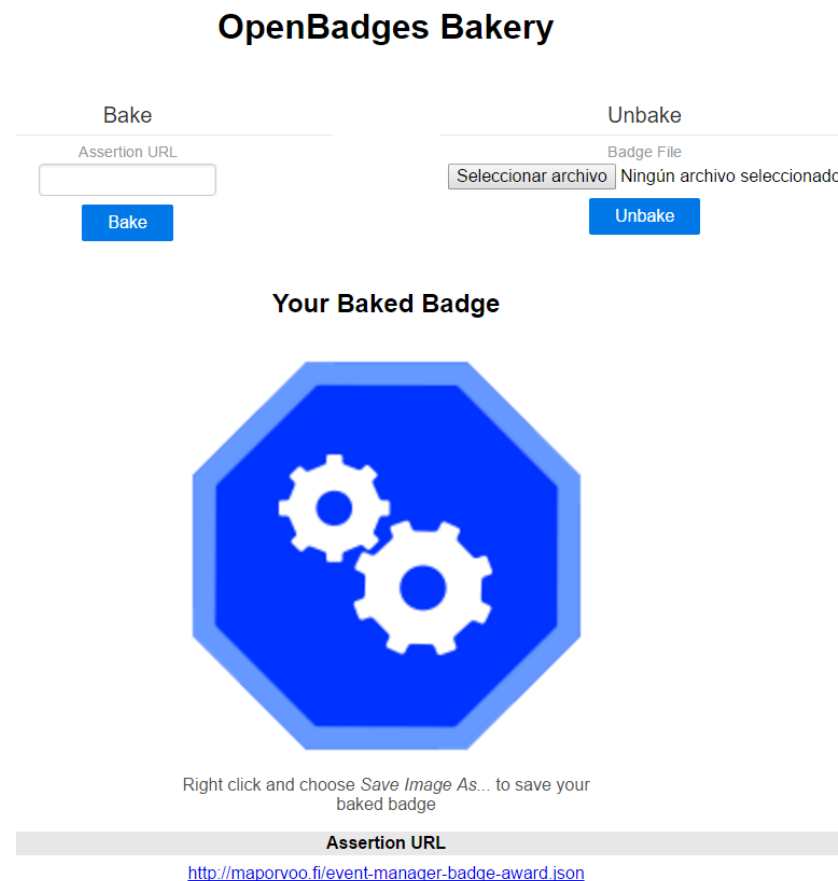

Figure 13. Digital badge with all the metadata embbeded. Screenshot taken from [37].

Figure 13 shows that the badge is an image that can be stored as a normal file. The linking of all the data contained inside the image will work since the recipient claims the badge in the display service and then shares it through social media and online portfolios. As discussed in section 3.4.1, the web acts like a database as linked data interconnects all the information contained in the badges, making it a versatile way to store information.

4.6   Storage of Badges

There are different services to claim digital badges. Mozilla Backpack [38] is part of the Open Badges initiative and has long-term support and update. Mozilla Backpack is a digital storage for the badges earned by users in different platforms. It also gives the possibility to link the badges to different social networks and online portfolios.

To register to the service an e-mail must be provided alongside with a password. There are two ways to claim badges:

1. When the issuer sends the badge by any means (e-mail, direct download, flash drive, etc.), the user has to log into the Mozilla Backpack and navigate to "Upload". There, an option to browse to the location in which the badge is and upload it to the service is shown. Then the user only has to accept the badge and it is integrated to the collection.

2. When the badge is sent automatically after completing an online test or task. In this case, the user will be required to give the registered e-mail and password for the Mozilla Backpack and then the badge will be uploaded. This procedure is done by the issuer and is generally referred to as "pushing a badge".
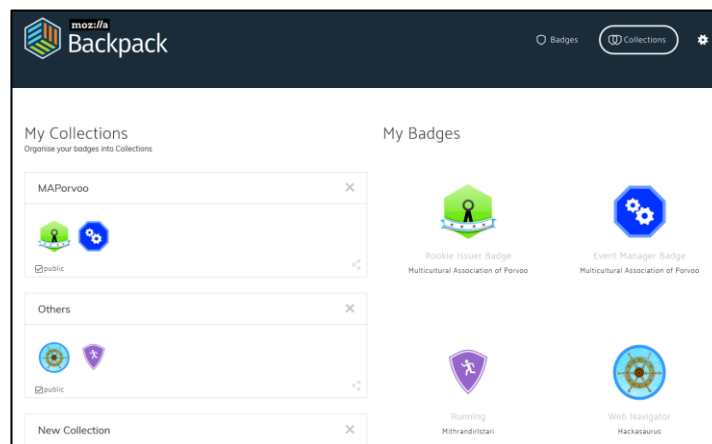

