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Designing Enterprise Gamification Architectures

Master Graduation Thesis

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Play the right way

~ Larry Brown ~

CONTENTS

LIST OF FIGURES

LIST OF TABLES

SOMMARIO

Il primo documento che introdusse il termine "Gamification" risale al 2008, ma solo nella seconda metà del 2010 il termine si diffonde in molti ambienti industriali. Gamification, applicando i meccanismi di gioco in attività di non gioco per modificare il comportamento degli utenti, è una importante e potente nuova strategia per influenzare e motivare gruppi di utenti. Solo ora si sta realizzando il potere che ha l'incremento del reclutamento, dell'impegno del cliente, costruire la fedeltà e incentivare i dipendenti partner per aumentare il livello di profitto.
Il concetto di Gamification ha un potenziale per risolvere una largo numero di problemi anche al di fuori dello stretto mondo del business ad esempio può essere utilizzato in ambito educativo, formativo in ambito medico e anche in ambienti politici.
Capire come e perchè la Gamification funziona, in quali contesti è maggiormente efficace è il primo obiettivo di questa tesi. Partendo proprio dalla sua definizione, ne esamineremo caratteristiche fondamentali e analizzando quelle che ad oggi sono le più comuni piattaforme che si trovano online che offrono soluzioni basate su questo approccio cercheremo di descrivere una possibile architettura di una applicazione che supporti la Gamification.
Nella seconda parte, analizzeremo il caso di implementazione, cioè descriveremo l'applicazione "gamificata" sviluppata per l'azienda WebRato, focalizzando l'attenzione sul design dell'architettura di Gamification e fornendo una valutazione dell'applicazione sviluppata basata sulle metriche di gioco descritte nella medesima.

ABSTRACT

The first documented that used term "Gamification" dates back to 2008, but gamification only entered widespread adoption in the second half of 2010, when several industry players and conferences popularized it. Gamification, applying the mechanics of gaming to non-game activities to change people's behavior, is an important and powerful new strategy for influencing and motivating groups of people. The business community is just starting to realize the power it has to improve customer engagement, build loyalty, and incent employees and partners to perform at high levels. And the concept has the potential to solve a variety of problems outside the business world as well, in areas such as: health & wellness, education & training, public policy & government.

Understanding how and why gamification works, in what contexts it is most effective is the first objective of this thesis. Starting precisely from the definition, we'll examine the fundamental characteristics and analyzing the actual and most common online platforms that offer solution based on this approach, we'll try to describe one possible architecture of an application that supports Gamification.

In the second part, we'll analyze the case of implementation, we'll describe the gamified application developed for the company WebRatio, focusing the attention on the design of the architecture of the Gamification and providing an evaluation of the application developed based on the metrics of game described in this thesis.

RINGRAZIAMENTI

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Grazie, di cuore, a tutti.
Loris e Giuseppe

1 INTRODUCTION

Gamification has taken shape during the past two years to become a significant trend affecting many areas of business, government and society. Organizations are challenged to more deeply engage customers, employees and the public at large, and gamification provides a way to create more meaningful relationships with these audiences.
Gamification describes the use of the same design techniques and game mechanics found in all games, but applies them in non-game contexts, including customer engagement, employee performance, training and education, innovation management, personal development, sustainability, and health.
Virtually all business areas can benefit from gamification, because its application achieves three broad objectives. In all contexts, gamification is being used to engage a defined audience to change behaviors, develop skills and enable innovation.
As the Figure below indicates, the number of Google searches on “gamification” has been rising steadily. Gartner has been tracking this trend since its inception, and has been publishing research on gamification since November 2010. Gartner analysts have fielded more than 200 inquiries on this topic since January 2011. In the past 12 months, there have been more than 2,200 searches on “gamification” on gartner.com.

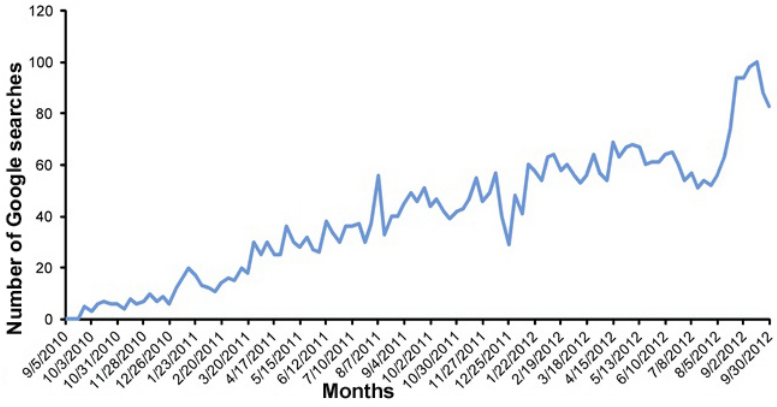


Figure 1.: Number of Google research about "Gamification" taken from [thisiswhatgoodlookslike(2013)]

As gamification moves from being leveraged by a limited amount of leading-edge innovators to become more broadly adopted by Type A organizations (early adopters), it is important that business and IT leaders in Type A organizations start to evaluate opportunities to leverage gamification. Business and IT leaders in Type B (mainstream adopters) or Type C (laggards) organizations need to become aware of the trend so they can respond to questions about gamification.
Always according to a the recent Gartner Research Report it is estimated that by 2015, more than 50 percent of organizations that manage innovation processes will gamify those processes. By 2014, Gartner predicts that over 70 percent of Global 2000 organizations will have at least one "gamified" ap-

plication, and that "gamification is positioned to become a significant trend in the next five years." M2 Research reports that gamification will be a $2.8B industry by 2016.

1.1 ORIGINAL CONTRIBUTION

Even with the successful predictions the same Gartner report says also that by 2014, 80% of current gamified applications will fail to meet business objectives, primarily due to poor design or poor user experience.
This thesis is focused on the design and the development of a Gamified application by following a structured approach to game design and software engineering and documenting in details the whole project, trying to define a general approach based upon past research work and our own experience. Our target is to create an application used to manage and entertain the community of users of a well established company by applying game elements and designing an architecture to support Gamification that could be integrated in the pre-existing enterprise infrastructure. Moreover, after the first release of the application we analyze the data collected to evaluate the user experience of the application.
The main contributions of this thesis are:

- The Gamification dynamics design, including the analysis of suitable business goals, game mechanics to use and the definition of the metrics to evaluate applications gamified.
- The implementation of an application that supports game mechanics.
- The evaluation of the application based on the metrics defined.

1.2 OUTLINE

The rest of the thesis is organized as follows:

- Chapter 2 introduces the context of this thesis, giving the needed notions that will be used during the presentation of the Gamification platforms.
- Chapter 3 presents the existing Gamification platforms and the commonalities between them.
- Chapter 4 presents the typical business objective that lead to use the Gamification approach, what are the elements to use and the metrics with which evaluate application gamified.
- Chapter 5 describes the implementation stages starting from the definition of business requirements to the analysis of the data collected after a first release of the application gamified developed.
- The Appendix includes tables that represent the useful information used in the phase of experimentation result about the case of study.

2 BACKGROUND

The use of game design and game elements in other contexts is an old topic in human-computer interaction (HCI): attempts to derive heuristics for enjoyable interfaces from games reach back to the early 1980s. Most recently, a growing body of research looks into two different way: "game with a purpose" piggybacking game play to solve human information tasks such as tagging images and application "gamified".
[Deterding et al.(2011)Deterding, O'Hara, Sicart, Dixon, and Nacke]
Gamification as a term originated in the digital media industry. The first documented users dates back to 2008, but gamification only entered widespread adoption in the second half of 2010, when several industry players and conferences popularized it.
In this section will try to first of all to define what is meant with "Gamification" and why derives from the term "Game" (Section 2.1), successively we will understand how Gamification motivates the users to do something (Section 2.2) and what are the game elements inherited by the games (Section 2.3). Finally, in the last Section 2.4 we will present some successful stories of companies that applying the Gamification in their business have benefited.

2.1 INTRODUCTION TO GAMIFICATION

The matter of Gamification is still young and rapidly developing, so there are numerous opinions as to what Gamification exactly is. A general and most used definition is:

> *"The Gamification is the use of game elements*
> *and game-design techniques in non-gaming contexts."*
> [Kevin Werbach(2012)]

To fully understand this definition, it is important to specify each term in a deeper and detailed way.

Game Elements
We are talking about games, not of play. While games are usually played, play represents a different and broader category than games.
Play can be played with in any way and only your imagination sets those boundaries. In that sense, plays are more open ended and can be played with in many different ways.
Games, however, have specific rules and a way of playing them that is "the right way" of doing it. This is not necessarily a bad thing, but it is different[Kevin Werbach(2012)].
So the difference between plays and games is the amount of constraint and authorship the player has over the experience. The more authorship the player has over the application, the more it becomes like a play. The more the player is the actor following the strict guides of the application, the more it becomes like a game.
Gamified application use elements of games that do not give rise to entire

games. Of course, the boundary between game and application with game elements can be very blurry, because often this boundary is personal, subjective and social.
Self representation with avatars, three-dimensional environments, narrative context, feedback, reputations, ranks, levels, marketplaces and economies, competition under rules that are explicit and enforced, teams parallel communication systems that can be easily configured, and time pressure are all game elements.
To generalize, using a very liberal interpretation, elements are characteristic to games, elements that are found in most (but not necessarily all) games, readily associated with games, and found to play a significant role in gameplay.

Game-design techniques
It's easy to believe that it is not so difficult to take a game elements such as a point system and stick it into a website or put the leaderboard to show who is the first, but the users often get burnt out by the endless treadmill of points accumulation and abandon the system, there's the fact that many user don't find points very interesting. Even the new users may arrive with high hopes, only to abandon the system when they see the top of the leaderboard immensely far above them. So is not so simple decide which game elements to put, where and how to make a successful gamified experience, here the game-design techniques come in. Game design is a bit of science, a bit of art and a lot of hard-won experience.
The game-design techniques travel on different level of abstraction shown in Figure 2.

Level	Description	Example
Game interface design patterns	Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations	Badge, leaderboard, level
Game design patterns and mechanics	Commonly reoccurring parts of the design of a game that concern gameplay	Time constraint, limited resources, turns
Game design principles and heuristics	Evaluative guidelines to approach a design problem or analyze a given design solution	Enduring play, clear goals, variety of game styles
Game models	Conceptual models of the components of games or game experience	MDA; challenge, fantasy, curiosity; game design atoms; CEGE
Game design methods	Game design-specific practices and processes	Playtesting, playcentric design, value conscious game design

Figure 2.: Design levels of abstraction

Non-game contexts
Gamification uses game elements for purposes which are different than the normal expected use for entertainment. Likewise, joy of use, engagement, or more generally speaking, improvement of the user experience represent

the currently predominant use cases of "gamification". The key element in each is that they involve real-world business or social impact goals, this is important to keep in mind, the users aren't there escape from your product into a fantasy world, but to engage more deeply them with the products or business objectives, to inactivate to participate, share and interact in some activity or community.
There are three particular non-game contexts: internal, external and behavior change.
In the first case, the companies use gamification to improve productivity within the organization in order to foster innovation, enhance camaraderie or to otherwise derive positive business results through their own employees. Internal gamification is something called "enterprise gamification", and in this case there are two distinguishing attributes. First the players are already part of a defined community, the company knows who they are and they interact with each other on a regular basis. The other aspect flows from the first, the motivational dynamics of gamification must interact with the firm's existing management and reward structures. Internal gamification can work for core job requirements, but there must be some novel motivation.
External gamification involves customers or prospective customer. These application are generally driven by marketing objectives. Gamification in this case, want improves the relationships between businesses and customer, producing increased engagement, identification with the product, stronger loyalty and ultimately higher revenues.
Finally, how last type of non-game contexts there is behavior-change gamification that seeks to form beneficial new habits among a population that can involve anything from encouraging people to make better health choices, eating better, studying more, etc.... producing desirable societal outcomes. [Kevin Werbach(2012)]Behavior change programs are often run or sponsored by nonprofits and governments. However, they can also create private benefits.

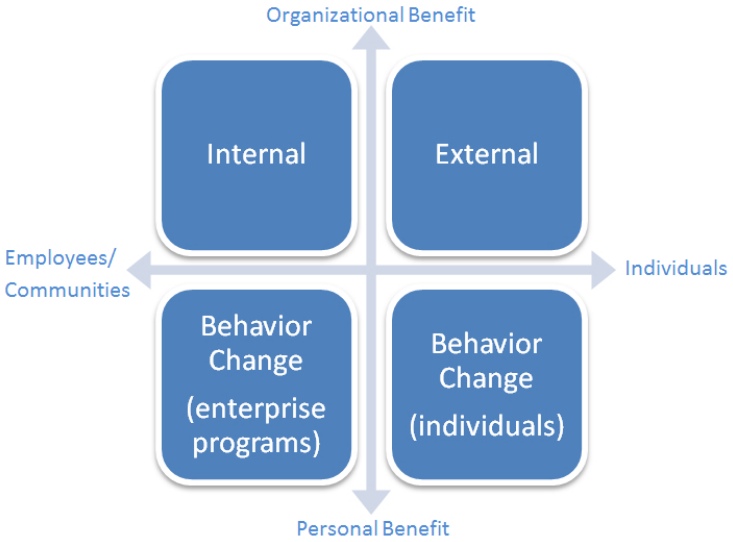


Figure 3.: Relationships between different Gamification contexts

2.1.1 Understanding the "players"

Gamification is a strategy for influencing and motivating the behavior of people – any people, whether they are customers, employees, students, fans, constituents, patients, etc. And while it uses techniques from game design, it is not a new way to reach the gamer market. The audience for gamification is anyone you want to engage repeatedly in order to elicit a particular behavior.
One of the most popular theory follows the work accomplished by Richard Bartle in understanding player types. In his seminal work, developed by studying players of MMOGs (massively multiplayer on-line games), Bartle identified four types of players.

Figure 4.: Bartle's player types.

Explorers
An explorer, in brief, likes to go out into the world in order to bring things back to his community and proclaim, "I discovered this thing!" In a sense, the experience is the objective. One example of a game suited to the explorer player type is any type of Action Game in which a player had to play different missions in different environments to find every hidden level behind every pipe and block, and bring that knowledge back to his peers for glory.

Achievers
People who like to achieve are an integral part of any competitive game. They drive a great deal of projects, services, and brands. The problem with designing exclusively for this player type is that it's difficult to develop a system where everyone can win and achieve. And for achievers, losing at the game will likely cause them to lose interest in playing it.

Socializers
This player type is made up of people who play games for the benefit of a social interaction. Games focused on socializer comprise some of the most enduring games throughout history—dominoes, bridge, mahjong, poker—the thread tying them together is that each is an extremely social experience. To be clear, it isn't that socializer don't care about the game or winning—they do. To them, the game is a backdrop for meaningful long-term social interactions. It's the context and catalyst, not the end in itself.

Killers
Also known as griefers, killers make up the smallest population of all of the player types. However, they are important to understand. They are similar to achievers in their desire to win; unlike achievers, however, winning isn't enough. They must win and someone else must lose. Moreover, killers really want as many people as possible to see the kill, and for their victims to express admiration/respect.

A player can have characteristics of all four types at the same time. However, most people are not. The result of the Bartle Test is the "Bartle Quotient", which is calculated based on the answers to a series of 30 random questions in the test, and totals 200% across all categories, with no single category exceeding 100%.
For the average person, the breakdown might look something like this:

80% socializer
50% explorer
40% achiever
20% killer

The vast majority of people—as much as 75%—are probably socializers. Explorers and achievers each make up about 10% of the population, and killers account for 5%.

2.2 HOW GAMIFICATION MOTIVATES THE USERS

A particularly compelling, dynamic, and sustained gamification experience can be used to accomplish a variety of business goals, and to solve this the key factor is motivate the users.
To be motivated is to be moved to do something. All students study several and different subjects in their scholastic life, but they are not always interested to study them. So why do they do? Many reasons, of course, but a simple division is between those who want to study and those feel like they have to study.
Wanting to do something is called *"intrinsic"* motivation because, for the person involved, it lies inside the activity, so refers to motivation that is driven by an interest or enjoyment in the task itself, and exists within the individual rather than relying on external pressures or a desire for reward.
On the other hand, feeling that you need to do something involves*"extrinsic"* motivation, because the motivation lies outside, so is a motivation refers to the performance of an activity in order to attain an outcome, whether or not that activity is also intrinsically motivated.
Intrinsic motivation has been studied since the early 1970s. Students who are intrinsically motivated are more likely to engage in the task willingly as well as work to improve their skills, which will increase their capabilities. Students are likely to be intrinsically motivated if they attribute their educational results to factors under their own control, also known as autonomy or if believe they have the skills to be effective agents in reaching their desired goals, also known as self-efficacy beliefs or are interested in mastering a topic, not just in achieving good grades. These are intrinsic motivations.

We are motivated to do something by reasons that come from outside your enjoyment or engagement with the activity.
While, common extrinsic motivations are rewards (for example money or grades) for showing the desired behavior, and the threat of punishment following misbehavior. Competition is in an extrinsic motivator because it encourages the performer to win and to beat others, not simply to enjoy the intrinsic rewards of the activity. A cheering crowd and the desire to win a trophy are also extrinsic incentives.
There are two important theories in matter of "How motivate the user". Behaviorist thinking suggested that extrinsic motivation was the way to encourage people to do things. A reward or punishment, systematically applied, would condition and reinforce responses in anticipation of further rewards or punishments.
Against this behaviorist approach arises the Self-Determination Theory (SDT), this suggest that human beings are inherently proactive, with a strong internal desire for growth, but that the external environment must support this; otherwise, these internal motivators will be thwarted. Rather than assuming, as the behaviorist approaches do, that people only respond to external reinforcements, SDT focus on what human beings need to allow their innate growth and well-being tendencies to flourish[Kevin Werbach(2012)]. SDT suggests that these needs fall into three categories; competence, relatedness and autonomy.