Figure 14. Mozilla Backpack collections screen. Screenshot taken from my Mozilla Backpack. [38]
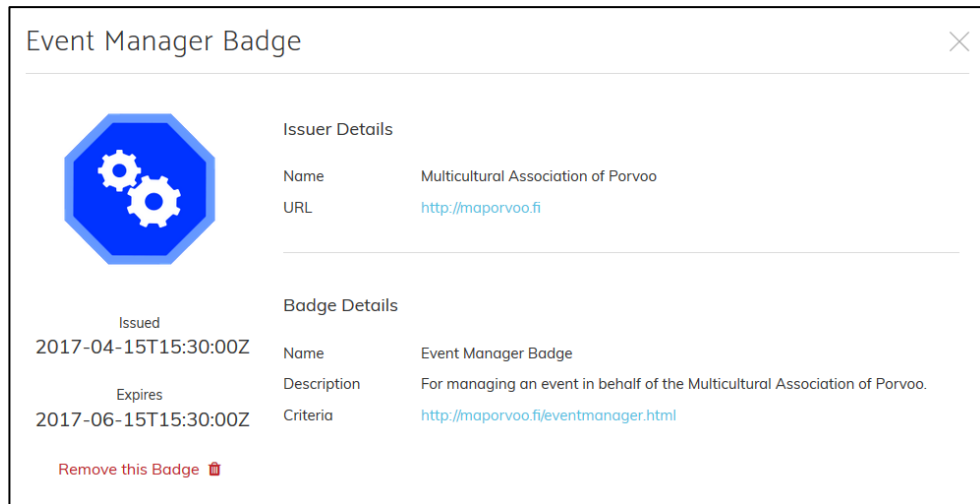
Figure 15. Details of a claimed badge. Screenshot taken from my Mozilla Backpack. [38]

Figure 14 shows how the badges are stored in the backpack. There is an option to organize them by collections by dragging the badges to the boxes. When the user clicks on the badge, the details will be shown as in figure 15. There, the issuer's and badge's details are displayed with the possibility to display the criteria used to award the badge. If the user wishes, there is an option to delete the badge as well. The display also shows if the badge has an expiration date or if it is permanently awarded (if no expiration date is shown).

4.7   Badge Display and Share

In the "Collections" box, users have the possibility to share the badges in a web page, social networks and online portfolios. For that, in each badge group there is a sharing icon represented by three interconnecting points, as seen in figure 16.

Figure 16. Sharing button. Screenshot taken from my Mozilla Backpack [38].

When the icon is clicked, it shows a screen with the sharing options as seen in figure 17. The user has to give permission and log into each of the social networks and online portfolios to be able to share the badges collections. As shown in figure 16, the "public" option must be checked for external users to be able to visit the web page in which the badges are displayed.
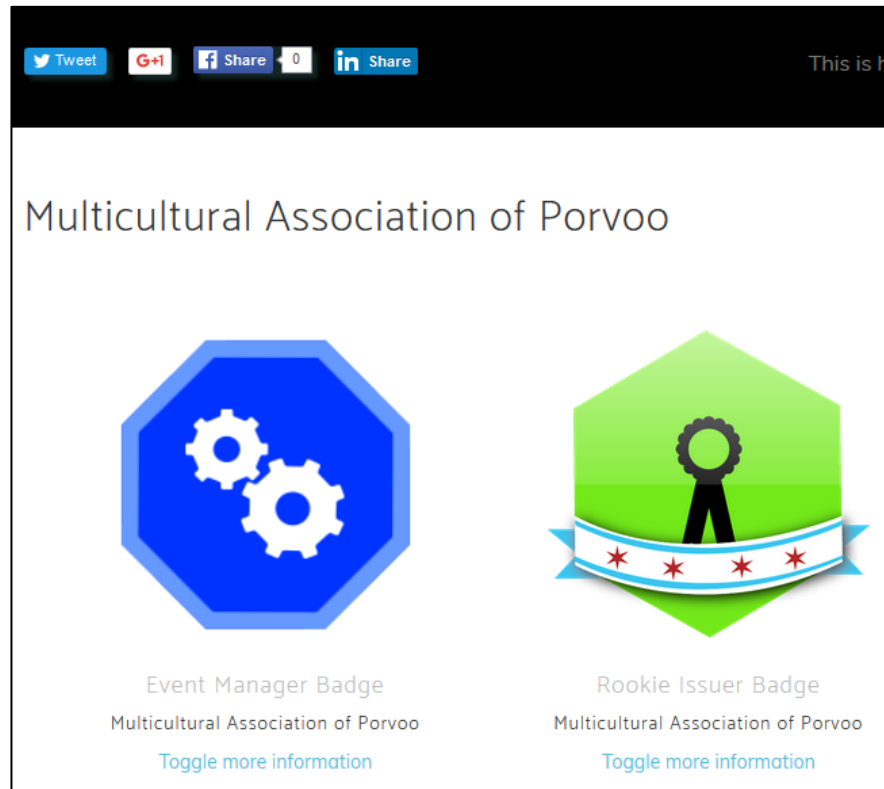

Figure 17. Sharing buttons. Screenshot taken from my Mozilla Backpack [38].

Each of the different social networks and online portfolio sites have their own options to share the badges. Some will only require to share them as a publication. Others will require a procedure in which the badges' description and URLs have to be filled to be displayed or attached to a particular skill or knowledge being displayed. Figure 18 shows an example of sharing a badges folder in an online portfolio website.
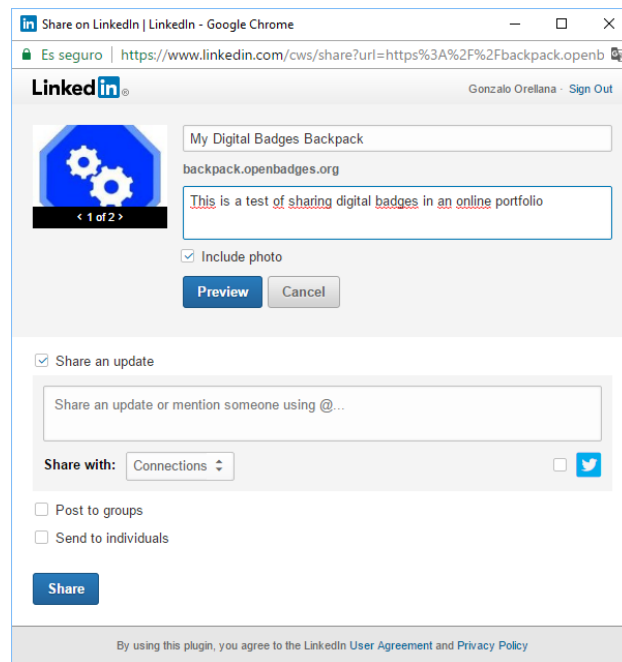
Figure 18. Sharing button. Screenshot taken from LinkedIn [39].

An alternative way to display badges is to embed them inside a web page using the HTML <iframe> tag. If the iframe needs formatting it is necessary to add it to the CSS file. Figure 19 shows an iframe within a web page with the badges collection.
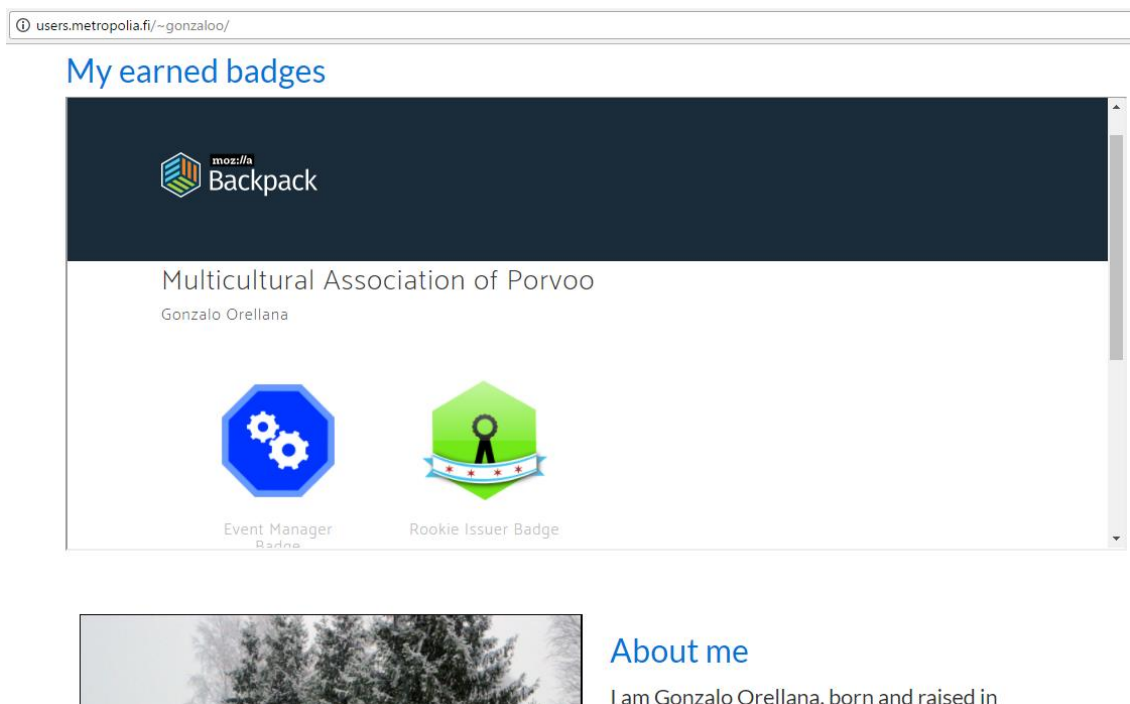