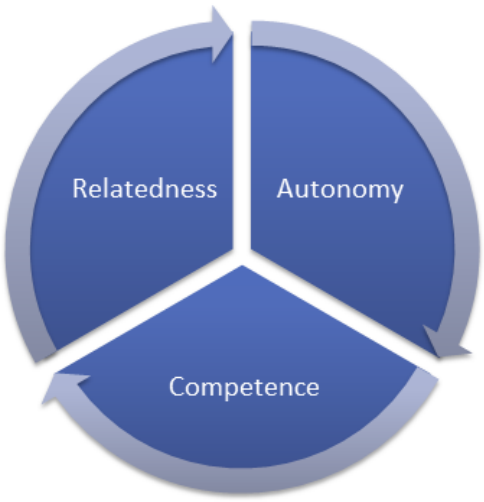


Figure 5.: Self-Determination Theory (SDT)

"Competence", or mastery, means being effective in dealing with the external environment: pulling off a difficult deal.
"Relatedness" involves social connection and the universal desire to interact with and be involved with family, friends and others.
And finally, *"Autonomy"* is the innate need to feel in command of one's life and to be doing that which is meaningful and in harmony with one's values. Task that implicate one or more of these innate human needs will tend to be

intrinsically motivated. In other words, people will do them for their own scope. Game are perfect illustrations of the lesson of SDT. Why do people play? As we're already sad, no one forces them to. Even simple game like Sudoku activates intrinsic needs for autonomy (which puzzle I solve and how I solve it is entirely up to me), competence (I figure it out!) and relatedness (I can share the achievement with my friends)[Kevin Werbach(2012)]. In the same way, gamification uses the three intrinsic motivators to generate powerful results. Levels and the accumulation of points can all be markers of competence or mastery. Giving players choices and a range of experiences as they progress feeds the desire for autonomy and agency. Social interactions such as Facebook sharing or badges you can display for friends respond to the human need for relatedness.

2.3 GAME ELEMENTS AND MECHANICS

Gamification can be applied across a broad spectrum of situations where individuals need to be motivated or encouraged to pursue specific actions or activities and drives participation and engagement by integrating game elements, in fact these, are the key of a good gamification strategy. There are three big categories of game elements that are relevant to gamification: dynamics, mechanics and components. They are organized in decreasing order of abstraction. Each mechanics is tied to one or more dynamics and each component is tied to one or more higher-level elements.

Figure 6.: Game Mechanics Cloud

Dynamics
At the highest level of abstraction are dynamics.The most important game dynamics are:

- Constraints: limitations or forced trade-offs;
- Emotions: curiosity, competitiveness, frustrations,happiness;
- Narrative: a consistent, ongoing storyline;
- Progression: the player's growth and development;

- Relationships: social interactions,status, altruism;
- Self-expression: the opportunities to express players' autonomy and originality, to mark themselves as having unique personalities from those around them.

Dynamics are the big-picture aspects of the gamifies system that you have to consider and manage but which you can never directly enter into the game.

Mechanics
Mechanics are the basic process that drive the action forward and generate player engagement. There are ten important game mechanism:

- Challenges: puzzle or other tasks that require effort to solve;
- Chance: element of randomness;
- Competition: one player or group wins, and the other loses;
- Cooperation: player must work together to achieve a shared goal;
- Feedback: information about how the player is doing;
- Resource Acquisition: obtaining useful or collectible items;
- Reward: benefits for some action or achievement;
- Transaction: trading between players,directly or through intermediaries;
- Turns: sequential participation by alternating players;
- Win State: objective that makes one player or group the winner-draw and loss states are related concepts.

Each mechanic is a way of achieving one or more of the dynamics described. A random event, such as an award that pops up without warning, may stimulate players' sense of fun and curiosity. It might also be a way of getting new participants hooked (on boarding) or keeping experienced players involved (interest curves).

Components
Components are more-specific forms that mechanics or dynamics can take.The fifteen important game component are:

- Achievement: defined objectives;
- Badges: visual representation of achievements;
- Avatar: visual representation of a player's character;
- Boss fight: especially hard challenges at the culmination of a level;
- Collections: set of items or badges to accumulate;
- Combat: competitions that enable users to challenge each other to get the high score at some activity;
- Content unlocking: resources available only when players reach objectives;
- Gifting: opportunities to share resources with other;

- Leaderboards: the "high-score tables" that show the player progression and achievement. They also indicate "how am I doing" against friends and against everybody else;
- Levels: an indication that you've reached a milestone, a level of accomplishment in a community and should be afforded a certain amount of respect and status. Levels are often defined as point thresholds, so that users can automatically level up based on their participation, or use levels to indicate status and control access to content on the site;
- Points: numerical representation of game progression that can be used to reward users across multiple dimensions, and different categories of points can be used to drive different behaviors within the same site or application;
- Quests: predefined challenges with objectives and rewards;
- Social graph: representation of player's social network within the game;
- Teams: defined group of players working together for a common goal;
- Virtual goods: non-physical, intangible objects that are purchased for use in on-line communities or on-line games, used like clothing, weapons or decorations to create an identity or used as a revenue center, by selling users virtual goods for real money.

Just as each mechanic ties to one or more dynamics, each component ties to one or more higher-level elements. Putting all these elements together is the central task of gamification design, and having knowledge of these game elements will make your gamification project compelling. Bear in mind, though, that no gamification project will include all of these elements.

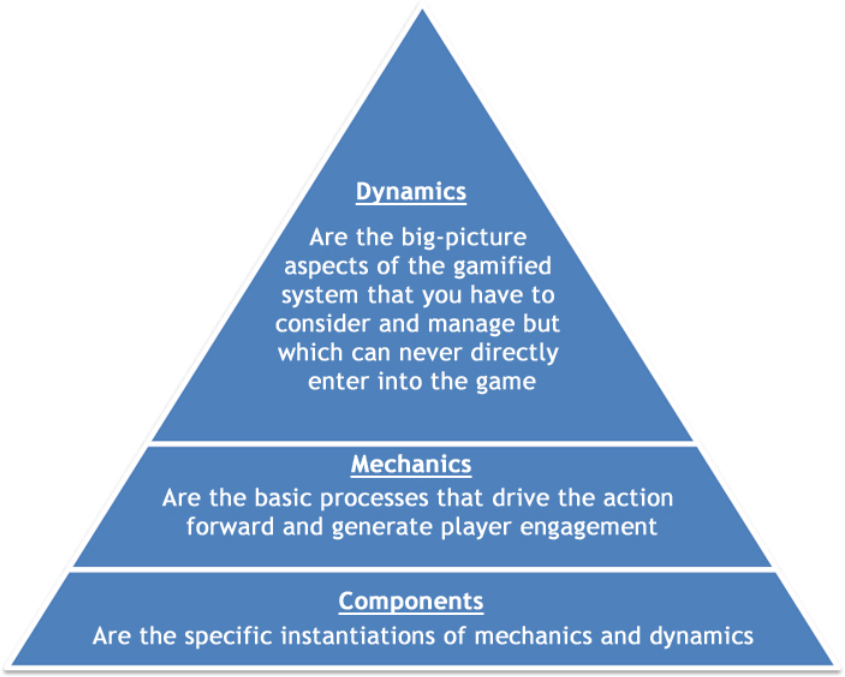


Figure 7.: The pyramid of game elements

2.4 SUCCESSFUL STORIES

In the following section are presented five cases of study of successful in which the business objectives are solved with the application of gamification techniques.

psych

The TV show Psych, broadcast on NBC channels in 2010 launched the gamified website with the scope to expand audience and deepen engagement to increase and impressions on-line and on-air, leveraging existing content and fan's social networks to drive market and revenue growth.

The application based on gamification includes: the entice fans to earn points as the they interact by watching videos, reposting content, playing games and browsing photo galleries; reward fans who check in before, during or after the show; empower them interact each other through on multiple social platforms via chatter integration and redeem badges and points displayed on leaderboards to spur competition.

As results, more than 30.000 fans registered on the site in the first year and the website experienced a 30% increase in overall site traffic, a 40% increase in viewership among 18-34 year old and a 47% increase in on-line merchandise sales

The Adobe System Incorporated is a software house famous above all, for video and digital graphics. What it needed was increase revenue by converting more free trials in sales of Adobe Photoshop, finding a quick way to teach users a few simple tasks to engage them.

So, the solution was created a "LevelUp for Photoshop", a gamified adoption program that onboards new customer quickly so that they felt confident enough in their abilities to buy the product, taking existing curriculum and organize it into a series of missions that teach common tasks, such as removing red eye and whitening in a photo, leveling task from easy to difficult and adding incentives to encourage completion to "unlock" the next level and making it easy to share earned badge acquired on social networks.

As results, Adobe experienced a 4x increase from free trial to sales as new users learned the product and existing developed new skills.

Eloqua Corp. is a marketing automation Saas company, a subsidiary of Oracle, with the need to make a successful on-line community even better

ELOQUA
THE POWER TO SUCCEED.

with more sustained activity and deeper connections between members.

The solution was use Jive Advanced Gamification Module, defining levels that community members unlock through activities that add value, reward points for interaction and contribution quality, create competition through leaderboards and making it easy to share earned badges and building a reputation on social network.

As result, an already active community experienced a sustained 55% increase in average active users and technical support requests declined as members found quality answers on community boards.

bluewolf™

Bluewolf, a global business consulting, had the objective to create an engaged employee community to grow the company's visibility and showcase their expertise in innovative business process and technologies, motivating distributed employees to effectively use social and collaborative platforms to market the team and their results.

The solution was developed a Salesforce chatter measuring baseline employees engagement on social networks and creating a social resource center to overcome common roadblocks with concise explanations and training, create a "pack profiles" that show employee's expertise, personal interests and social activity. Moreover, award points to employee for completing profiles, sharing content and receiving inbound clicks, offering virtual and tangible rewards for accumulated points, including badges and gift cards.

As results, Bluewolf doubled use of Salesforce Chatter from month-to-month since launch, accelerated traffic from social media sites by 20% month-over-month and increased internal collaboration by 57%.

Microsoft

The traditional business setting uses specific language Service provider to perform translation work, and then a secondary Service provider to assess the quality. The challenge was that, for some languages and locales, finding two independent language translation service providers could be difficult and expensive.The objective was to make certain a high quality language release and using the diverse population of native language speakers within Microsoft has enabled the pre-release software to be validated in a fun and cost-effective way.

To address this business objective the Language Quality Game was developed to encourage native speaking populations within Microsoft to do a final qualitative review of the Windows user interface and help identify any remaining language issues.
The goal of the game was to achieve reviews of screenshots and dialogs for translation accuracy and clarity. Points were awarded and the peers were able to see their cohorts score and the number of defects logged. Native language speakers were encourage to play from across Microsoft's diverse, international population of employees.

As result more than 4600 players have reported more than 6700 defects. Success in the game was defined as the amount of coverage of screens across the 36 languages tested, with the incredible response, most languages had several reviewers provide feedback per screen.

Summarizing, as a final point, we are able to answer at the question: Why should a practice based on games be taken seriously in business? There are three particular reasons:

- Engagement
- Experimentation
- Results

Engagement
The most basic answer is that gamification is about engagement. The same human needs that drive engagement with games are present in both the workplace and the marketplace. Think of gamification as a means to design systems that motivate people to do things. Anything that makes customers and employees want to strengthen their relationships with the company or to buy company's products or to engage with the goals of the company, is going to be good for the company's business.
Engagement has business value itself. If workers aren't fully engaged in their jobs, this undoubtedly affects not only their performance but their happiness. People know they should exercise more, eat better, use less energy, study more, but the hard part is being sufficiently motivated to do so. And for consumers, engagement is what leads them to initiate a transaction. In some cases the benefits are indirect[Kevin Werbach(2012)].

Experimentation
A second powerful aspect of game-based motivation is to open up the space of possibility. Mastering a game is all about experimentation. It's possible some failures, but because the game can always start over, failures doesn't feel so daunting. In most games, we can win, but we can't permanently lose. If game is not too difficult and not too easy players are continually motivated to strive for improvement[Kevin Werbach(2012)]. So, they encouraged to try new and different approaches, even crazy ones, to find better solution.
That ethos of constant innovation is perfectly suited for today's fast-moving business environment.

Results
Despite the novelty of the practice, a number of companies have seen significant positive results from incorporating game elements into their business

processes (just reading the five cases study explained before). Unfortunately, their process and the data to sustain the thesis that gamification helps to reach the defined objectives are not documented and thus the evaluation process they have applied cannot be checked against statistical tests.

3 GAMIFICATION ARCHITECTURE DESIGN

Today, searching on Google we find several platforms that use a Gamification approach to solve a variety of business needs. The evolution and the continually change of Gamification theories leads to a constant redefinition of the platform that operate in this environment.
In this chapter, starting to briefly describe the most important Gamification platforms (Section 3.1), we'll find the common functionalities offered by this platforms (Section 3.2) trying to generalize a possible set of common features belonging at one Gamification portal.
In the Section 3.3 we'll describe a generic data model of an application to support the gamification approach and in Section 3.4 we'll describe a typical architecture of a purposive gamification platform.

3.1 SURVEY OF EXISTING GAMIFICATION PLATFORMS

A major sign of the explosive growth of the gamification platforms, it is detectable looking several companies who are making a non-game application more engaging by adding game-like features through the packaging of game mechanics as an off-the-shelf solution provided by several emerging gamification platform vendors[Barber(2011)].
Now it can be plugged into website, application or community via licensing a third-party engine, widgets and APIs without writing a single line of code.
In the list below there are the some of the most used Gamification platform that are available today:

- Gamify
- Bunchball
- Badgeville
- BigDoor
- Crowdtwist
- IAtionable
- Gigya
- Bamboo

Let's see each one of this Gamification platforms.

Gamify is a Gamification Platform designed primarily for the Casino Gaming Industry to make their existing games more engaging and addictive by applying game mechanics and game-design strategies, such as Badges, Quests and Levels. It is the first ever Casino Gamification Platform. [Crunchbase(2013)]
The characteristics of this platform are the possibility to setup and manage users across multiple project, setup actions that will be rewarded and so, the possibility to setup game mechanics like events, points, badges and quests and the rewards (virtual or real) for players.
Other choice is relative to embed widget such as leaderboards and user profiles and get real-time data to help tweak the gamification approach.
[Gamify(2013)]

Bunchball provides a cloud-based software as a service gamification technology platform to help companies improve customer loyalty and on-line engagement using game mechanics.
Bunchball offers: Bunchball Nitro, Bunchball Nitro for Salesforce, Jive Gamification Module and Nitro for IBM.
Bunchball Nitro is a gamification platform which aims to motivate on-line user engagement. It contains a set of game mechanics, including badges, team points, and leader boards for websites, social communities, mobile applications, and desktop and enterprise applications. In March 2012, Bunchball released an updated version of Nitro, code-named Flamethrower, which allows customers to sustainable engage users with highly personalized, collaborative and rewarding game mechanics. With this new release, gamification missions can be tailored for specific users and groups, to maximize their engagement and participation. Sites can also create collaborative missions that require multiple people within a group or team to contribute towards a central goal. To make the rewards meaningful, Flamethrower offers end-to-end fulfillment of virtual or physical rewards[Bunchball(2013)].
Bunchball Nitro for Salesforce motivates sales teams by adding gamification to Salesforce.com. It utilizes the same techniques that game designers have used for years: points, badges, levels, leaderboards, and real-time feedback. The software plugs directly into the Salesforce.com user interface, adding a single new menu item 'Nitro' which contains the gamification features[Bunchball(2013)].
The Jive Gamification Module is an integrated, add-on module of the Jive social business platform, and is powered by Bunchball Nitro. It gives users a set of missions to complete, each of which exposes them to a critical piece of functionality within the Jive platform. Users earn points and unlock badges for using and mastering these pieces of functionality, and "level up" when they hit key milestones. Social elements like high score tables, news feeds, and sharing statuses drive friendly competition and collaboration among

the user base.
Nitro for IBM Connections helps businesses train new users and keep existing users engaged within the IBM Connections application. Using the Nitro platform, businesses can employ gamification techniques, like completing missions and earning rewards, to engage users with IBM Connections.
[Bunchball(2013)]

Badgeville
THE BUSINESS OF GAMIFICATION

Badgeville offering, The Behavior Platform is a cloud-based tool that enables to measure, analyze, and recognize user behaviors across digital ecosystem, all from one unified interface. With the flexibility to make real-time updates, is possible iterate and optimize engagement program in real-time without any coding necessary, enabling you to adapt to new business challenges instantly[Badgeville(2013)].
The Behavior Platform goes beyond rudimentary point, badge and leaderboard systems by providing a sophisticated suite of Engagement Mechanics to influence user behaviors at every stage of their journeys. With rich personalization features, you can tailor rewards to each and every user.
With a simple, but powerful, user interface, team can identify and manage user behaviors that want to influence. Then, build out a full suite of game, reputation and social mechanics, and apply them to your digital assets in real-time.
The Behavior Platform features rich REST APIs to facilitate fast, secure integration with site, community or application. The JavaScript SDK features a one-to-one mapping with the Badgeville REST APIs, empowering developers to build beautiful visualizations[Badgeville(2013)].
Measure how well your program resonates with end users, and modify game, reputation and social mechanics in response to new engagement challenges.

BIGDOOR

BigDoor platform enables to optimize the use of virtual and tangible rewards controlling the quantity of rewards in order to create a sense of scarcity and increase their desirability, encouraging visitors to cross a certain threshold of participation before they can collect their desired rewards, rewarding users with music downloads, e-books, and more via our seamless integration with the Amazon Gift Card API[BigDoor(2013)].
With the BigDoor Loyalty Plugin, is possible drop a single snippet of JavaScript code into the site and instantly activate a wealth of features. BigDoor's Loyalty API gives the access to scalable and rapid system-response times. JavaScript libraries have all the necessary API calls to power the program and secure transactions to ensure that there are no user reward errors.
Tie in existing user accounts with secure cookie technology. Customers continue to log into the website the same way they did before. Or they can sign in with their social media accounts.
BigDoor creates content, consults on program details and analyzes the key metrics and thanks to The BigDoor Gamification Management System al-

lows to be in charge without requiring to have any programming skills. Moreover, with the Real Time Audience Management Process (RAMP) technology gives complete control over the implementation of your rewards program with the following features[BigDoor(2013)].

CROWDTWIST

The Crowd white label technology gives you the ability to customize and configure their platform's interface so it fits with the brand aesthetic and overall brand experience. In addition, because they're a SaaS–based business, the customers benefit from regular feature and functionality enhancements without the iterative costs and strain associated with custom development[Crowdtwist(2013)].
The platform is easily customized, configured and integrated across all brand channels and various technologies. They provide numerous configurations, each representing a different level of integration, from those that can be activated and implemented within days to those requiring a greater level of technical integration over several weeks or more, depending on the scope.
They make it easy for you to leverage any of the data that's captured by their platform across more of brand's on-line experiences. The robust API provides you with information ranging from: member-specific and points-earned data, rewards redeemed, demographic info on members, social engagement results and completed member actions.
In addition, they provide an extensive API library that includes numerous widgets and plugins which can be leveraged across sites, mobile applications and any other digital experience.