Figure 19. Sharing button. Screenshot taken from my Metropolia web page [40].

Listing 6 shows the HTML code used to embed the web page in which the badges are displayed by integrating it to another web page. This method is the most direct to link to the Mozilla Backpack, but also the image of the badges with a hyperlink to the display can be used.

```
<div class="section" id="eBadges">
  <div class="container">
    <div class="row">
      <h1 class="text-primary" id="badges">My earned
badges</h1>
      <iframe width="100%" height="500" src="https://back-
pack.open-
badges.org/share/65936e9fcee3c3674fbaaf87cba22bf5/"></iframe>
    </div>
  </div>
</div>
```

Listing 6. Code to embed the badges collection within a web page using an iframe.

One disadvantage observed in the open badges display system is the lack of automatic direct identification of the recipient. There is still no option in the specifications to include the name of the recipient in the awarded badge. The guarantee that the person displaying the badges is the one who owns them comes from the account created in the badge storage web site. That is because the user's e-mail is tied both to the account and to the awarded badge, and for that is very hard to be the wrong recipient of them.

4.8   Current State of the Project and Future Implementations

At this stage and in the near future, the system will operate with human interaction. That is, if new badges are needed, an association's collaborator will have to fill on the necessary information to create the badges. The templates for the badge class, assertion and criteria are available for edition depending on the association's needs, and the online designer can be used until the project gets funding to hire a professional designer. Even if the APIs available from Mozilla are implemented, a collaborator will have to enter the information. That is because the APIs only help to easily fill in the information contained inside the badge, to validate it and to bake it.

The badges that can be awarded without human interaction are the ones that the users can claim when they finish an online activity. That is because the badge can be coded to be awarded automatically when the user successfully finishes a test or form. One of

the badges that is being planned to be awarded automatically at the moment is the "MAPorvoo Membership". This badge will be awarded when a member starts or renews her/his membership. Upon confirmation of the fee payment, a code will be sent to retrieve the badge by filling in a form with the payment and the member's e-mail. The rest of the badges (awarded to collaborators, volunteers, participants, etc.) are still being planned for future implementation.

The next step that will be taken by the association is to apply for funding. The findings of this thesis will be attached to the funding application, as it serves as the proof of concept with a case study successfully implemented. Funding will be used to keep developing the project, especially to get a server and hire a developer to implement the different APIs available. The APIs will make easier the process of creating the necessary JSON to award the badges. The recommended APIs to be implemented in the future for the association are:

- BadgeKit API and web app, which provides back-end management to issue badges. It provides a web interface to fill in the information needed to create a badge. [41]
- Open Badges Validator, which connects with the latest specifications to check if the information contained in the badge has the right configuration. [42]
- Issuer API, which pushes the badges to Mozilla Backpack having the assertions validated. [43]
- Displayer API, which can explore the recipient's backpack for public collections and display them. [44]

The APIs use a range of frameworks, web developing programming languages and databases. All APIs are installed in a Linux server cloning the repositories published in GitHub. A Raspberry Pi can be tested as a low-cost and low-energy-consuming server, as it will not manage any other service than the digital badges.

The badges considered for the case study will be awarded by the end of May 2107. An informative meeting directed to the association's board, members and the general public will be addressed to inform about the project. It will include topics on how badges work, how people can benefit from the badges, and how they can claim, display and get advantage from the badges system..

5   Conclusions and Recommendations

Working in multicultural associations is important for immigrants, because it gives them the opportunity to show their skills through their participation in hobbies and volunteer work. Participating in volunteer work and events are essential part of their integration into Finnish society. Most importantly, if associations officially recognize those skills and work, it could allow their volunteers and collaborators to find a stable job in the future. Besides, rewarding those activities can be a tool for the associations to motivate members and volunteers to keep or increase their participation, especially if those rewards have the possibility to improve people's opportunities acting like certificates. As generally associations cannot remunerate, they have to search for other ways to compensate people for their work, and digital badges can be a viable solution.

Similar initiatives are being analysed for future implementation by highly recognised organizations, such as the European Union, Finnish Scouts, Sitra and the Finnish government. These implementations can be applied to the unemployment problem, as people involved in voluntary work can also show they are active by earning these kind of certifications [45, 46]. Besides, it is important for immigrants to have the recognition from recognized organizations, to prove they acquired learning, knowledge and skills prior to come to Finland. This because at present it is difficult for someone to prove the said qualities, as foreign certificates are not widely accepted or recognized in Finland.

Through the development of this thesis, the necessary infrastructure and technology to issue the digital badges were defined. It was found that the Multicultural Association of Porvoo has the required technological infrastructure to start issuing digital badges on their own. It was also defined what is the needed information to start creating and awarding digital badges. By applying the information mentioned above, it was successfully run a pilot project, awarding volunteers and collaborators who participated in the "Naisten Päivä" event. In the future, if the association can get a better web hosting or their own server, they could improve their badges implementation through automation. With that, they could have the possibility to offer the service to other cultural associations in the area, allowing them to get resources to keep organizing their events and reach to the community.

Although automation is part of the association's future implementation, there are still some aspects to be considered. The badges' design can be improved to make them

visually attractive to people. The association has to make the decision on what will be the long-term badges to be implemented, and the creation of their own linked data to give more depth and professionalism to their system. Badges creation, at this time, will continue to be a step-by-step process with an automated implementation for the mid-term application. This can give an opportunity to more people to join the association if they need to do their work placements, write their thesis or do volunteer work.

References

1   Deterding, S., Khaled, R., Nacke, L.E., Dixon, D. 2011. Gamification: Toward a Definition. In CHI 2011 Gamification Workshop Proceedings, Vancouver, BC, Canada. Available from: http://hci.usask.ca/uploads/219-02-Deterding,-Khaled,-Nacke,-Dixon.pdf [Cited 6 March 2017].

2   Fuchs M, Fizek S, Ruffino P, Schrape N. Rethinking gamification [Internet]. Lüneburg, Germany: meson press; 2014. Available from: http://meson.press/wp-content/uploads/2015/03/9783957960016-rethinking-gamification.pdf [Cited 6 March 2017].

3   Höglund P. Gamification in training: engagement and motivation. Helsinki, Finland: Hanken School of Economics; 2014.

4   Schell J. The art of game design. 1st ed. Amsterdam: Elsevier; 2010.

5   Kapp K. The gamification of learning and instruction. 1st ed. San Francisco, USA: Pfeiffer; 2012.

6   Zichermann G, Cunningham C. Gamification by design. 1st ed. Beijing [u.a.]: O'Reilly; 2011.

7   Reiners T, Wood L. Gamification in education and business. 1st ed. Cham: Springer; 2015.

8   Maxfield V. The military decorations of the Roman army. 1st ed. Berkeley: University of California Press; 1981. [cited 15 March 2017]

9   Badgeville: The #1 Gamification Platform for the Enterprise [Internet]. Badgeville. 2017. Available from: https://badgeville.com/ [Cited 15 March 2017].

10 Gibson D, Ostashewski N, Flintoff K, Grant S, Knight E. Digital Badges in Education [Internet]. 1st ed. 2013. Available from: https://www.researchgate.net/publication/258839995_Digital_badges_in_education [Cited 22 April 2017].

11 Steam badges for "Wolfenstein: The Old Blood" by Machine Games, published by Bethesda Softworks.]

12 About Open Badges [Internet]. Openbadges.org. 2017. Available from: https://openbadges.org/about/ [Cited 25 March 2017].

13 Issuing Open Badges [Internet]. Openbadges.org. 2017. Available from: https://openbadges.org/get-started/issuing-badges/ [Cited 25 March 2017].

14 What's an Open Badge? [Internet]. Openbadges.org. 2017. Available from: https://openbadges.org/get-started/ [Cited 25 March 2017].

15 Open Badges Specification Version 1.1 [Internet]. Openbadgespec.org. 2017. Available from: https://openbadgespec.org/history/1.1.html[Cited 26 March 2017].