IActionable

At the heart of IActionable is the Engage Engine, an advanced data processing cluster of computers that processes millions of events against complex customized rules in order to deliver the correct results to each individual person in real time. This advanced engine can be configured to create the perfect game for users[IActionable(2013)].
IActionable Gives users clear and measurable goals, track their progress towards those goals, and make that progress transparent.
Achievements represent the important milestones and difficult tasks accomplished by the users. The Engage Engine can support both simple and complex reward structures. Encourage your users to go that extra mile with some visible recognition.
The Engage Engine point system is fully customizable and can supports an unlimited number of point types within the same account. Points drive many of the other Engage Engine features such as Levels and Leaderboards. The Engage Engine supports time-based leaderboard rounds such as Daily, Weekly, Quarterly, Yearly and Lifetime.
IActionable can interface with any application that can access on Internet in an standard industry, with an easy to use format. The Engage Engine is built on the same protocol as the web so any web developer should be able

to understand and start using their API in a snap. What that means is that they are limited only by the data you have available.

GIGYA

Gigya is the gamification solution that offers two ways to define game-based actions: Default Gigya actions and custom user actions.
Default Gigya actions are initiated by Gigya plugins like Social Login, Comments, Ratings & Reviews, Reactions and more. Gigya automatically tracks these actions, so there is no need for additional coding. This unique method of leveraging existing plugins allows your site to quickly implement powerful and deeply integrated game mechanics in a short amount of time [Gigya(2013)]
Custom user actions are any activities that take place on your site that are not powered by Gigya. A few examples of these actions include page views, answering a poll, completing a survey, watching a video and clicking a link. All custom user actions can easily be recorded through a simple Gamfication APIcall that refers to the unique action taking place. Gigya can also automatically reward users with points when other users react to their actions on your site. For example, a user can earn points when another user gives a comment a "thumbs up" or when their shares bring in new visitors. You can also reward users for additional predetermined passive actions.
Setting up achievements can easily be done within Gigya's Gamification dashboard[Gigya(2013)]. Achievements are represented in the form of points, levels, badges and trophies, and are unlocked when a user performs a defined action or set of actions on your site. Achievements can also be used to reward users with real-world incentives such as discounts, coupons or special offers.

Bamboo™

Manumatix, a leading developer of applications for social media and mobile platforms, has incorporated a number of new game mechanics and features into its Bamboo Social Rewards Platform[Manumatix(2013)]. Bamboo, in its simplest form, is a game in which a company's fans (brand ambassadors) earn and redeem points for creating more awareness about them. Leveraging these core fans allows them to share all kinds of interactive messages with their friends on Facebook and Twitter. The content ranges from wall posts, invites, virtual gifts and coupons, to real-time alerts, interactive polls, videos, product info and the latest news, etc. All the content delivered via the Bamboo platform opens the door for companies to reach untapped audiences to sell products and services, thus generating a new incremental revenue stream while continuing to engage and drive sales from their existing fan base. New game mechanics/features include: Rewards Staircase that stimulates activity with multiple reward levels, badges, providing instant gratification with achievements and bragging rights, leaderboard, achievement notifications, coupons, virtual gifts and social plugins.
For Marketers, Bamboo records and measures every impression, hit, visit, page view, click path, lead, and sale. Equally, it records who did it, when,

where they came from, and measures the audience (friends and followers) and their interconnections. From all of the data collected, Bamboo allows marketers the ability to run an exhaustive statistical analysis and create reports: projected/actual reach, popularity and conversion rates of specific pieces of content, results of polls, etc.

3.2 EXTRACTING FEATURES AND COMMONALITIES

Once analyzed the functionalities of each Gamification platforms discussed before, try to finding the common elements or the common ideas of Gamification applied at the website, applications and communities.
The thread on which is based this approach is shown in Figure 8 where we find three key elements: Reward User, Elevate Status's User and Provide Social Proof[Badgeville(2013)].

Figure 8.: Elements of commonalities between platforms

Reward User
Rewards should be relevant to any brand. Award top performers whatever desire, from virtual badges, access to premium content or discounts to tangible prizes like a new smart-phone. There are two categories of rewards: "extrinsic rewards" like tickets, merchandise, discounts and "intrinsic rewards" like goal achievement, customer satisfaction and personal achievement. Rewards create goals and incentives in the gamified experience. They encourage deeper engagement and loyalty over time[Badgeville(2013)].
Actually, the most important Gamification platform cited before, provide the industry's most robust gamification tool set to recognize users at every stage of their life cycle. Leaving rudimentary point, badge and leaderboard systems in the dust, these platforms help you drive long term gamification success by ensuring rewards and personalizations for all user experiences.
With a simple point-and-click interface, it is possible to configure several features which ensure relevant rewards for the users, helping drive long term value. Also build rewards that require who the user have specific traits, such as gender, city of origin, interests, department, or job title. Pairing user behaviors with rich meta-data that's already embedded throughout your website or application, contextual rewards recognize customers for interact-

ing with specific products or content, or employees for executing a key step in a business process.
As users earn rewards by performing valuable behaviors, you define, a set of contextual milestones that helps users track their progress towards a larger achievement, privilege, or status. On a customer website, a mission can encourage users to share out to different social networks, or contribute content to specific product areas. In an enterprise application, a mission can be mapped to a business process, such as converting sales leads into opportunities or closing a support ticket. Once users get rewards the platform notifications systems provide real-time recognition as users earn points, unlock rewards, progress through a mission, or level up.

Elevate User's Status
Any game mechanics but in particular reputation mechanics, empower world-class companies to elevate the status, rank and expertise of their customers and employees across their key sites, communities and applications.As people unlock new achievements across digital ecosystem, they can earn special access, privileges and rewards that matter to them.
Levels mark key milestones or inflection points in a user's overall journey, helping them feel growth and progress. With each level, people can earn additional achievements, rewards and recognition that champions their status in the site, application or community.
Levels, achievements, rewards contribute to build contextual leaderboards allowing to highlight reputation by championing engaged customers and high-performing employees.
The Leaderboard plugin offered by the Gamification platforms highlights top performers and can be filtered by time period, achievement type, and content type. It leverages the social graph to display connected friends and to encourage friendly competition within site, application or community. The Leaderboard seamlessly integrates with your site and allows Gamification admins to define layout options like size and number of users to display. Typically, the Leaderboard shows a user's profile photo, name and rank, and awards the top three ranking gamers with a medal.
To show how change the status of the users the platforms offer profile plugins to displays a user's current status and social rank, and provides a complete overview of where any given user stands within your gamified environment. Within the plugin, users have full control over privacy settings such as showing notifications when an achievement is earned, or auto-sharing newly earned badges to social networks.
Behind the elevation of the status, the platforms are focus on the loyalty aspect, because, only if the user is loyal with the website/app or community is possible increase the user's status. Loyalty programs are designed to encourage frequent and repeated buying patterns. Rewards for participation are typically transaction-based, either based on the number of purchases or dollars spent. Common examples are airline mileage programs or coffee punch cards (buy 10 get 1 free). These programs benefit the brands by increasing sales and rewarding customers' loyalty with the things they value.

Provide Social Proof
Delivering a social experience can have profound effects on the behavior of customers and employees. According to Gartner, nearly 75% of consumers rely on social networking to guide purchasing decisions, while more than half of businesses have begun adopting social capabilities alongside their

traditional applications.
The Gamification platforms' social mechanics engage users by leveraging the same dynamics that power social networks like Facebook and Twitter, but apply them directly to companies' websites, on-line communities, and enterprise applications, allowing to embed social features naturally into the user experience of virtually any digital touch point, connecting users and surfacing the key behaviors they perform in real-time.
The four keys applied by the common platforms are: develop an activity streams, in which whether it's seeing the latest review or executing a business process in your enterprise systems, end users can receive updates from just the people and content they explicitly follow. Empower users to cull their social networks to see if they have any personal connections on companies' website, application or community, and easily follow all of them and their activities. Enable users to follow specific content, products, and business processes with the simple click of a button, and see behaviors performed on those objects surfaced in activity streams embedded throughout the experience. And finally, provide social notifications alert users about contextually relevant behaviors as they happen in real-time, driving them to valuable content, products, and business processes. This ensures a fresh, dynamic experience across sites or applications.

3.3 DESIGNING DATA MODELS TO SUPPORT GAMIFICATION FEATURES

The Data Model focuses on a specific class of tasks deployed in the form of a gamified application and expresses the engagement and rewarding mechanisms typical of gaming (including gaming scores, leaderboards, and achievements)[Bozzon et al.(2013)Bozzon, Fraternali, Galli, and Karam].
The Data Model is depicted in Figure 9. A *Game* is an entertainment application described by a Title and Characterized by a Genre (e.g. Puzzle, Educational), a Mode (Single Player, Multi Player), and a Theme (e.g. Abstract, Comic, Crime, Science Fiction). A *GamePlay Action* is a human computation action that the user has performed while playing a Game during a specific session of that game, the *Gameplay*. Since the *Gameplay* tracks all the actions performed by different players during a specific running game, it is possible to retrieve social information regarding the relationship among the gamers. A Game may also have a list of available Roles that a *GamePlayer* may assume during a specific *Gameplay*. A Role can be described with a Name and a list of Abilities that define which are the allowed actions in the game for a particular role.
The *Player* entity accommodates game-specific personal and social features. Avatar and Nickname allow the user to be recognizable by using a custom image or a unique fictional name, while Motto and Bio convey customization.
To enable social interactions, attributes like Friends and Fans keep track of the players the user likes to play with and the players that appreciate the user's performance, while the Status attribute denotes if the player is on-line, off-line, occupied or the game he is playing. Reputation in on-line gaming communities is fundamental and distinctive feature of any player; being able to recognize whether a player is bad mannered, prone to cheating, unpleasant to play with is of utterly importance to assure a satisfying

gaming experience for the user of an entertainment platform; it is usually measured as an integer number. *GameStats* are stored in order to keep track of the HoursPlayed by a player on a specific Game, the Score he has obtained or other meaningful variables. *Games* have *Achievements*, i.e. means to foster an entertaining experience for users and a way to profile them. An *Achievements* is a specific challenge or task that the player can perform in order to get a reward in terms of points or other special features (in-game items, artworks, behind the scene videos); it is defined by a Category that species which kind of task the achievement was associated with such as Quests, Socializers, Grinders and the like as they have been defined and a Points Given attribute which contains the amount of points to be given if the requirements for the achievement have been met, Icon, which describes it in a visual way, a Category that specifies the task (Instructor, Grinder) and a Boolean attribute OfTheDay defining whether the achievement has to be completed on a specific day in order to obtain virtual goods, more points, or increased levels. Once a player reaches the goals of a listed achievement, she will gain a Badge related to that specific achievement. A *GameBadge* is used to relate a player with the achievement she has obtained, and it is described by a Completion Percentage attribute that shows how much the player has already achieved in order to complete a specific task.
Finally, a *GamePlayAction*, associated with a specific *Gameplay* of a player, records the Start Date and End Date of the gaming session and the actual actions performed by the player on that specific time frame and the Role defines which are the allowed actions in the game for the role associated to a player.

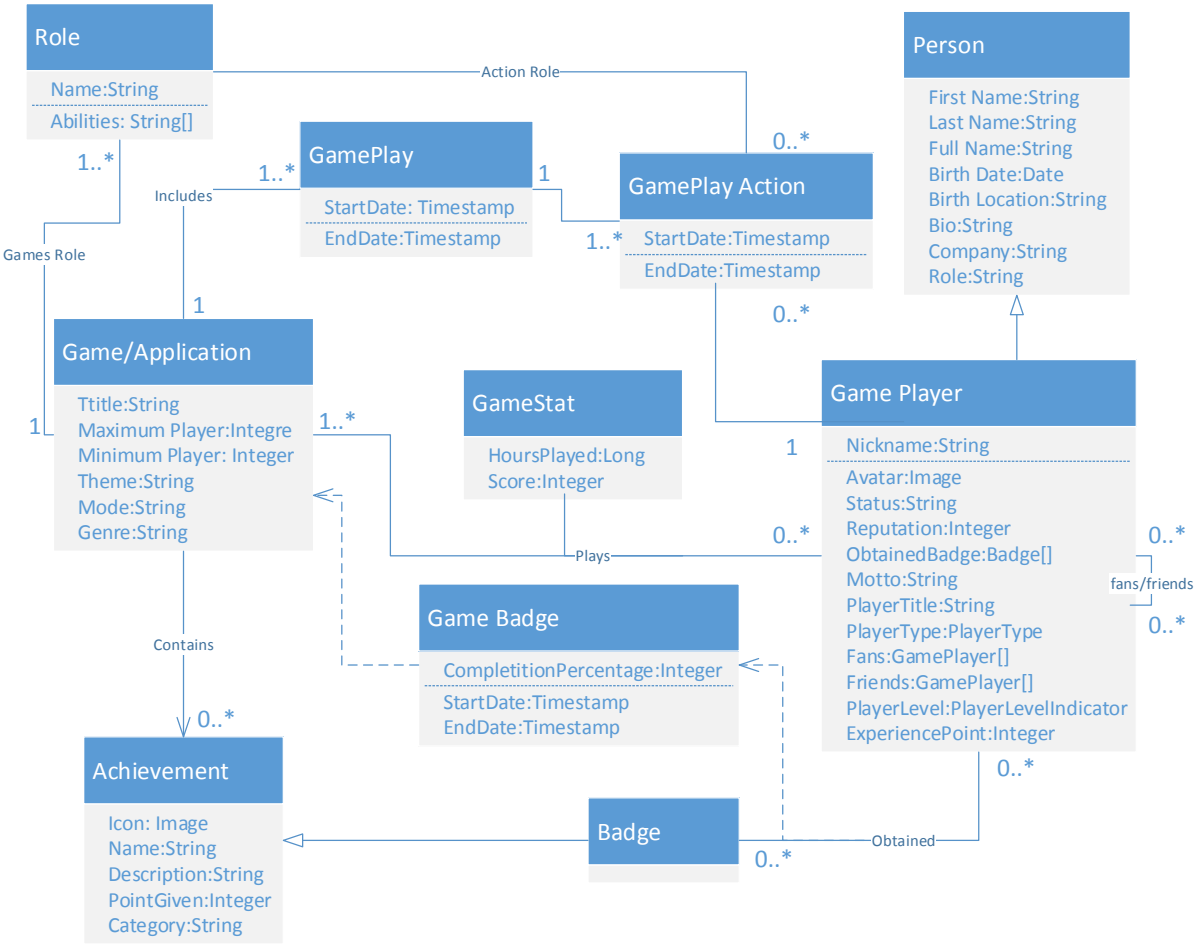


Figure 9.: Data Model of a Purposive Gamification Platform

3.4 DESIGNING THE ARCHITECTURE OF ENTERPRISE GAMIFICATION PLATFORMS

Analyzing the existing gamified platforms it is possible to describe the general architecture of a purposive gamification platform as in Figure 10. Objective of the platform is to monitor events generated by legacy and novel applications or by traditional digital games and augment their functionalities by enhancing the participation of the users or managing task instances. Given the iterative life cycle of the application, the ever changing requirements resulting from business objective refinements and play testing analysis and the need of reacting in real time to the input provided by the users, the architecture of a gamified system requires responsiveness to unpredictable and asynchronous environments, characteristic commonly attributed to "Event-driven architecture" patterns[Galli and Fraternali(2013b)]. Since the most important requirement for a gamified application is to provide immediate feedback and incentives based on the actions that the users have performed, the application has to be centered on the actions performed by the users and the events that such actions may trigger based on specific conditions to be met. The importance of maintaining the history of all the possible meaningful actions performed by a user, not only to provide him with immediate rewards but also to be able to profile him, brings the need of defining a storage system able to persist a description of the actions performed by the user along with the content that may have been produced as a result of them.
Thus a custom CMS able to store, retrieve and backup this information constitutes one of the core components of the platform. The events that have to be monitored are generated by the legacy system that has to be augmented or by the novel application that will be developed and that will make use of the gamified platform. This is accomplished by using a *Frontend Adapter* which is an Object Adapter in charge of receiving the events emitted by the front-end of the application (mouse clicks, keyboard shortcuts or other meaningful interface interactions) and send them to a *Gamification Adapter*, which is another adapter designed for collecting all the events generated by the application that has to be gamified, and thus also from its back-end. The purposive gamification platform listens, with the use of an *Event Detection* module to incoming *Gameplay* events, events received from the *Gamification Adapter* which has performed a first filtering of the interesting actions, and also possible other events generated by the surrounding context or other application that does not need a gamification strategy but they may still concur in the generation of meaningful actions. The *Event Detection* module performs the filtering and composition of the events through the use of *Monitored Events* rules, expressions defined by the designer of the gamification platform denying the admissible actions that are meaningful for the game mechanics designed for the platform. The difference between the *Gamification Adapter* and the *Event Detection* module resides in the fact that while the former is used to allow data transformation, adaptation and protocol bridging by decoupling the legacy system from the gamification platform and has thus to collect every event that may be relevant, the latter is used to filter just the events that could be meaningful for the gamification rules that has been inserted in the platform and may change frequently in the future. All the resulting filtered events are then managed by a *Game Logic Analyzer*, which checks if the conditions of a particular set of rules defining particular

conflicts or meaningful events are satisfied and, if it is the case, dispatching the event to the appropriate module able to handle it.