16   Open Badges Specification v1.1 [Internet]. Openbadgespec.org. 2017. Available from: https://openbadgespec.org/history/1.1-specification.html [Cited 26 March 2017].

17   Open Badges Specification [Internet]. Openbadgespec.org. 2017. Available from: https://openbadgespec.org/ [Cited 26 March 2017].

18   Wood D. Linked Data. 1st ed. New York: MANNING PUBLICATIONS; 2014.

19   Metadata at W3C [Internet]. W3.org. 2017. Available from: https://www.w3.org/Metadata/ [Cited 31 March 2017].

20   Baca M, Gill T. Introduction to metadata. 2nd ed. Los Angeles, Calif.: Getty Research Institute; 2008.

21   Finland [Internet]. En.wikipedia.org. 2017. Available from: https://en.wikipedia.org/wiki/Finland [Cited 20 April 2017].

22   Understanding Metadata [Internet]. 1st ed. Baltimore, USA: National Information Standards Organization (NISO); 2017. Available from: http://www.niso.org/apps/group_public/download.php/17446/Understanding%20Metadata.pdf [Cited 1 April 2017].

23   JSON [Internet]. json.org. 2017. Available from: http://www.json.org/ [Cited 2 April 2017].

24   JSON Introduction [Internet]. W3schools.com. 2017. Available from: https://www.w3schools.com/js/js_json_intro.asp [Cited 2 April 2017].

25   JSON-LD - JSON for Linking Data [Internet]. Json-ld.org. 2017. Available from: http://json-ld.org/ [Cited 3 April 2017].

26   Unix Time Stamp - Epoch Converter [Internet]. Unixtimestamp.com. 2017. Available from: http://www.unixtimestamp.com/ [Cited 5 April 2017].

27   Chapman N, Chapman J. A web developer's guide to secure communication. 1st ed. Kilchoan: MacAvon Media; 2011.

28   Venue C. A guide to computer hacking including vulnerabilities, hacking tools, cybercrime, hacker ethics such as White Hat, Black Hat, Grey Hat, and more. 1st ed. [United States]: [Webster's Digital Services]; 2012.

29   Virtualization for Beginners - Acclaim [Internet]. Youracclaim.com. 2017. Available from: https://www.youracclaim.com/org/vmware/badge/virtualization-for-beginners [Cited 9 April 2017].

30   Multicultural Association of Porvoo [Internet]. Maporvoo.fi. 2017. Available from: http://maporvoo.fi [Cited 11 April 2017].

31   Open Badges Homepage [Internet]. Openbadges.org. 2017. Available from: http://openbadges.org/ [Cited 11 April 2017].

32 International Women's Day [Internet]. Maporvoo.blogspot.fi. 2017. Available from: https://maporvoo.blogspot.fi/2017/03/womens-day.html [Cited 12 April 2017].

33 En dag med kvinnan i fokus [Internet]. Ostnyland.fi. 2017. Available from: https://www.ostnyland.fi/artikel/en-dag-med-kvinnan-i-fokus/ [Cited 12 April 2017].

34 MAPorvoo Event Manager Badge [Internet]. Maporvoo.fi. 2017. Available from: http://maporvoo.fi/eventmanager.html [Cited 12 April 2017].

35 openbadgestest.myknowledgemap.com » Badge designer [Internet]. Open-badges.me. 2017. Available from: https://www.openbadges.me/designer.html [Cited 10 April 2017].

36 OpenBadges Metadata Validator [Internet]. validator.openbadges.org. 2017. Available from: http://validator.openbadges.org/ [Cited 12 April 2017].

37 OpenBadges Bakery [Internet]. bakery.openbadges.org. 2017. Available from: http://bakery.openbadges.org [Cited 12 April 2017].

38 Backpack [Internet]. backpack.openbadges.org. 2017. Available from: http://backpack.openbadges.org [Cited 13 April 2017].

39 LinkedIn [Internet]. Linkedin.com. 2017. Available from: http://www.linkedin.com [Cited 21 April 2017].

40 Metropolia users [Internet]. http://users.metropolia.fi. 2017. Available from: http://users.metropolia.fi/~gonzaloo [Cited 22 April 2017].

41 mozilla/openbadges-badgekit [Internet]. GitHub. 2017. Available from: https://github.com/mozilla/openbadges-badgekit/wiki/BadgeKit-Self-Hosting-Guide [Cited 22 April 2017].