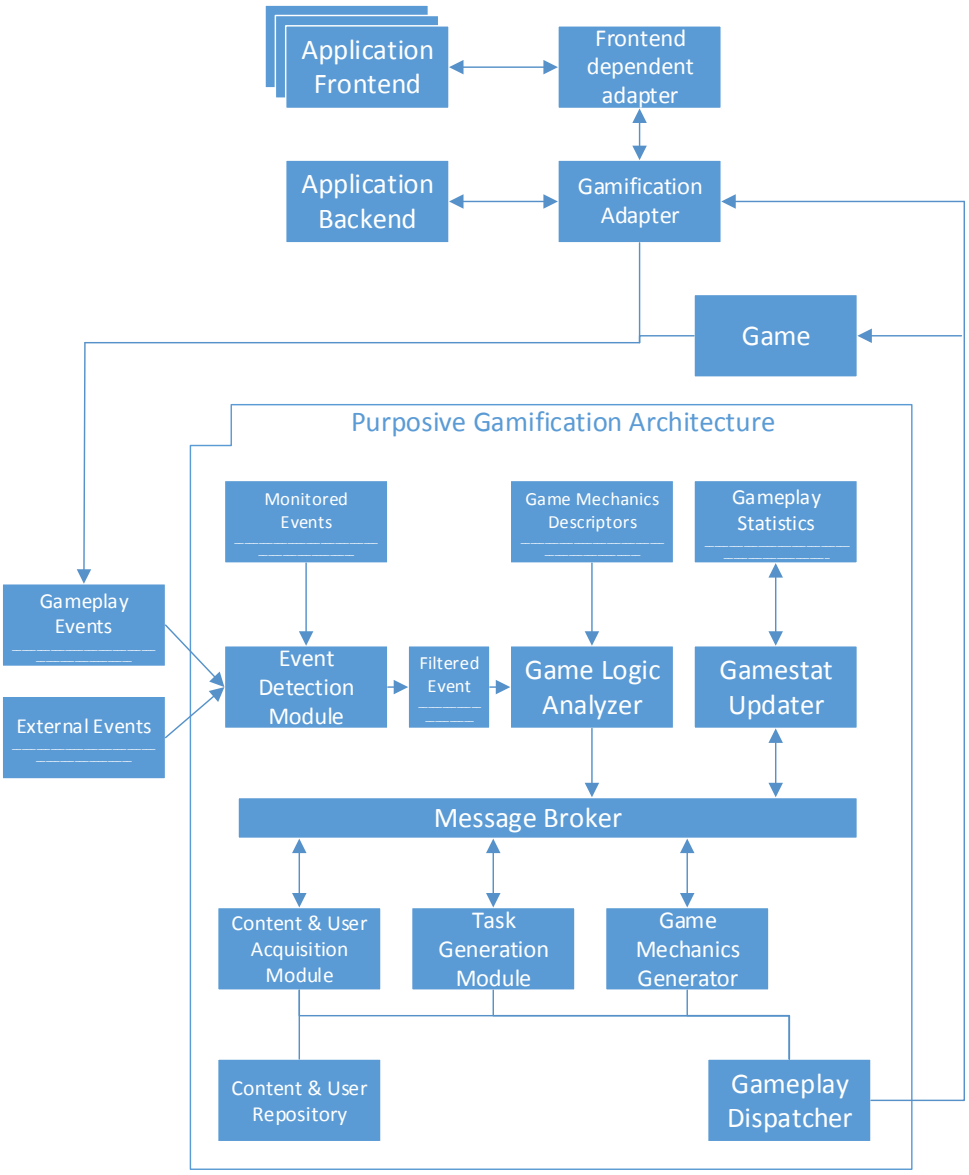


Figure 10.: Architecture of a Purposive Gamification Platform

The *Game Logic Analyzer* can be implemented by exploiting the event-driven architecture of an Active Database. The *Game Mechanics Descriptors* represent the Event-Condition-Action rules of the active database under the form of triggers used to define gamification rules or status updates within the system.

The Event part species which action, event or interaction with the system triggers the invocation of the rule, the Condition part species the logical predicate that defines the precondition for applying the rule, and the Ac-

tion part represents the dispatch of the event to the module best suited to deal with the triggered mechanic. The *Content & User Acquisition* Module is in charge of managing the creation, update and deletion of users and multimedia content within the platform through the use of a Content and User repository. The *Task Generation* Module defines task to be submitted to user through the gamified application by specifying the set of admissible inputs and a description of the task either in the form of text or conflicts defined by game rules. It is also in charge of analyzing the results of a performed task and process them before making them persistent by inquiring the *Content & User Acquisition* Module. The *Game Mechanics Generator* is in charge of the creation, update and deletion of game mechanics stored under the form of rules, to analyze the status of the users in the system and their interaction with the application that has to be gamified to issue new conflicts to be solved and reward the users for the objective they have reached based on the specific game mechanics that has been implemented. The *GameStat Updater* Module tracks and persists features related to the metrics along with any specific high-level construct created specifically by the rules in the form of *Gameplay Statistics*, entries characterized by a name and a numerical value. The *Gameplay Event Dispatcher* manages the routing of the events and updated status of the gamification platform back to the gamified applications by sending them to the appropriate adapters or game instances.

Now, we want expand The Game Mechanics Descriptor explained before to study in more detail this element, in particular we want analyze the one of the most important game mechanics: the Achievement System.
The Achievement System is structured into the components and data flows illustrated in Figure 11 the *Action Detection* module filters raw events and returns only the meaningful achievement actions. The *Action Detection* performs the filtering and composition of the events through the use of *Achievement Action Patterns*, i.e., expressions defined by the game developer denoting the sequence of events that trigger the notification of an action meaningful for the unlocking of the achievement. *Achievement Action Patterns* can be simple predicates selecting events of a specific type, e.g., "Level Completion", or more complex expressions, that detect an action based on a sequence of game-play events, such as "Find the key, open the chest and return the crown to the King". Achievement actions are processed by a *GameStat Updater* Module, which tracks and persists the monitored actions as *Gameplay Statistics*. Achievement actions and player statistics are the input to the *Achievement Detector*, which checks if the required conditions for a particular achievement, defined through *Achievement Descriptors*, are met, assigns the associated badge to the player and outputs the updated profile data regarding him.
The *Achievement Detector* can be implemented by exploiting the event-driven architecture of an Active Database. The *Achievement Descriptors* represent the Event-Condition-Action rules of the active database under the form of triggers used to define the requirements of an achievement. The Event part specifies which achievement action triggers the invocation of the rule, the Condition part specifies the logical predicate that defines the precondition for granting the achievement, and the Action part represents the generation of the badge associated to the achievement and the update of the player statistics[Galli and Fraternali(2013a)].

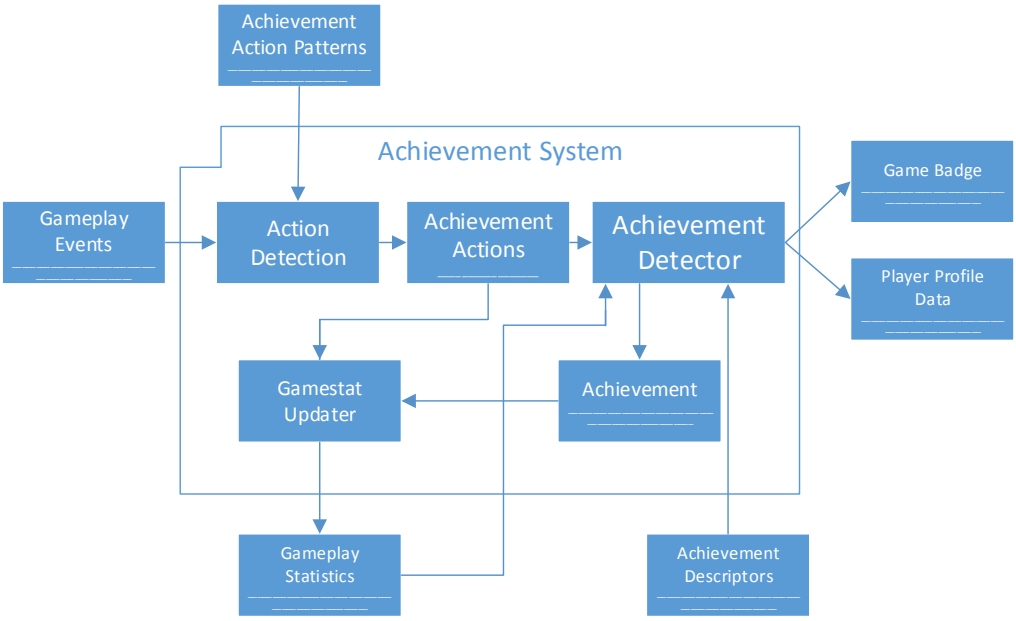


Figure 11.: Achievement System of a Purposive Gamification Platform

4 GAMIFICATION DYNAMICS DESIGN

Analyzing many cases of study of companies that have developed gamified application in this chapter we'll identify the suitable business goals classifying them by the target player (Section 4.1), secondly we'll explain in detail the most important game elements used in application with Gamification approach (Section 4.2) and in the last Section of this chapter we'll identify the game metrics used to evaluate the application developed (Section 4.2).

4.1 ANALYSIS OF SUITABLE BUSINESS GOALS

Analysis of business goals or in other words, analysis of requirements specification is the activity in which the designer must understand and define the needs that motivate the usage of a gamified approach while attempting to solve the shortcomings of an application. The most important part of the analysis is thus to identify the business objectives that have to be met by describing the processes supported by the application and why they are not reaching the expected results. The business objectives are strictly related to identify Target Players, selecting a subset of the possible users of the application not only among the "external" ones, such as the customers, but also among the "internal" users, such as the employees or the developers. Let's identify the typical business goals focused on the two big categories of target players.

4.1.1 Business goals for internal users

The typical business goals addressed to internal users or more simply to the companies' employees are:

- Motivate sales teams
- Social collaboration between employees
- Engage service and support teams
- Employees development

Let's see in more detail each goal.

Motivate sales teams
The fastest way to boost revenues and grow a business is to tap the full potential of the sales force this means motivate the sales team to increase the productivity of them[Badgeville(2013)]. Salespeople are subject to extra pressures like quotas, market changes, difficult tasks, so is important create a more motivation workplace, recognizing the solution to improve the work environment and increase the employees' sales.
Proper motivation is equal parts support, recognition and reward.

Social collaboration between employees
We have to imagine companies' employees how a real community that work to common scope and if all members work good even the success of the business is good and one of the most problem in the community is manage the social collaboration that in a professional context has the power to create a dynamic and more productive work environment, especially in large organizations and among remote workers where the communication is more difficult between employees.
The social collaboration is crucial even in the situations where experts keep knowledge to themselves or within their group without sharing the information to the whole community of employees team.

Engage service and support teams
Generally, one part of employees constitute a team of support for internal and external users. When customers seek help if the service and support teams experience high turnover and lack motivation, the customers will know it.
Instead of managing team support by command and control the goal sets out to find a way to motivate and engage its[Badgeville(2013)].

Employees development
Engaging service and support teams is an increasing challenge can be a good occasion to involve employee development and workplace learning initiatives that often take the back seat to more direct business drivers. Rote completion of mandatory courses minimizes information retention and utilization and there's a possibility that employees does not see accomplishing learning tasks as part of a larger goal or mission and busy professionals lack incentives for casual sharing, contributors to innovation and new insights. Effective professional development and robust learning communities can have a real, measurable impact on productivity, compliance and retention.

4.1.2 Business goals for external users

The typical business goals addressed to external users that are new customers that don't know the companies or the products offered and the old customers that yet know the companies and the products/services offered are:

- Grow audience, participation and customer loyalty
- Identify customers and partners
- Activate an online community
- Customer learning and training
- Business data collection

Let's see in more detail each goal.

Grow audience, participation and customer loyalty
Content may be the key, but engagement is what matter. With so many channels and so many brands competing for the customers' attention, the companies have to get audience involved to keep them tuned in.
Expand audience and deepen engagement to increase the participation is fundamental goals as customer loyalty goals that is not addressed to new

users but to old users. Acquiring a new customer may cost six times as much as keeping the ones, but this doesn't means that is is more simple. Is not enough to hope that a customer follow forever a company after knowing it, should be proposed the right activity, news, events and tasks.
Once the company win them over, they can become company's biggest advocates.

Identify customers and partners
Identify the customer is important for the company and for the customer itself.
Often customers come from the companies that are partner or that are associated with our company, exploiting the visibility of customers the companies can promote itself showing in which companies they work.
For the customer side instead, the companies have the necessity to identify the customer to build a user's profile created with the information setted by the users. Give visibility to the user means create a social profile in which the user recognize itself and that accept to show in public sponsoring consequently the company.

Activate an online community
Building a community around companies can be one of the cheapest ways to create momentum for companies' products, but build a community hides some specific requirements do not forget if the goal is that to create a community to increase participation of new and old users, because people need a compelling reason to join and participate in a community, the enrollment doesn't necessarily generate activity with value for the business and user often suffer from no activity (or viceversa too much activity) and moreover customer need incentives to share or to collaborate with other in the network[Bunchball(2013)].
Develop a community could means create a community of support to improve the assistant system that often of limited assistance by the support center of the company, in fact incentivizing the participation on the community the users can help each other, creating deeper connections between customers, to solve personal problems decreasing in same time, the workload of the support team of the company.

Customer learning and training
Engage participation is not all. Above all in the situation when the companies have the need to improve the awareness of the products offered to the customers.
Create programs of learning and training helps customers to use in right way the products or services increasing the know how about its.
Making more experienced customers the companies have the possibility to develop a sort of "community of support", a community that including expert members, can help users to solve their problem, decreasing, in a certain way, the workload of the support team.

Business data collection
This goal is not strictly related to the previous goals in sense that the objectives is not improve the "status" of the customers or the participation to the activities of them, but is more oriented to collect business data or to trace the activities or to trace other discrete tasks to compute some statistical and not only analysis.

Lastly the non-functional requirements for the application are defined; non-functional requirements are fundamental for accomplishing the business goals but non specially related to the functionalities of the application. Some of the most important non-functional requirements for a gamified application, given its peculiar dynamic and asynchronous nature, include response time, localization, usability and virality.

4.2 DESIGNING GAME MECHANICS

As we have seen before, the mechanics of a gamified system are made up of a series of tools that, when used correctly, promise to yield a meaningful response from the players. For our purposes, we'll focus on ten primary elements:

- Points (4.2.1)
- Levels (4.2.2)
- Badges (4.2.3)
- Leaderboards (4.2.4)
- Achievements (4.2.5)
- Challenges and quests (4.2.6)
- Avatar (4.2.7)
- Social engagement loops (4.2.8)
- Gifting (4.2.9)
- Onboarding (4.2.10)

Let's see in more detail each mechanics.

4.2.1 Points

Points are important regardless of whether their accumulation is shared among players, or even between the designer and the player. As the designer, it is of utterly importance to track every move your players make, even if those scores are only visible in the management console and not to them. In this way, one can see how players are interacting with the system, design for outcomes, and make appropriate adjustments.
Point systems run the gamut from in-your-face obvious to barely visible, and they serve a wide range of purposes. As such, there are a few types that we have encountered in our life[Gabe Zichermann(2011)].

There are many types of scorekeeping you may already be familiar with.

Cash score
This number indicates how much money the players have in the bank. Considering how much we value money in our society, it's curious that we don't just tell others our bank balance in casual conversation. Instead of breaking this social taboo, we give cues on our cash scores through what we wear, where we go on vacation, what cars we drive, etc. Instead of shouting out our actual score, we signal it using status objects.
In this point model, signals tell the score, exact numbers don't.

Video game score
A much more overt score is that in almost any video game. The score is always at the corner of the screen, letting the player know how close or far he is from the next level, other players, and ultimately winning the game. Few systems in real life keep the score as omnipresent as video games.

Social networking score
When Facebook was developed, there was nothing overtly indicating that the number of friends a user had served much function whatsoever. Similarly, the number of followers or mentions on Twitter was never explicitly pointed to as a designated "score." But they are.
Most players can name how many friends and followers they have on any given social network. What's more, they can probably name who among their friends has an unusually high number of friends or followers. An inventory of sorts is taken, simply because Facebook and Twitter place the "score" prominently on the page.

Composite metrics
Any metric has the power to become a type of score. Sometimes it is better to create a composite metric in order to convey complex data in a simple form. A FICO score, for example, is an amalgam of a whole series of different pieces of information — from average monthly credit card payments to amassed debt over a lifetime. We could, of course, show different scores for each vector we wanted to measure. But by summarizing the complexity of creditworthiness into a single number, anyone from a prospective landlord to a bank clerk can derive meaning from it without needing a Ph.D. in economics.

In gamification, we can leverage one of five point designs to form the foundation of our experience. In some cases,the point system will be overt, direct, and highly motivational. In some designs, you might use four different kinds of points to achieve your objectives. In still other instances, points will take a back seat to other mechanics, doing their duties in the background as the designer's workhorse.
A good point system includes one or more of the following points type:

- Experience points
- Redeemable points
- Skill points
- Karma points
- Reputation points

Figure 12.: Sample of acquisition of points

Experience points
Of the five kinds of point systems, the most important are experience points (XP). Everything a player does within the system will earn her XP and, in general, XP never goes down and cannot be redeemed. By assigning XP to every activity in the system, the designer aligns his behavioral objectives with the player in a long-term way. In some systems, XP can expire (say monthly or annually) to create goal loops. However, perhaps even more importantly, XP never maxes out. A player continues to earn them as long as she plays the game.
That is the power of XP.

Redeemable points
The second point system is made up of redeemable points (RP). Unlike XP, RP can fluctuate. The expectation for most people is that these points are usable within the system in exchange for things.
The term for this loop in social games and loyalty programs is "earn and burn," which clearly indicates the purpose of an RP system.
RPs generally form the foundation of a virtual economy, and are often given names like coins, bucks, cash, etc. Like any economy, players will need to monitor, manage, and tweak the flows of capital to ensure everything runs smoothly, as well as to avoid massive inflation or deflation. In addition, redeemable points come with substantial issues from a legal and regulatory standpoint.

Skill points
The third point system is called a skill point system. Skill points are assigned to specific activities within the game and are tangential to both XP and RP. They are a bonus set of points that allow a player to gain experience/reward for activities alongside the core.
By assigning skill points to an activity, we direct the player to complete some key alternate tasks and subgoals. In the nongame context, you might assign a set of varied skill points on a photo-sharing website. For example, players may earn some points for the quality of their photos and other points for the quality of comments.

Karma points
Karma points are a unique system that rarely appear in classic games. The

sole purpose of karma is to give points away. That is, players gain no benefit from keeping their karma points, only from sharing them. Often, karma points are given as part of a regular grind, or check in behavior, for example: earn 3 karma points for every monthly check in.
The main purpose of karma points is to create a behavioral path for altruism and user reward.

Reputation points
Finally, reputation points make up the most complex point system. Any time a system requires trust between two or more parties that you can't explicitly guarantee or manage, a reputation system is key. Its purpose is to act as a proxy for trust.
The reason why reputation systems are generally more complex lies both in how they are designed and how they are used. In general, they must incorporate a wide range of activities in order to be meaningful and the design must consider incentives and unintended consequences. Moreover, because they are a proxy for trust, players will certainly attempt to game the system. Integrity and consistency will be paramount.

4.2.2 Levels

Levels are a system, or "ramp", by which players are rewarded an increasing value for a cumulation of points. Often features or abilities are unlocked as players progress to higher levels. Leveling is one of the highest components of motivation for gamers. There are typically three types of leveling ramps:

- Flat
- Exponential
- Wave Function

Flat leveling
In game design of this type the level difficult is linear. In other words, it does take 100 points to get to level one, 200 for level two, 300 for level three, and so on.

Exponential leveling
In this case, the level difficult increases proportionally in the early levels and then the difficulty increase exponentially with the last levels with high difference between the previous level.For example, it does take 100 point get to level one, 200 for level two, 500 for level three, 1000 for level five, 2500 for level six and so on.

Wave Function leveling
In the last case the level difficult doesn't follow a regular trend, is not linear or exponential, instead, difficulty increases in a curvilinear form. Difficulty increases exponentially through each level and then decreases over time[Gabe Zichermann(2011)].