42 mozilla/openbadges-validator [Internet]. GitHub. 2017. Available from: https://github.com/mozilla/openbadges-validator [Cited 22 April 2017].

43 mozilla/openbadges-backpack [Internet]. GitHub. 2017. Available from: https://github.com/mozilla/openbadges-backpack/wiki/using-the-backpack-con-nect-api [Cited 22 April 2017].

44 mozilla/openbadges-backpack [Internet]. GitHub. 2017. Available from: https://github.com/mozilla/openbadges-backpack/wiki/Using-the-Displayer-API [Cited 22 April 2017].

45 Your skills recognised in every European country | European Youth Portal [Internet]. Europa.eu. 2017. Available from: http://europa.eu/youth/fr/arti-cle/55/29489_en [Cited 16 April 2017].

46 Harrastustoiminnassa ja vapaaehtoistyössä hankitun osaamisen todentaminen - Sitra [Internet]. Sitra. 2017. Available (in Finnish) from: https://www.sitra.fi/hankkeet/harrastustoiminnassa-ja-vapaaehtoistyossa-hank-itun-osaamisen-todentaminen/#ota-yhteytta [Cited 16 April 2017].

Appendix 1: Badge System Template

To have a better control of the badge creation and criteria, the following aspects can be considered:

Badge team		
Content	*Technical*	*Visual*
Person in charge of the badging process	Person responsible of the technical features of the system	Person responsible for the badges' design

Badge information	*Name*	A descriptive name of the badge in relation to the criteria
	Type	Will it reward skills, learning, knowledge, etc.?
	Purpose	Why is this badge awarded?
	Description	Explain the badge and its purpose
	Criteria	What have to be done to earn this badge?
	Evidence	What people have to show to earn this badge?
	Assessment	If there will be mastery involved in the badge.
	Requirements	Are there pre-requisites to acquire this badge?
	Time	Will the badge have expiration date? Is there a time frame to earn the badge?
	Level	Does the badge has levels, of mastery for example?
	Cumulative	If the badge will unlock other badges or cumulate value to other badges.
	Standards	Is the badge linked to any standards (for example, ISO)?

Issuing		
Technology	*Notification*	*Design*
Describe the technical specifications of the badge, the issuing process, infrastructure.	How the recipients will be notified? (for example, e-mail)	The sketch of how the badge can look like.

Appendix 2: Badges to be awarded by the Multicultural Association of Porvoo for the "Naisten Päivä" event

The badges and criteria are shown in the figure:

Badge name:
Event manager
Criteria:
- Promote the event
- Contact lecturers
- Assign tasks / responsibilities
- Hire catering service / cleaning service
- Coordinate volunteers

Badge name:
Lecturer
Criteria:
- Participate in an event or activity organised, co-organised or invited in behalf of the Multicultural Association of Porvoo

Badge name:
Representative
Criteria:
- Represent the Multicultural Association of Porvoo in a major event of activity

Badge name:
Translator
Criteria:
- Aid in translating for the participants during a major event or activity organaised, co-organised or invited in behalf of the Multicultural Association of Porvoo

Badge name:
Haaga-Helia volunteer
Criteria:
- Special badge.
- Awarded to the Haaga-Helia students from the "Event Management" course
- For volunteering in the "Naisten Päivä" event held on March 11th. 2017

Appendix 3: HTML and CSS code for the proposed criteria web page

HTML code:

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
  <head>
    <meta  http-equiv="Content-Type"  content="text/html;  char-
set=utf-8">
    <meta name="author" content="Gonzalo Orellana">
    <title>MAPorvoo Event Manager Badge</title>

<!-- Latest compiled and minified CSS -->
    <link    crossorigin='anonymous'    href='https://maxcdn.boot-
strapcdn.com/bootstrap/3.3.7/css/bootstrap.min.css'        integ-
rity='sha384-
BVYiiSIFeK1dGmJRAkycuHAHRg32OmUcww7on3RYdg4Va+PmSTsz/K68vbdEjh4u
' rel='stylesheet'>

<!-- Optional theme -->
    <link    crossorigin='anonymous'    href='https://maxcdn.boot-
strapcdn.com/bootstrap/3.3.7/css/bootstrap-theme.min.css'  integ-
rity='sha384-
rHyoN1iRsVXV4nD0JutlnGaslCJuC7uwjduW9SVrLvRYooPp2bWYgmgJQIXwl/Sp
' rel='stylesheet'>

<!-- jQuery (necessary for Bootstrap's JavaScript plugins) -->
    <script                              src='https://ajax.goog-
leapis.com/ajax/libs/jquery/1.12.4/jquery.min.js'></script>