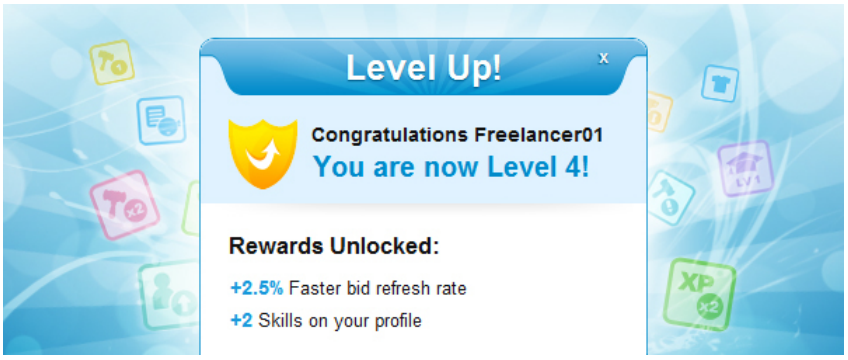


Figure 13.: Sample of reaching a new level

Using well-designed levels, the player progresses almost seamlessly, gaining confidence and experience. However, at one of the much higher levels in the game, the player encounters a decidedly more complicated sequence of challenges than the one before it. It is, in fact, so difficult that there is only one sequence of actions that will get the player through. It is the first time in the game that a player is likely to notice that he has passed to a new and more difficult level.
Inevitably, players who find the challenge too much will drop out of the game. But on the other side of the argument, those who pass the level are more likely to feel as though they've achieved something special and have become part of an exclusive group. Clearing the level will unlock the next board, so it's a major achievement (and one that bedeviled your authors for quite a while).
In today's gaming systems, designs start at the very simplest levels and move progressively toward the complex.
In some systems, levels might define the difficulty or the leading element of the game, or else they might serve as a passive marker to give more depth and complexity to your system.
Either way, the best design tips for levels are to make them logical (or easy for the player to understand), extensible (so that you can add levels as needed beyond the initial "boss level"), and flexible. Finally, the levels should be testable and refinable. Level balancing is just as complex as building the game in the first place, and should be tested and retested even as the players are in the game.

Progress bars are appearing all over the Internet. In most incarnations, they use percentages to inform a player of how close she is to completing, for example, all the necessary sign-up information (see Figure 14). Principally, they are used to encourage new players to add personal information to a site or to create a deeper core experience or to show some other information respect the other players.
Progress bars work hand in hand with levels, serving as a percentage-based progress guide for a player.

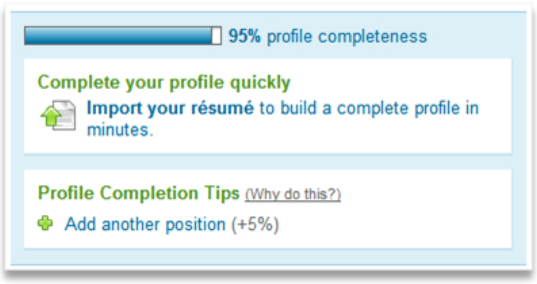


Figure 14.: Sample of progress bar

4.2.3 Badges

Badges are indicators of accomplishment or mastery of a skills is especially meaningful within a community that understands its value. Often used to identify skills and expertise within a group. People desire badges for all kinds of reasons. For many people, collecting is a powerful drive. Other players enjoy the sudden rush of surprise or pleasure when an unexpected badge shows up in a gamified system. A well-designed, visually valuable badge can also be compelling for purely aesthetic reasons.
For game designers, badges are an excellent way to encourage social promotion of their products and services. Badges also mark the completion of goals and the steady progress of play within the system. In some designs, badges can replace levels as effective progress markers.
For example, Foursquare uses check-in counting badges to demarcate levels in lieu of a separate leveling system, to represent players' progress and to create for them a sense of delight or surprise. As a result of the social, collectible, and visual nature of badges, an increasing number of gamified systems are following in Foursquare's lead. (Figure 15)

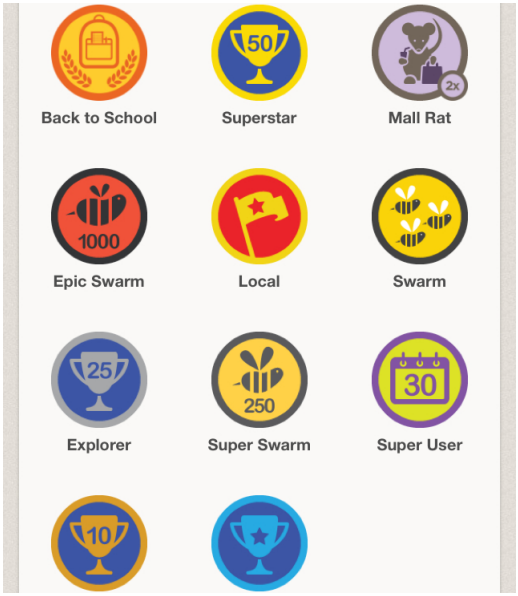


Figure 15.: Some Foursquare's badges

4.2.4 Leaderboards

The purpose of a leaderboard is to make simple comparisons. Unsurprisingly, most people don't need any explanation when they encounter a leaderboard. By default, we see an ordered list with a score beside each name, and we understand that we are looking at a ranking system.
There are two kinds of leaderboards largely used today.

- The no-disincentive leaderboard
- The infinite leaderboard

The no-disincentive leaderboard
The leaderboard of today has seen some radical redesign since the heyday of pinball machines and quarter arcades. In the era of Facebook and the social graph, leaderboards are mostly tools for creating social incentive, rather than disincentive.
They accomplish this simply by taking the player and putting him right in the middle. It doesn't matter where he falls in ranking order, whether he is #81 or #200,000, the player will see himself right in the middle of the leaderboard. Below him, he will see friends who are on his tail, and above him he will see exactly how close he is to the next best score. And he will know exactly what he has to do to beat it. However, if the player is actually in the top 10 or top 20, the leaderboard should reflect this directly. In the case of these players, the leaderboard should show them their literal ranking, which is likely to be meaningful to them[Gabe Zichermann(2011)].

The infinite leaderboard
In an arcade, there are not too many ways to allow every player to exist on a given game's leaderboard forever. At some point, a player's score will be beaten and she will fall off or she will hit a number and sit there for weeks until someone finally beats it. In today's world, there are ways to control leaderboards such that no player ever falls off or gets stuck.
Some games allows its players to see the leaderboard sliced in various ways: locally, socially, and globally. A local view shows a player where he ranks compared to others in the system in his immediate area. Socially, he can see how he ranks among his friends and followers in the game. A global view allows the same thing within the system as a whole.
There is no reason players can't slice and dice their leaderboard however they want. In fact, tracking the leaderboard behavior of a player will also inform the designer about her players. For example, a player with a deep interest in leaderboard positioning is likely to be a more competitive player and can be guided accordingly. Leaderboards can also be displayed with a limited available view for the player, which can be an important tool in a game with millions of players.

With the truly competitive, a straight leaderboard can be a powerful tool for motivation.
But for most explorers and socializers, and for many achievers, it can be both positive and negative. Consider your players' motivations and make your leaderboard social: it's a win-win proposition.

4.2.5 Achievements

Achievements are a virtual or physical representation of having accomplished something. Achievements can be easy, difficult, surprising, funny, accomplished alone or as a group. Achievements are a way to give players a way to brag about what they've done indirectly as well as add challenge and character to a game. Achievements are often considered "locked" until you have met the series of tasks that are required to "unlock" the Achievement[gamification.org(2013)].
Being recognized for achievement is a core desire that is reflected in almost all humans.
Achievement- and killer-oriented types (per Bartle's classification) are substantially more likely to care about this kind of recognition, but it affects all players. Like collecting, achievement-recognition mechanics are among the most frequently seen in gamified design, and they can be found in a broad range of experiences.
While there is an extraordinary range of possible options for expressing achievement, some of the most popular mechanics include the following:

- Badges, trophies
  How, said before, these are the most common recognition items found in games because of their versatility and flexibility. If they're well designed, they can be fine-tuned in almost limitless ways.
- Contests, game shows, award shows
  These can be used to socialize achievement in bigger-bang ways that tend to attract more attention than individual activities.
- Kudos systems
  These are generally used to provide positive reinforcement in the form of karma points or stars given from one player to another.

4.2.6 Challenges and quests

Challenges and quests give players direction for what to do within the world of the gamified experience.
Some people enter the game with no idea of its goals or fundamental drives. So, even if a challenge isn't at the front and center of the experience, using challenges as an option somewhere in the body of the system can add depth and meaning for the player.
The idea is to ensure there is always a challenge for players to take. Players should be able to come into the experience and always have something interesting and substantial to accomplish or try that is on your intended path for their overall experience. Some players will play challenge after challenge in sequence, trying to vanquish as much of the game as possible. Others will just try one as needed to maintain interest.

Cooperative questing are a particular questing experiences, as they are known, depend on a community of players. These are the most difficult type of quest to build. In organizing a soccer game, for example, the challenge is not in finding a pair of goal posts or a ball, it's in getting 22 people to show up at the same time and play.
In the beginning of the design process for a gamified system, it is better to design a single-player game that can evolve into cooperative play as the player gains mastery and more players join the game.

Obviously, cooperative designs are more socially powerful. The flip side of the soccer example we gave (which has a high minimum bar) is that the social/reward power of the experience (lots of people) also tends to increase. If your community already has a large number of active players, you should strongly consider designing something cooperative.
You can also design for single-player experiences in a group context, where players act alone but their achievements roll up to a group, or the results are shared/scored with a group. Sometimes even just having the rewards doled out in a group setting can be enough to trigger that response.
The power of group reinforcement is so powerful that despite a decline in the expected reward (more people splitting the pot), engagement shot up substantially.

4.2.7 Avatar

Avatars are unique representations for a player that usually represent a customizable picture to represent the player in many visual ways across a website[gamification.org(2013)].
Avatar customization allows for deeper levels of emotional attachment by the player. As the player decorates the avatar they create a bond, the avatar becomes an extension of themselves. Often Avatar Customization is used as an extended piece of monetization for social games. Generally a small bit of customization is allowed for free while deeper levels of customization are charged at a premium price.
Customization can come in many forms; for example, a game designer might leave it to his players to dress up and trick out their avatars or virtual worlds. In most gamified systems (in comparison to games), the demand for 3D avatars is fairly low. However, even a simple player headshot and screen name can be considered an avatar, providing players with an opportunity for customization.
While, avatar decoration refers to the ability for a player to add virtual assets to an existing avatar. For example, if the avatar was a human representation, the player could customize the appearance of an avatar by changing their hat.
But be warned, customization has a dark side. From Barry Schwartz's 2004 paper, *"The Tyranny of Choice"* we learn that people are most satisfied when choice increases from zero to one. Satisfaction then tends to increase proportionately to the number of options. However, he cautions, only to a point. When there are too many choices, satisfaction drops precipitously. In brief, enough choice is good—too much choice is bad.
His research divides people into two groups: maximizers and satisficers (satisfice is a portmanteau of satisfy + suffice). According to Schwartz, when looking to buy a new car, maximizers would have to see every car option available on the market before they could make a decision. Satisficers, on the other hand, define minimum criteria for choice; for example, they have $16,000 to spend on a two-door coupe. When they find the first car that meets those specifications, they simply buy it[Schwartz(2013)].
The research (backed up by personal observation) clearly shows that satisficers are generally happier people. So when it comes to gamified options, it isn't good to reveal the entire complexity of the system upfront. Give the player just enough choice to be engaged without the feeling of being overwhelmed.

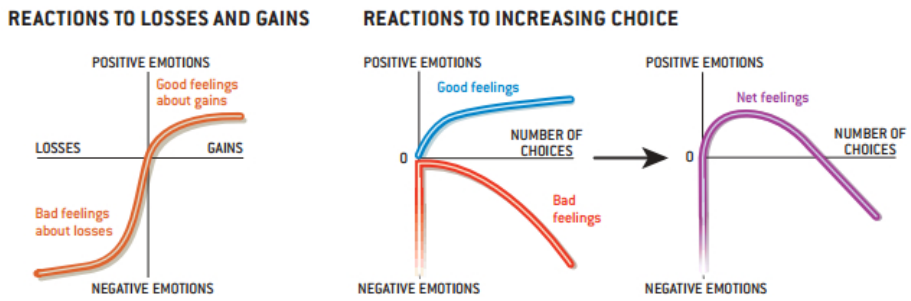


Figure 16.: Feelings evoked by increasing choice

Early decision-making research by Daniel Kahneman and Amos Tversky showed that people respond much more strongly to losses than gains (depicted schematically in left graph). Similarly, the authors belive that feelings of well-being initially rise as choice increases (blue line in schematic plot, center graph 16) but then level off quickly (good feelings satiate). Meanwhile, although zero choice (at the y axis) evokes virtually infinite unhappiness, bad feelings escalate (red line) as we go from having few choices to many. The net result (purple line in right graph) is that, at some point, added choice only decreases happiness.

4.2.8 Social engagement loops

Social engagement loops, while not exclusive to games, borrow heavily from a viral loop design. A designer must not only see the way a player engages with the system, but also how he leaves it and, perhaps even more importantly, what brings him back again.
In a social engagement loop, a motivating emotion leads to player re-engagement, which leads to a social call to action, which flows to visible progress and/or rewards, which loops back around to a motivating emotion.
[Gabe Zichermann(2011)] Figure 17 illustrates this concept.

The best way to design the intrinsic virality in your gamified system is to think about the social engagement loop at various points along the progress to mastery we described earlier. Below, we've used the example of Twitter and unpacked how the viral loops work for this popular communications platform.
For novice players of Twitter, the view of the engagement loop is as follows:

- Motivating emotion = Connecting and expressing
- Player reengagement = @Mentions
- Social call to action = Tweets
- Visible progress/reward = Followers

In summary, a novice player of Twitter will decide that she wants to connect and express what she thinks. Once she has done so, she may leave the system; however, if someone mentions her in a tweet (known as an @mention), she will reengage with the system. This then leads her to tweet back in response to her @mention. As a result, she gains followers because people

Figure 17.: Social engagement loops concept

on the site find what she has to say relevant or interesting. Thus, she is motivated yet again to connect and express herself.
The game for a novice player always varies slightly from the game played at the expert level or beyond. So, using the same engagement loop, we will illustrate how an expert player leaves and is brought back to the game:

- Motivating emotion = Collecting and ranking
- Player reengagement = Tweets and retweets
- Social call to action = Follows retweets
- Visible progress/reward = Listing followers

In summary, an expert player will be motivated by how he ranks in the system. He will focus on how many followers he has and how that compares to other players in the game. Re-engagement, in addition to the @mentions, is going to also come from an interest in making other players' lists, showing up on leaderboards and having his tweets retweeted. The social call to action has more depth for an expert player.
As a novice, he didn't necessarily understand what a retweet was, but now he does. Finally, as his following and status in the game grows, there's a visible reward.
The social engagement loop is important. As a designer, it is vital that you are clear about what kind of player engagement you are looking for, and then hone it to make sure your players come back.

4.2.9 Gifting

Gifts form a core part of cultures across the globe, with complex and often conflicting views on process and propriety. In the online world, gifts are increasingly used as a regular expression of connectedness and as a core method of socialization and virality in the design itself.
Gift-giving involves an expectation of reciprocity, and the more valued the

experience, the more resources in time, effort, or money people are willing to invest.
Gifts can refer to anything that makes the receiver happier, and may be creatively interpreted to include invitations, thank you's, compliments, thoughtfulness, and kindness. It is an effective and encouraging way to get the user to involve their social graph, and should be one of the first game mechanics a designer considers for their gamified site[SHARLEEN(2010)].
Gifts can be presented from the perspective of personality types and motivaions:

Players Type	Gift Giver	Gift Receiver
Achiever	- Achievements based on giving to new users - Gift categories unlock at status levels, premium gifts	- The more gifts received, the higher the receiver's status - The gift has high prestige value
Explorer	- Sending gifts to others unlocks hidden areas on site - Mystery gifts unlock when X number are sent out	- Gift contain "Easter Egg" surprise - Gift is early access to new content or product
Socializer	- The more friends, the more value - Winning an item gives player a gift to share with another friend - Useful gift to new friends in game	- The gift comes with another gift to pass to receiver's friends - The gift is an invitation to join a club or team
Killer	- Gift is also an invitation to challenge - Humorous taunting gift	- Gift is an invitation to challenge -Humorous taunting gift

Figure 18.: Gifting variations by Barte Players Types

Because virtual gifts are experiences, the actual implementation and design of the user experience for both giving and receiving are very important. Small details such as wrapping paper and personalization transforms the virtual good from advertising to gift. Design the user experiences for convenience, offering a fast, easy way to select friends.
Some interesting options for gift-giving features:

- Keep track of who the user has sent gifts to, and remind users to send gifts often, especially to those who may have been overlooked.
- Offer a special group of items that may only be received as gifts.
- Personalizing gifts and wrapping paper as an added experience or upgrade.
- Depending on the cultural background, public gifts may be more valued.
- Be aware that any social interaction within your community is a potential for gifting.

4.2.10 Onboarding

Onboarding is the act of bringing a novice into an existing system. It is a carefully calculated way of thinking about how someone goes from zero to five miles per hour without crashing his car. Although there is a standard web design way of looking at onboarding (throw a huge number of options at a player to make sure he does something, anything) the game view is very, very different.
Lessons from the casual games market have shown that the first minute a player engages with a system are the most important, because that's when most of a player's decisions are made. Casual and social game designers understand this concept.
They think about players entering a funnel, so they aim to maximize the value and effect of that first minute. Train and engage, but don't overwhelm. The first minute a player spends with your system is not the time to explain anything. Instead, allow the player to experience the site. Immediately, the player is experiencing the core behavior of the site and, with that first interaction, she is drawn in.
A fundamental mistake of many systems is to ask a player to register before allowing him to experience the site. For the player, there is nothing to compel him to want to give out personal information to a service he doesn't yet know. The designer's agenda to get the player's valuable information and data might seem overt and off putting to him.
So, the second thing a good system will offer in that very first minute is something of value. In some case, the player is offered the opportunity to view and rank more attractive people. Other sites might offer prizes, achievements (like badges),or virtual items. No matter what the offer is, it should have value for the player.
Then, and only then, ask her to register.

So, if we execute our onboarding process well, we can accomplish a few key things in the first minute (or two):

- Reveal the complexity of the system slowly
- Reinforce the user positively
- Remove opportunities to fail
- Learn something about the players

Without a doubt, this is one of the most challenging and complex aspects of gamification to get right. Accomplishing all four objectives in the first few minutes may be nearly impossible in your environment, but we highly encourage you to try. The benefits of doing this right are substantial for your long-term success.

4.3 EVALUATION METRICS

After the definition of the suitable business goal and the game mechanics applied to the gamified application, another important point is define what are the metrics by means we can say if the Gamification approach contributed positively.
To compute this evaluation we need to classify a set of game metrics. While the term "game metric" has become something of a buzzword in game development in recent years; metrics have arguably been around for as long as digital games have been made, but the application of game telemetry and game metrics to drive data-driven design and development has expanded and matured rapidly in the past few years across the industry[Drachen(2012)].
Game metrics start with raw telemetry data, which can be stored in various database formats, ordered in such a way that it is possible to transform the data into various interpretable measures, e.g. average completion time as a function of individual game levels or revenue per day. These are called game metrics. Game metrics are, in essence, interpretable measures of something, can be variables/features and vice versa, or more complex aggregates or calculated values, for example the sum of multiple variables/features.
The game metrics used more often are:

- ARPU
- Churn
- Retention
- DAU
- MAU
- DAU/MAU
- Cohort
- Engagement
- Re-Engagement
- Entry Event
- Exit Event
- Viral rate/K Factor
- Lifetime Network Value
- Customer Self-Realization Value

Let's see them in more detail.

ARPU
Average revenue per user (sometimes average revenue per unit) usually abbreviated to ARPU is a measure used primarily by consumer communications and networking companies, defined as the total revenue divided by the number of subscribers[wikipedia(2013d)].
Method of Calculation: To calculate the ARPU, a standard time period must be defined. Most telecommunications carriers operate by the month. The total revenue generated by all units (paying subscribers or communications

devices) during that period is determined. Then that figure is divided by the number of units. Because the number of units can vary from day to day, the average number of units must be calculated or estimated for a given month to obtain the most accurate possible ARPU figure for that month.
The ARPU can also be calculated according to diverse factors such as geographic location, user age, user occupation, user income and the total time per month each user spends on the system.
Also related is ARPPU (Average Revenue Per Paying User) which is calculated by dividing up the revenue amongst the users who paid anything at all. This yields a figure that is significantly larger than ARPU. For example in the case of a subscription game (that has a free play version), the ARPPU, measured by accounts, is the subscription price, diluted slightly by free trials[wikipedia(2013d)].

Churn
The turnover rate (or "attrition rate") of a social game's active players. The noise level in casual gaming is extremely high, which means social games have a user base that is constantly changing as gamers abandon the game. Churn refers to this constant loss and gain of members[MATT(2010)].
In its broadest sense, is a measure of the number of individuals or items moving out of a collective over a specific period of time. It is one of two primary factors that determine the steady-state level of customers a business will support. The term is used in many contexts, but is most widely applied in business with respect to a contractual customer base. For instance, it is an important factor for any business with a subscriber-based service model, including mobile telephone networks and pay TV operators. The term is also used to refer to participant turnover in peer-to-peer networks. Churn rate is an important input into customer lifetime value modeling, and can be part of a simulator used to measure Return on Marketing Investment using Marketing Mix Modeling.
Churn rate, when applied to a customer base, refers to the proportion of contractual customers or subscribers who leave a supplier during a given time period. It is a possible indicator of customer dissatisfaction, cheaper and/or better offers from the competition, more successful sales and/or marketing by the competition, or reasons having to do with the customer life cycle[wikipedia(2013a)].
For customers the formula can be simply:

$$\left(\frac{\text{subscribers lost}}{\text{starting subscribers}}\right) \times 100$$

Others choose to base their churn rate off of the number of subscribers at the end of the period instead of the beginning of the period.

$$\left(\frac{\text{subscribers lost}}{\text{ending subscribers}}\right) \times 100$$

While, in some business contexts, churn rate could also refer to employee turnover within a company. The company size and industry also play a key role in attrition rate. An "acceptable" attrition rate for a given company is relative to its industry. Regardless of industry or company size, attrition rate tends to be highest among the lowest paying jobs, and lowest for the highest paying jobs[wikipedia(2013a)].
Churn rate can also describe the number of employees that move within

a certain period. For example, the annual churn rate would be the total number of moves completed in a 12-month period divided by the average number of occupants during the same 12-month period.
For employee the formula can be:

$$\textit{Attrition rate (\%)} = \left(\frac{\text{No. of employees resigned during the month}}{\text{Average no. of employees during the month}} \right) \times 100$$

Where:

$$\textit{Average no. of employees during the month} = \frac{(\text{No. of employees at the start of the month} + \text{No. of employees at the end of the month})}{2}$$

Retention
Think of it as the opposite of churn. Retention is how well you maintain your user base. The term "retention rate" is used in a variety of fields, not only in games or gamified application, including marketing, investing, education, in the workplace and in clinical trials. One of the most mathematically accurate formula described by [HADEN(2013)] as:

$$\textit{Retention rate (\%)} = \left[\frac{(CE - CN)}{CS} \right] \times 100$$

Where:

- CE = number of customers at end of period
- CN = number of new customers acquired during period
- CS = number of customers at start of period

In practice, if we start the (week/month/year/other period you choose) with 200 customers and we lose 20 customers, but we gain 40 customers. At the end of the period we have 220 customers. So, applying the formula:

$$\textit{Retention rate (\%)} = \left[\frac{(220 - 40)}{200} \right] \times 100 = 90\%$$

DAU (Daily Active Users)
Social gaming companies use this number to understand their active users in much more granular detail. It is the count of the number of active users on any given day. It is used to track the active nature of the gaming app. 1 million daily active users versus 1 million monthly or active users are very different numbers and indicate very different success rates for the games. DAU's are used to calculate your revenue trajectory as a game company because it captures the smallest calibration of spending activity. For many social games, if a unique user does not spend money in their first day playing the game, they will likely never spend money[Sheeley(2013)].

MAU (Monthly Active Users)
Social gaming companies use this number to understand their active users in much more granular detail. It is the count of the number of unique active users in any given month. It is used to track the active nature of the gaming app. 1 million monthly active users versus 1 million active users can mean two different numbers[Sheeley(2013)].

DAU/MAU
The DAU/MAU ratio is one of the hot metrics in social games derived from

the previous two[MATT(2010)]. Daily Active Users (DAU) to Monthly Active Users (MAU) ratio is a popular metric many consumer startups are being judged by. The ratio is used to find out how many of the active users are logging in on a daily basis. This metric is very important when determining how "sticky" the application is. In other words, it is a way to measure the application's retention. Giving an example, if we have 500,000 daily users and 1 million monthly users, the DAU/MAU is .5, translating to the average user logging in 15 days per month.
The DAU to MAU ratio is a very powerful metric that every consumer company needs to track. But what is important is to defining the "active" user, this is really the key to using it effectively. Logging in to the application is a great indicator of which users are engaged but it isn't the only measure. Stay flexible with the definition of "active" and experiment with the scope of your product to really make the DAU to MAU ratio work for your product.

Cohort
In statistics and demography, a cohort is a group of subjects who have shared a particular event together during a particular time span (e.g., people born in Europe between 1918 and 1939; survivors of an aircrash; truck drivers who smoked between age 30 and 40)[RJMetrics(2013b)].
In social gaming metrics, cohorts are used for analyzing retention. By organizing users in groups such as "everyone that visited on June 10th" and analyzing the percentage that revisit, you can pinpoint what promotions are having the greatest effect.
Imagining, we could group customer by how they were originally referred to their business and track how much money they spent over time.

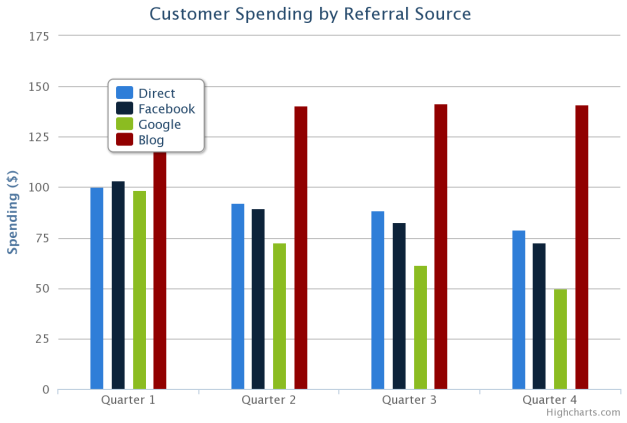


Figure 19.: Example 1 of Cohort chart by [RJMetrics(2013b)]

Figure 19:Above, we see that customers referred by the blog deliver strong, consistent long-term spending. Search engines and other channels, however, refer customers who spend a decreasing amount over time.

Perhaps the most popular cohort analysis is one that groups customers based on their "join date," or the date when they made their first purchase. Studying the spending trends of cohorts from different periods in time can indicate if the quality of the average customer being acquired is increasing or decreasing in over time.

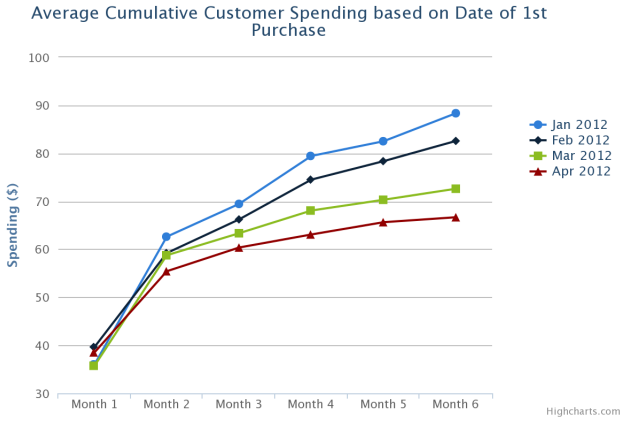


Figure 20.: Example 2 of Cohort chart [RJMetrics(2013b)]

Figure 20:In the chart above, the average customer in newer cohorts is spending less as time goes on. This would be a red flag for many investors or acquirers because it implies that the value of recently-acquired customers is less than those acquired in the past.

Entry Event
An entry event is the first action a user performs when they enter the game[MATT(2010)]. Online social games can track every action you perform, and the *Entry Event Distribution* is one of the more important metrics to follow. What do your users do first? Which entry events are the most effective at bringing people back?
By determining the more popular entry events, we can push more resources towards them, thus increasing retention,engagement and re-engagement.

Exit Event
The opposite of entry events. Exit events are the last actions a user performs before exiting the game[MATT(2010)]. Tracking the *Exit Event Distribution* helps show why users are disengaging with the game.

Viral rate/K-Factor
Measured by K-Factor, the Viral Rate shows how much your users are promoting, evangelizing and spreading the application/game. Because of this, social games are increasingly built around cooperation, competition and the constant addition of new features, which increase virality. Every feature is a source for growth, whether it's "liking," Facebook notifications or tweets for example.
The formula of K-Factor is:

(Infection Rate) * (Conversion Rate)

Where:

- An Infection Rate is how much a given user exposes the game to other players, such as through status updates or email invites;

- A conversion rate, as marketers know, is when that "infection" results in a new sign up (or "install").

Put more simply, a K-Factor of 1 means every member is bringing you one additional member. A high K-Factor is treasured by social game publishers, because it becomes a very effective vehicle for bringing in new players.

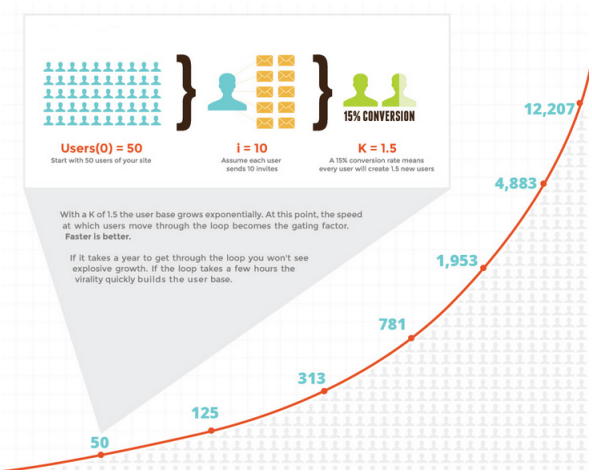


Figure 21.: K-Factor to evaluate the Virality Rate by [Brown(2013)]

Engagement
The term "engagement," in a business sense, indicates the connection between a consumer and a product or service[Gabe Zichermann(2011)]. There is no single metric on the Web or in mobile technology that breaks down or sufficiently measures engagement. Page views and unique viewers don't quite answer the question of who is engaging with our products, services, ideas, websites, and businesses as a whole.
We would be better off thinking of engagement as being comprised of a series of potentially interrelated metrics that combine to form a whole.
[Petersen(2011)]
These metrics are:

- Recency: How long ago did customers visit?
- Frequency: How often did customers come back?
- Duration: How long did customers stay?
- Virality: How many people have customers told about company? (Explained before)
- Rating: What did customers explicitly say when asked about company?

Collectively, they can be amalgamated as an "E" (or engagement) score. The relative proportion, or importance, of each of these metrics will vary depending on the type of business.
Substantially, engagement measures how long they spend playing your game. How many features do they access? Are they spending hours or seconds? How many pages does the average user view? What percentage are returning visitors?
An example, for Facebook the engagement metrics are translated how: *Interactions* (Like, Comments, Shares, Replies, Rewteets, and so on), *Reach* (the percentage of fans that have seen your post from your Page) and *Engagement Rates* calculated with the follow formula:

$$\frac{(\text{Likes} + \text{Comments} + \text{Shares}) \text{ on a given day}}{\text{Total fans on a given day}} \times 100$$

Even if the previously formula is related to Facebook, it can be generalized finding the "useful" actions related to the company and dividing for the number of active users.

Re-Engagement
Gamers stop playing eventually. Re-engagement is how you get them back. It includes re-engaging gamers who have been signed off for an hour, a day, a month, or more[MATT(2010)]. There's a lot of competition out there, so implementing and tracking re-engagement practices is a must.

Lifetime Network Value
Also called LTV, it's the value a user provides to your network over the course of their entire "lifetime" on the network. For instance, is the user contributing to viral effects? Evangelizing the game? Contributing positively to ARPU? This is compared to the User Acquisition Cost, or how much it costs (via marketing and viral efforts) to bring in new members.
LTV metrics is composed by six key shown in Figure 22.

Figure 22.: LTV's keys by [Hoover(2012)]

Let's unpack each LTV's key.

- Monetization: of course the most obvious component of LTV is direct monetization. "Premium" game purchases and pay-to-play transactions is the ideal type of monetization. Influencing a non-paying player to pull out their wallet increases their likelihood of spending in the future and becoming an invested, engaged player.

- Marketplace Exposure: rankings drive free exposure and organic installs, providing ancillary Value for each new install. Consistent expo-

sure is key to driving long-term organic installs. Reviews, and more so ratings, influence user's likelihood of tapping the install button.

- Virality: as said before, each player has the potential to drive new user adoption through face-to-face recommendations, online word-of-mouth, or more formal viral loops. These socialites often re-engage existing and churned players through these organic notifications.
- UGC and Community: new, fresh content is key to keeping an engaged user base; however, this is typically the most costly investment for game creators. Games that support UGC not only benefit from "free" content but also create a meta-game that extends the life of their game, particularly for the most engaged, elder players. Community interaction in forums, leaderboard rankings, and multiplayer/co-op experiences also contribute to Value creation. Although a player may never provide LTV in other areas, their participation in multiplayer matches helps ensure players always have competition to quickly match up against and provides social proof that other are playing the game.
- Loyality: loyal players tend to associate themselves with brands they love, promoting them on their sleeve or through online channels. They also thirst for behind-the-scenes info and sneak-peeks of new content or titles, often signing up for newsletters and other communication channels for future re-engagement.
- Feedback: explicit feedback is provided through support emails, social network posts, forums, reviews, and in-game surveys. As creative and experienced as one may be, some of the best ideas come from players. Arguably more important is understanding what players actually do through implicit feedback. User behavior analytics (when are players churning? what content is selling?) and crash reports (which devices and OS' are experiencing issues?) provide empirical data on areas of improvement. Each player can contribute but statistical significance is required before making any strong conclusions.

Customer Self-Realization Value

Strictly related to the previous concept, this metric want analyzes the behavior of the customer through his lifetime in the company's business.
At the beginning the customer doesn't really knows the products or services offered by the company and so, the relative know-how about these is minimal, but with experience and with the help of the company's services the customer increase his know-how, learning more about the product.
The Customer self-realization value respond for the question like How the customer know who the company is? How the customer know the products? How the customer learn with the company's services? But also, How the sense of self-realization influence the actions computed by the customer or How the self-realization value can influence the Virality Rate.

5 IMPLEMENTATION AND EVALUATION: WEBRATIO GAMIFICATION

In this last chapter, we present the implementation of an application gamified following the game design techniques explained before.
First of all (Section 5.1), we will introduce the environment of the company and the requirements specification that lead to the development of a Gamification approach.
Secondly (Section 5.2) we will describe the architecture of the application, starting from the analysis through UML Diagram, Data Model, the integration with the existing modules and Hypertext Model in which we'll describe the IFML Model used to develop the application.
In the Section 5.3 we will focus on the Gamification design and on the game elements included to solve the business goal defined by the company.
The last section (5.4) of the chapter will be entirely dedicated to the evaluation of the application developed, based on data collected after a phase of Beta testing, finding if the Gamification approach was right to solve the requirements specification.

Before the description of the requirement specification, let's present WebRatio.

WebRatio is a development tool used to design complex data-intensive Web Application by using the Web IFML (Interaction Flow Modeling Language) a modeling language dedicated to the definition of the "User Interaction" dynamics between an application and its user, given the fact that Web IFML is not widespread as other languages, the only source of information and training is the material offered by the company, through its forum and tutorials. At the current time, the resources with which the company interact with its users, current and potential, are substantially: the on-line portal, forum, store and the e-learning center.

on-line portal
The institutional website is fully functional in order to act as an entry point to the world WebRatio. In this sense, the site was built to be a corporate portal and institutional and is perfect for the user who does not know the product but who wants to initially inquire. On the website, the user can download the free version of the tool and can sign up not only to active the personal installation of the tool but to access at the other application (Forum, Store and E-learning center).

Forum
Essential element for any community based on the tool stackexchange.com.

Store
Application that allow the user to expand its personal set of units, downloading new component or style template for own applications. Moreover there is the possibility to publish component that doesn't exist yet on the store to make a possibility to other user to download it.

E-learning center
The Learn Management System (LMS) is the platform newly developed and outgoing with the Gamified application that aims to instruct the user to interact correctly with the tool building applications in the right way using better solution and help him to figure out any component/properties or any other configuration of the tool by using reading, video with short quiz, courses, guides and books.