<!-- Latest compiled and minified JavaScript -->
    <script      crossorigin='anonymous'      integrity='sha384-
Tc5IQib027qvyjSMfHjOMaLkfuWVxZxUP-
nCJA7l2mCWNIpG9mGCD8wGNIcPD7Txa'        src='https://maxcdn.boot-
strapcdn.com/bootstrap/3.3.7/js/bootstrap.min.js'></script>
```

```
<!-- Fonts -->
    <link            href='https://fonts.googleapis.com/css?fam-
ily=Open+Sans|Roboto|Noticia+Text|Montserrat' rel='stylesheet'>

<!-- Style -->
    <link          href="eventmanager.css"         type="text/css"
rel="stylesheet">
  </head>

  <body>
    <div id="header">
      <div id="site_title">
        <a      href="http://maporvoo.fi/"   target="_blank"><img
src="banner-badges.png"></a>
      </div>
    </div>
    <div class='site-main col-xs-12 col-md-10' id='primary'>
      <div class="row">
        <div id="information" class="col-xs-12">
          <div class="row">
            <div id="badge" align="center" class="col-xs-12 col-
md-6">
              <img  src="event-manager.png"  alt="Event  Manager
Badge" height="300px" width="300px">
            </div>
            <div class="col-xs-12 col-md-6">
              <p id="info">The <a href="http://maporvoo.fi/" tar-
get="_blank">Multicultural Association of Porvoo</a> awards this
badge to the recipient for:</p>
              <ul>
                <li id="item">Promote an event</li>
                <li id="item">Contact lecturers</li>
                <li  id="item">Assign  tasks  /  responsibili-
ties</li>
```

```
                <li id="item">Hire the catering service / clean-
ing service</li>
                <li id="item">Coordinate volunteers</li>
                <li id="item">Write the event's report</li>
              </ul>
            </div>
          </div>
        <div class="row">
          <div class="col-xs-12 col-md-6">
            <p id="bName">Event Manager Badge</p>
          </div>
          <div class="col-xs-12 col-md-6">
            <p id="info">This badge acknowledges the recipient
about her/his events management skills in an admirably way, making
sure all the details have been met before the start of a major
event. The <a href="http://maporvoo.fi/" target="_blank">Multi-
cultural Association of Porvoo</a> hereby certifies the carrier
of this badge and recommends her/him to a similar position in any
other institution, organization or company.</p>
          </div>
        </div>
      </div>
    </div>
    <div align="center" class="col-xs-12">
      <div class="hrLine"></div>
    </div>
    <footer   class='site-footer   col-xs-12'   id='content-info'
role='contentinfo'>
Copyright   ©   2017   <a   href="http://maporvoo.fi/"   tar-
get:"_blank">MAPorvoo</a>
    </footer>
  </body>
</html>
```

CSS code

```css
/* CSS file, ver. 1.10 coded by Gonzalo Orellana for MAPorvoo */
/* GENERAL STYLE */

body {
  margin: 0;
  padding: 0;
  color: #ddd;
  font-size: 24px;
  line-height: 1.6em;
  font-family: "Lucida Sans Unicode", "Lucida Grande", sans-
serif;
  background-color: #000;
}

img {
  padding: 5px;
}

li#item {
  list-style-type: square;
  text-align: left;
}

p#info {
  text-align: justify;
}

p#bName {
  color: yellow;
  font: normal normal normal 80px/1.2em 'montserrat',serif;
}

.row {
  margin-right: -15px;
```

```css
  margin-left: -15px;
  margin-bottom: 10px;
  margin-top: 5px;
}


.hrLine {
  border-bottom: thin solid gray;
}


a, a:link, a:visited { color: #9CF; font-weight: normal; text-
decoration: none }
a:hover { color: #FF6; text-decoration: none; }


p { padding: 0; margin: 0 0 15px 0 }


#primary {
  width: 100%;
  margin: auto;
}


#header {
  width: 100%;
  background-color: #ffaf23;
  height: 175px;
  margin-top: 0px;
  color: black;
  padding: 5px;
}


#information {
  width: 75%;
  align: center;
}


footer#content-info {
  height: 50px;
```

```
  width: 100%;
  margin: 0 auto;
  padding-right: 100px;
  text-align: right
}


#site_title { display: block }
#site_title a { color: #000; font-weight: 700; letter-spacing:
10px; line-height: 30px }


#content{
  overflow:hidden;
  width: 8a00px;
  position:relative;
  height: 487px;
}
```