5.1 REQUIREMENT SPECIFICATION

Business Objectives
Having a collector, a starting point for each user that uses WebRatio, improving the connection and functionalities between the various resources, offering an unique and complete user experience, solving the fragmentation of the platforms and encouraging the user to explore them but, above all, to actively participate at the Portal, Forum, Store and E-learning center. Increasing the participation, the company want loyal users also involving them in all proposed activities and in the same time increasing the vehiculation of the know how of the product triggering a whirlwind of contacts that can increase the market share of WebRatio. Another objective is increasing the visibility of the contacts that use the tool, in particular the visibility of partners and firms using WebRatio. This last aspect is important because show the companies and big firms is a symbol of prestige and importance that instantly situate WebRatio in the influential business societies.

Target Players
Students and professors of universities that want use the WebRatio tool per personal or educational scopes, clients that use the tool to generate applications for personal business scope and partner and partners that share the use of the tool such a new methodology to build web application. Do not forget, also the WebRatio's employees use Forum, E-learning and Store to increment their know how.

Target Behaviors
Registering to the platform, Registering the serial of a product (to distinguish between partners, firms or common users), Login to the platform, Posting or replying to questions in the forum, Reviewing, downloading or publishing content to the store, Training with the use of the E-Learning platform.

5.2 ARCHITECTURE

After having examined all the business goals, the idea of creating a centralized entry point for all the Webratio public activities was born. The company needed an application which was able to join all the other modules, already present on the web (Forum, Store, LMS and Institutional Website), creating an unique user experience.
According to these goals the best choice that could fit all the requirements it is a web community, called **WebRatio Community**. In this way all the customers who use Webratio will obtain visibility and new users and potential clients will be attracted to this new social platform.
All the existing portals are developed with WebRatio tool and also the community will be created with the web modeling software of the company. WebRatio offers, through the IFML (Interaction Flow Modeling Language) standard a graphical way to create applications, thanks to a modeling language dedicated it is possible define the user interaction dynamics between an application and its user.
It allows the definition of: the pages/windows through which the application interacts with the user, the objects/data displayed by the application or managed by business logic, the bindings among displayed contents, objects/data and events and the logic that determines the sequence of actions to perform in response to an event.
The language is abstract and independent from the implementation technology. It covers all application domains: desktop applications, client-server, Web, digital TV, HMI, etc....
The language has a very compact and intuitive visual notation that makes it a versatile and universal tool used by software architects and developers for the UI specification.
WebRatio is integrated in the Eclipse IDE. WebRatio shares therefore the same workspace as all the tools and extensions already available in Eclipse for developing JEE applications.
Web applications built by WebRatio comply with the Java/JSP 2.0 standard and can be deployed on any application server, including: Apache Tomcat, JBoss, Caucho Resin, Oracle WebLogic Application Server, IBM WebSphere.
Web applications built by WebRatio are naturally integrated in a SOA environment, where they can collaborate with any other distributed system. WebRatio natively supports the definition and generation of applications that publish, consume and orchestrate Web Services. Generation rules can incorporate any graphic template, written in any language HTML, CSS, AJAX, Javascript, as well as Rich Internet Application interfaces and components.
Web applications built by WebRatio employ the most popular java libraries, including Hibernate, Struts, JSTL, JSP, and Java Servlet. The generated code is completely open and does not rely on proprietary components. If needed, applications can be maintained without using WebRatio any more, like a standard Java/JSP project.
Code generation rules produce highly optimized code, meeting the standards of mission critical applications. If needed, post-production optimizations can be applied to the generated code, and incorporated in the generation rules.
WebRatio's Web applications can manage user authentication and profiling by integrating with the most popular identity management systems like LDAP, Oracle SSO and MS Active Directory. Security can be enhanced by exploiting the SSL protocol. All the user-dependent features are managed

by the application model.
Through the development and integration of new custom components, Web applications built by WebRatio can integrate with any legacy system. WebRatio exploit the Hibernate libraries and can be connected to any database supporting the JDBC standard, including: PostgreSQL, MySQL, Oracle 8i/9i/10g/11g, IBM DB2, Microsoft SQL Server 2000/2005/2008, Apache Derby.
WebRatio fully supports the production of multilingual applications. The application model editor allows to define translations for every label and a localized format for each data type, in all the desired languages. The Web applications built by WebRatio are UTF-8 compliant. All the portals already present in WebRatio have as database PostgreSQL with the exception of LMS module which uses MySQL. For homogeneously reasons, the community opts for PostgreSQL.
PostgreSQL is a powerful, open source object-relational database system. It has more than 15 years of active development and a proven architecture that has earned it a strong reputation for reliability, data integrity, and correctness. It runs on all major operating systems, it is fully ACID compliant, has full support for foreign keys, joins, views, triggers, and stored procedures (in multiple languages).
An enterprise class database, PostgreSQL boasts sophisticated features such as Multi-Version Concurrency Control (MVCC), point in time recovery, tablespaces, asynchronous replication, nested transactions (savepoints), online/hot backups, a sophisticated query planner/optimizer, and write ahead logging for fault tolerance.
All the business portals are deployed on Apache Tomcat, so since even the community will be one of the portals of WebRatio, we decide to deploy the application on it.
Apache Tomcat is an open source software implementation of the Java Servlet and JavaServer Pages technologies. The Java Servlet and JavaServer Pages specifications are developed under the Java Community Process.
Tomcat implements the Java Servlet and the JavaServer Pages (JSP) specifications from Sun Microsystems, and provides a pure Java HTTP web server environment for Java code to run in.
Apache Tomcat includes tools for configuration and management, but can also be configured by editing XML configuration files. As non-functional requirements, the community does not need particular expedients, but to provide an enjoyable experience, we focus on three precise aspects: Usability, Performance and Extensibility.
Before explain in depth the architecture we give a definition of these parameters:

- Usability, the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use. It is composed of: Learnability, how easy is it for users to accomplish basic tasks the first time they encounter the design?, Efficiency, once users have learned the design, how quickly can they perform tasks?, Memorability, when users return to the design after a period of not using it, how easily can they re establish proficiency? Errors, how many errors do users make, how severe are these errors, and how easily can they recover from the errors? Satisfaction, how pleasant is it to use the design?

- Performance is measured by the output behavior of the application. In other words, performance is whether or not the application is fast.

A good performing web application is expected to render a page in around or under one second (depending on the complexity of the page). It is very important to maintain good performances even under a heavy load

- Extensibility is a system design principle where the implementation takes future growth into consideration. It is a systemic measure of the ability to extend a system and the level of effort required to implement the extension. Extensions can be through the addition of new functionality or through modification of existing functionality. The central theme is to provide for change, typically enhancements, while minimizing impact to existing system functions.

5.2.1 Use case

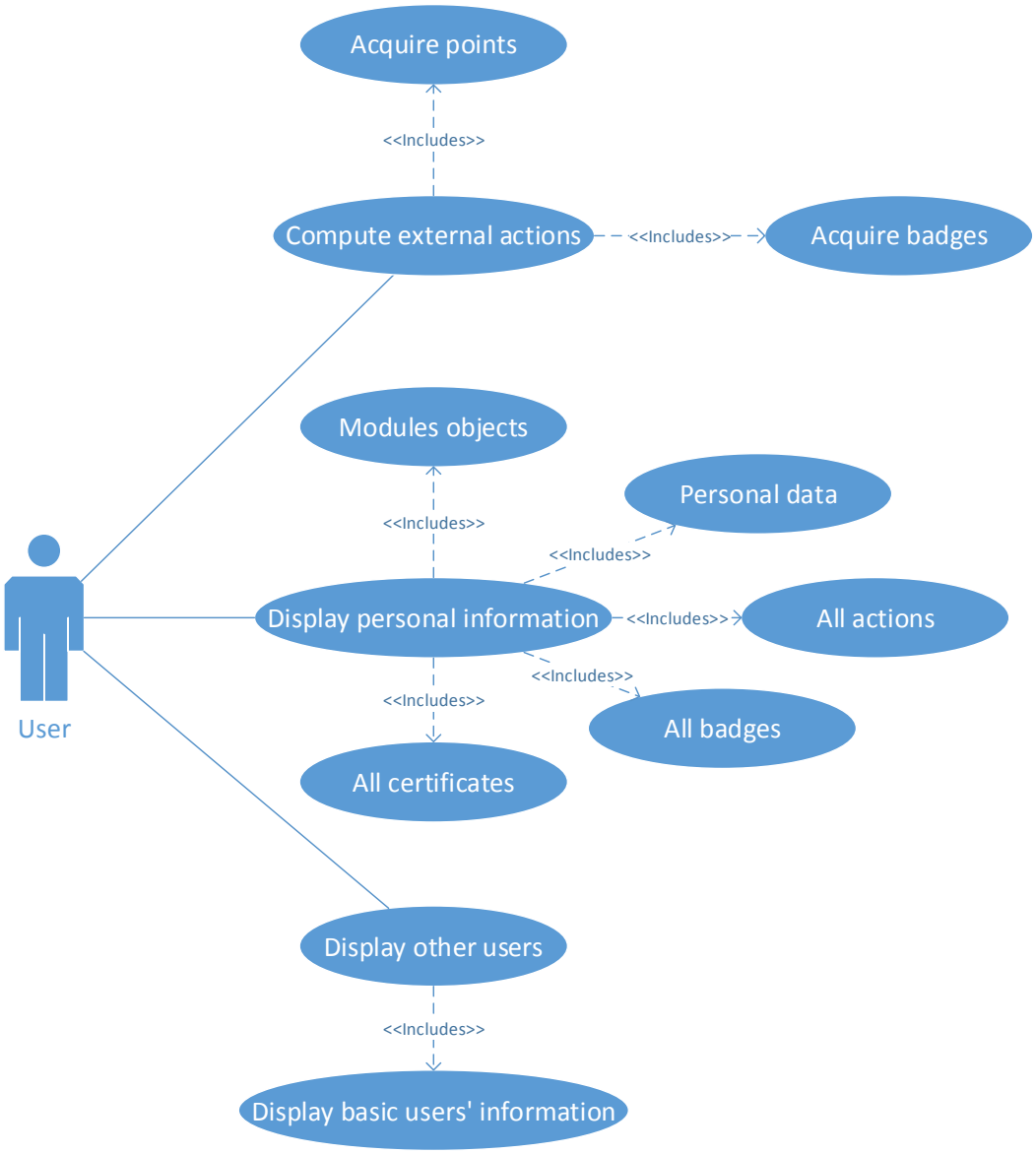


Figure 23.: Use case diagram of WebRatio Community

In Figure 23 there is the Use Case diagram that shows the most important actions that the user can perform inside the community:

- Compute external actions: consumers can execute a lot of operations through all the portals, such as post a new question inside the Forum, read an article in the LMS, acquire a WebRatio certification,etc.... Albeit all these actions take place outside the physical pages of the community, they are strictly linked to it. In fact each action contributes to all the gamification parameters owner of the community. Every time that a new action is performed, the customer receives points regarding participation, reputation and credits. Moreover the system checks, through specific gamification logic, if the user is entitled to receive an award and, if it is the case, it assigns the badge to the user. In conclusion, the user accomplishes an action through one of the modules, and as consequence this event is registered with the scores about it and the game mechanisms are computed.

- Display personal information: user can display all his information, regarding the classic personal data (first name, last name, company name, social accounts...), all the actions performed (in chronological order) which have contribute to obtain all his scores in the community, the history of the badges acquired with the date of acquisition, the certificates of WebRatio knowledge obtain. The certificates and the badges are shown through a graphical representation that show even the goals that the user has not yet gained, in this way the game mechanisms of challenge are fulfilled. Moreover the customer can consult a set of data regarding the modules integrated inside the community. It is possible flip through the LMS articles read, courses done, video watched, Forum post where he took part, the component downloaded from the Store and an expansive set of new object suggested in each modules.

- Display other users: Any user can consult the data about the other person in the community. Even the latest objects and activities performed in the other portals are visible.

5.2.2 Data model

A crucial point in all software developing process is the planning of a suitable data model that is suitable for the software functions.
For these reasons, to manage all the game mechanisms and features we design a data model based on the main principles of the gamification theories. As shown below, the structure of the community database is developed to fit all the gamification requirements and to be as independent as possible respect all the WebRatio portals.
Now we introduce an explanation and a description for each table by mentioning their motivation, their structure and their use in the application.

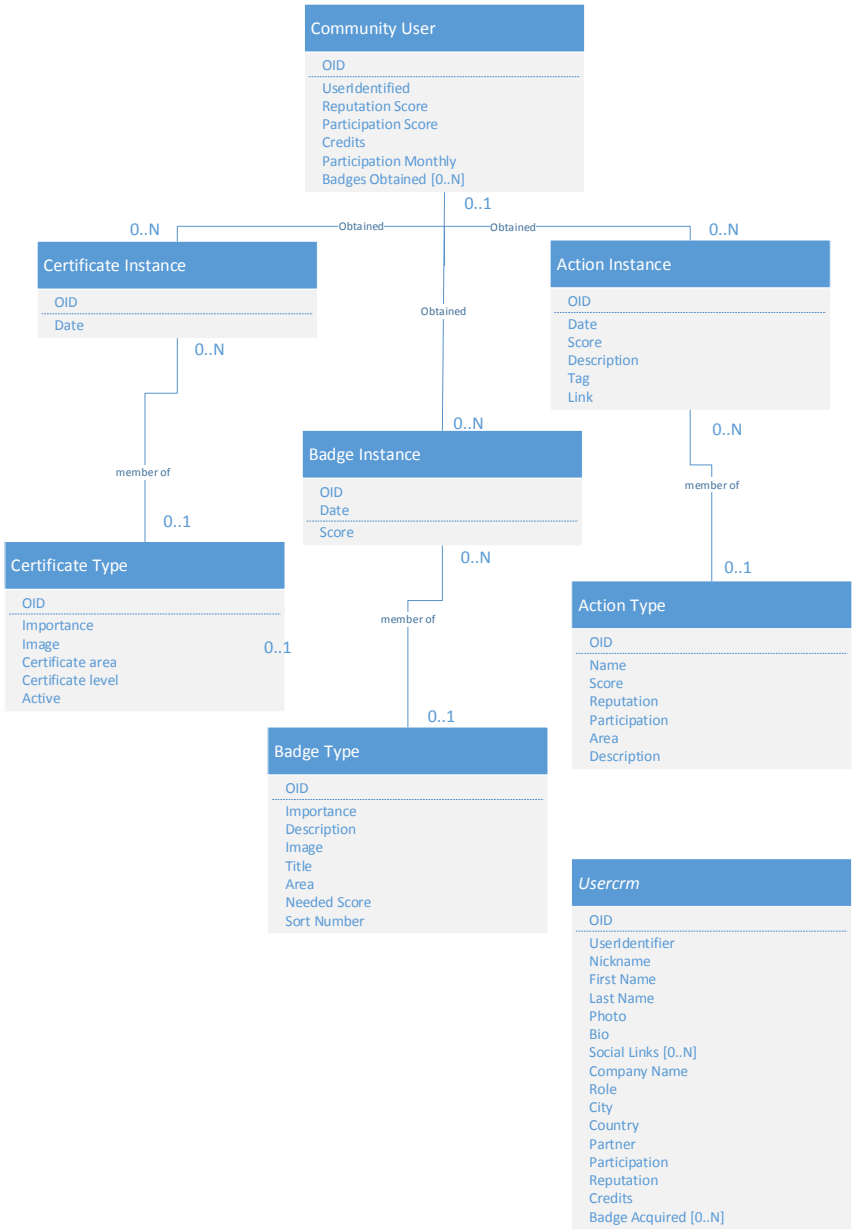


Figure 24.: Data model of WebRatio Community

Community User

The table where all the user of the community are stored. For each consumer, his personal data (biography, social accounts, photo, first name, last name, nickname, etc.) and all points (participation, participation monthly, reputation and credit) with the most important badges acquired are gathered.

The nickname, if set, is the attribute that identify the user internally the community, otherwise the first name and last name are shown. The Community User table is necessary to store all the customers who participate on the community with their personal info.

It is fill in the first time when the user perform one action, always if his profile is set as public (prerogative to be part of the community).

Structure

- OID, PRIMARY KEY (Integer)
- User Identifier (String)
- Reputation (Decimal)
- Participation (Decimal)
- Monthly participation (Decimal)
- Credits (Decimal)
- Certification Badge (Image)
- Certification Badge Title (String)
- Forum Badge (Image)
- Forum Badge Title (String)
- Store Badge (Image)
- Store Badge Title (String)
- LMS Badge (Image)
- LMS Badge Title (String)
- Nickname (String)

Information model

Table 1.: Information model of Community User

OID	User Identifier	Reputation	Participation	Monthly participation
1456	matteo.rossi	400	1600	300

Credits	Nickname	Cert.Badge	Cert.Title	For.Badge	For.Title
1600	Matteo Ros	cert-01.jpg	Trainee	for-01.jpg	Starter

Store.Badge	Store.Title	LMS.Badge	LMS.Title
store-01.jpg	Starter	lms-01.jpg	Scholar

UserCrm

The Community User is strictly connected to a database view which has a fundamental role inside the community architecture. UserCrm is a view cross-database, executes thank to dblink, that is a module which supports connections to other PostgreSQL databases from within a database session. It connects the table Community User owner of the community database with the Contact table owner of the WebRatio CRM (Customer Relationship Management) database.
In this way the community can access to all the WebRatio contact without using directly the business database of the society. In general the big difference between the Community User table and the UserCrm view is that the first one is utilized to store in a persistent way all the customers who have take actively part inside the community and to allow the creation of the relationship among the users and all the table owner by the community database (Action Instance, Badge Instance, Certificate Instance).
Instead the view is used to display the list of users and all the data related to each customers in the community application, so it is not necessary to import all the personal data regarding each user but it is possible import only a simple unique attribute, the User Identifier. In fact the matching

between the Community User and UserCrm is made through the User Identifier, a special attribute assigned in a precise way by WebRatio during the registration phase in the WebRatio portal. Through this view it is possible to maintain a large grade of independence among the community and all the portals, and in the detail with all the personal information of the users. The view captures all the information regarding the customers and join these personal data with the data regarding the gamification (badges) present in the Community User.

Structure

- OID (Integer)
- User Identifier, PRIMARY KEY (String)
- First Name (String)
- Last Name (String)
- Company Name (String)
- Certified (Boolean)
- Role (String)
- Small photo (Image)
- Big photo (Image)
- Partner (Boolean)
- Internal (Boolean)
- Twitter (String)
- Linkedin (Strin)
- WebSite (String)
- Bio (String)
- Country (String)
- City (String)
- Geographical area (String)
- Reputation (Decimal)
- Participation (Decimal)
- Monthly participation (Decimal)
- Credits (Decimal)
- Certification Badge (Image)
- Certification Badge Title (String)
- Forum Badge (Image)
- Forum Badge Title (String)
- Store Badge (Image)
- Store Badge Title (String)
- LMS Badge (Image)
- LMS Badge Title (String)
- Nickname (String)

Information model

Table 2.: Information model of UserCrm

OID	User Identifier	First Name	Last Name	Company Name	Certified	Role
1253	matteo.rossi	Matteo	Rossi	PoliMi	False	Student

Small photo	Big photo	Partner	Internal	Twitter	Linkedin	WebSite
photo.jpg	photo.jpg	False	False	twitter.com	linkedin.com	website.com

Bio	City	Country	Geo.Area	Reputation	Participation	Month.Participation
Info	Como	Italy	Europe	400	1600	300

Credits	Cert.Badge	Cert.Title	For.Badge	For.Title	Store.Badge
1600	cert-01.jpg	Trainee	for-01.jpg	Starter	store-01.jpg

Store.Title	LMS.Badge	LMS.Title
Starter	lms-01.jpg	Scholar

There are three tables that work as dictionaries and are Action Type, Badge Type and Certificate Type. These table are created to be the keys of their objects, are developed to be completely manageable and they allow the system administrator to organize all the features.

Certificate Type
Certificate Type consist of all the WebRatio academy certificates divided by area, level and importance.
The certificates are a written declarations that proof the abilities and the knowledge in the use of the WebRatio tool.
This table has been created to management reasons, because it has been necessary to have a schema where all the type of certificates are described and cataloged.
It is completed by the administrator of the system in a static way, basically once it is compiled, it does not change.

Structure

- OID, PRIMARY KEY (Integer)
- Key (String)
- Importance (Integer)
- Image (Image)
- Checked Image (Image)
- Area of Certificate (String)
- Level of Certificate (String)
- Active (Boolean)
- Sort Combination (String)
- HD Checked Image (Image)
- HD Image (Image)

Information model

Table 3.: Information model of Certificate Type

OID	Key	Importance	Image	Checked Image	Area
1	area.level	1	cert-01-no.jpg	cert-01.jpg	Certification

Level	Active	Sort Combination	HD Checked Image	HD Image
Trainee	False	1	cert-01.jpg	cert-01-no.jpg

Action Type
Is the table where all the activities executable in the community are described, in this way all the actions that are responsible of the gamification mechanism are traceable and manageable.
For all actions are depict the area of WebRatio where the event can take place, the score assigned to the user, the nature of the occurrence, if it has a reputation impact and the action's name and a brief description.
It allows the classification of the actions and the related identification, it is one of the most important table to implement the gamification mechanisms.
It is managed by the system administrator who compile it in a static way but he can manage it motoring how is the community going, modifying points or actions.

Structure

- OID, PRIMARY KEY (Integer)
- Name (String)
- Score (Decimal)
- Reputation (Boolean)
- Participation (Boolean)
- Area (String)
- Description (String)

Information model

Table 4.: Information model of Action Type

OID	Name	Score	Reputation	Participation	Area	Description
32	Post a question	10.00	False	True	Forum	Post a question

Badge Type
Is used to declare all the rewards that the community provides to its customers, in this structure is describe for each badge the area of WebRatio where it can be gain, the needed score that the user must have to obtain it, the importance of it, in relationship of a classification of all the other awards grouped by area.
As the two previous one, it is created for manage the badge by the system administrator and thanks to its dynamics planning, it allows several adjustments even while the community is running.

Structure

- OID, PRIMARY KEY (Integer)
- Importance (Integer)
- Description (String)
- Checked Image (Image)
- Image (Image)
- Title (String)
- Needed Score (Decimal)
- Area (String)
- Sort Number (Integer)

- Key (String)
- HD Checked Image (Image)
- HD Image (Image)

Information model

Table 5.: Information model of Badge Type

OID	Importance	Description	Checked Image	Image	Needed Score
1	1.00	First answer	for-01.jpg	for-01-no.jpg	100.00

Area	Title	Sort Number	Key	HD Checked Image	HD Image
Forum	Starter	1	area.level	HD for-01.jpg	for-01-no.jpg

These three dictionary tables are each one their instance tables: Certificate Instance, Badge Instance and Action Instance.
Each occurrence of the instance tables is connected to a particular object of the competence dictionary.

Certificate Instance
Is where all the certificates acquired by the user is stored with the date and time of acquisition.
Each row of this table is linked with its dictionary table Certificate Type through the foreign key.
It is use every time that an user gains a certificate of knowledge.

- OID, PRIMARY KEY (Integer)
- Date (Timestamp)
- Certificate Type OID, FOREIGN KEY (Integer)
- Community User OID, FOREIGN KEY (Integer)

Information model

Table 6.: Information model of Certificate Instance

OID	Date	Certificate Type OID	Community User OID
1	2013-02-03 16:00:00	10	4516

Action Instance
Registers all the actions performed by the users with the date and the time. Each instance is linked with the Action Type identifier. Two important attributes are saved: Tags and Link, that identify a set of meaningful words associate at the action performed and the hyper-textual link relate to the web page where the action occurs. It is use to store all the actions of the customers inside the community database, every time an event happens a new row is inserted in the action Instance table.
WebRatio tool allow to import in a table some derived attributes from other tables that are in relationship with it (through the creation of a view).
In this case attributes derived are Action Area, Reputation, Participation, Name (of the action) and Description.

Structure

- OID, PRIMARY KEY (Integer)
- Date (Timestamp)
- Score (Decimal)
- Action area (String)
- Reputation (Boolean)
- Participation (Boolean)
- Name (String)
- Description (String)
- Tag (String)
- Link (String)
- Action Type OID, FOREIGN KEY (Integer)
- Community User OID, FOREIGN KEY (Integer)

Information model

Table 7.: Information model of Action Instance

OID	Date	Score	Action area	Reputation	Participation	Name
1	2013-02-03 16:00:00	400	Forum	False	True	Answer to a post

Description	Tag	Link	Action type OID	Community User OID
How do I compare strings...	Java,String	345	33	2341

Badge Instance
Is the collection of all the awards assigned by the community with date and time of the gains.
Each row of this table is linked with its dictionary table Badge Type through the foreign key, but the score attribute is registered and not imported, so in this way it will be possible keep track of contingent score points variation during the community evolution. It is use every time that an user gains a badge thanks to the points acquired inside the community.

Structure

- OID, PRIMARY KEY (Integer)
- Date (Timestamp)
- Score (Decimal)
- Badge Type OID, FOREIGN KEY (Integer)
- Community User OID, FOREIGN KEY (Integer)

Information model

Table 8.: Information model of Badge Instance

OID	Date	Score	Badge Type OID	Community User OID
3	2013-02-03 16:00:00	400	1	2341

5.2.3 Integration

For the community project, the integration is a main operation, since one of the scope of the community is to centralize all the WebRatio existing modules and develop a unique, universal application. The community has been created to be the main and crucial core of all WebRatio business.
The centrality is a key point, all the existing modules are put in relationship with this new heart of WebRatio.
To accomplish these functionalities, we have developed a set of "bridge applications" (generated with WebRatio tool) that are able to create a connection between the community and each individual module. These bridge applications are developed in a independent way that allow all the systems to remain autonomous, without any need to be redefined or changed.
This is a material point for the community, which has as requirement the independence across modules, platforms and programming language. Basically for each WebRatio portal, a bridge application has been developed, all these applications are able to understand when a new relevant event (for the purposes of Gamification action) happens, in consequence they alert the Gamification core of the community that handles the occurrence according to the application rules. The applications are able to take notice of something happens thanks to an automatic triggering that execute the applications and the control of the new events.
In order to interact with the "bridge applications", the community provides a set of Web Services which can be invoked by all the application that they want to send some actions.
The services are software system designed to support interoperable machine-to-machine interaction over a network, they are developed with WebRatio tool through the SOAP protocol.
SOAP, originally defined as Simple Object Access Protocol, is a protocol specification for exchanging structured information in the implementation of Web Services in computer networks.

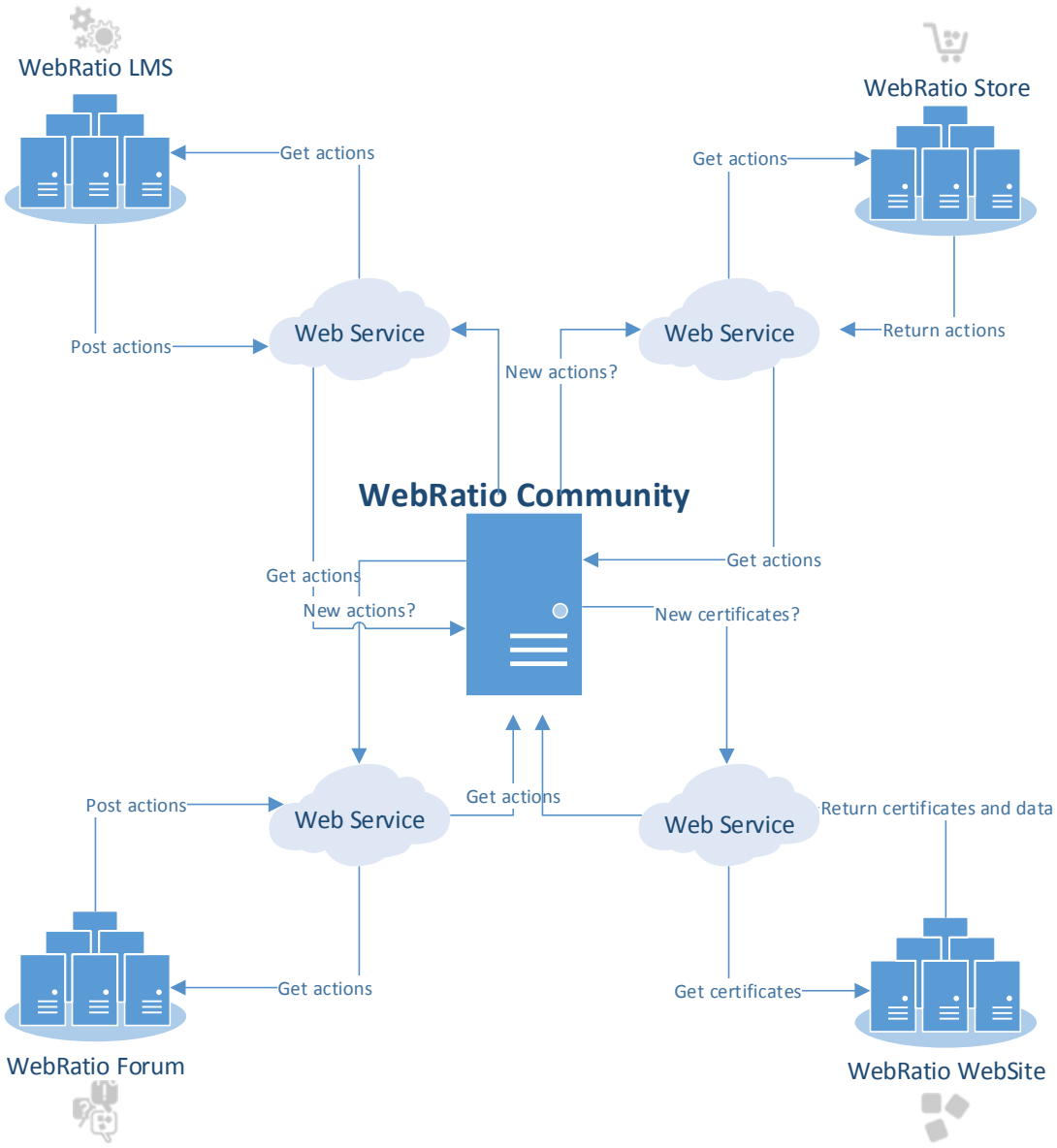


Figure 25.: Integration of WebRatio Community with WebRatio's modules

This graph show the architecture of the application, all modules communicate with the core of the application or vice versa is the core that communicates with the module.

- For the Store: the community periodically controls if there is a new user, who downloads, uploads, votes or reviews components and with these data the application can assign points to the user that has accomplished those operations in the store area.

- For the Forum: the procedure is the opposite, it is the same Forum that advise the community that something happened. The Forum invokes the Web Service of the community sending the information related to the action executed (create post, answer, vote up, subscription...).

- For the Learning Management System: as for the Forum, LMS, directly invokes the community providing all the information regarding the activity performed by the user.

- For the Web Site: the institutional site that call the Web Service of the community that assigns points for every login, update of user data or for a new user's registration. At the database used for the website, the community takes advantage of the "bridge application" that periodically scan the its finding if there are users who have acquired new WebRatio Certification or if there are new users who have activated the license of WebRatio.

The community can not begin with no data or with no information, basically for two reasons: for gamification purpose, it is not a good choice to reset and cancel all the previous user's actions, and for fundamental design rules because it is less attractive start with an empty portal.
To fulfill this crucial point for all the platforms, we use the "bridge applications" to perform a first time import (execute only one time) of all the previous data belonging to each modules, in this way all the historical data are preserved and made available to the community.

5.2.4 Sequence diagram

To explain in a better way how the Web Services and the bridge applications work, we describe depth two sequence diagrams which represent two typical instances.

The diagram in Figure 26 depicts the situation where is the WebRatio module (LMS, Forum, Site) itself that is able to catch the user action and consequently call the community to alert it.
The user executes an action in one of the portals which are able to advise the community, for instance, he could read an article about Webratio knowledge, he could create a new Forum post or in general any actions performable in LMS, Forum and WebRatio Site (with the exception of the certificates acquisition).
When the user has executed the action, the module call directly the Web Service of the community, that receives the action with all the data needed (action name, descriptions, user nickname, area of the portal, date, time, tags, and link).

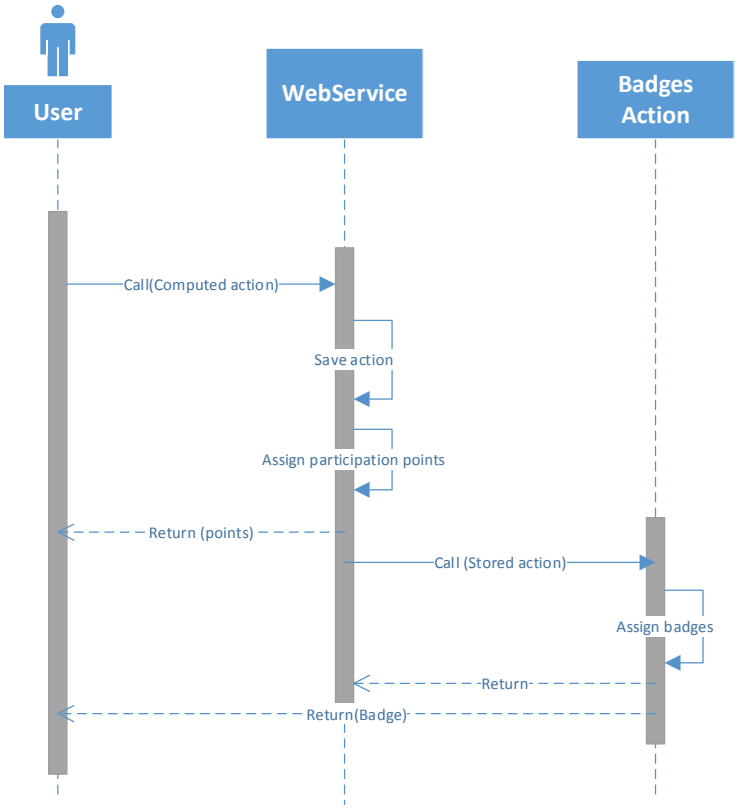


Figure 26.: Sequence diagram 1 of WebRatio Community

From this moment the community takes charge and computes the points and the possible reputation influence which will be assigned to the user. After that the points and credits are appointed, the gamification logic about badges and awards are performed.
The community checks if the user has acquired a sufficient number of points to acquire a badge, whether this is the case, the user will receive one or more badges which certify his success.

In the opposite case, the second diagram (Figure 27) depicts the situation where a bridge application (a job) is needed to check if there are new actions to send at the community Web Service.
The job service consults with a mean of three, five minutes the databases of the WebRatio modules (Store, Certificates) and parse the data.
Whether the job finds out that the new actions have been executed, prepare the data in the right format and send them at the community Web Service.
From this point forward the dynamics are the same one of the previous sequence diagram, that is, before the community saves the actions assigning the participation, credit and if is the case even the reputation, after that the gamification logic controls whether is the user has enough points to acquire badges.

One key point to note, that is valid also for the previous example, is that it can happen that some actions which arrive at the community Web Service are not stored because the gamification logic considers them not valid.

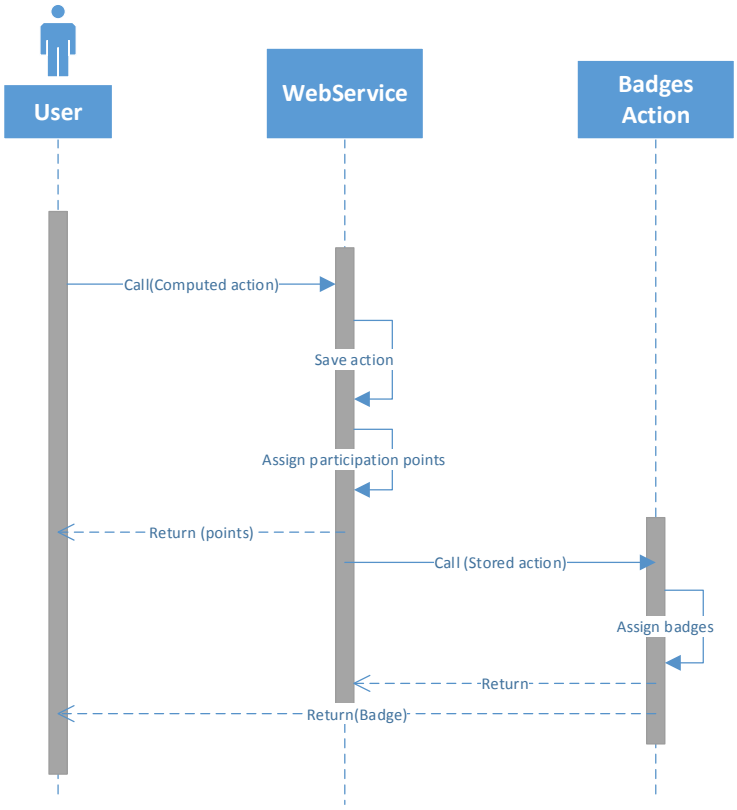


Figure 27.: Sequence diagram 2 of WebRatio Community

For instance, the community assigns participation point for every login, if and only if, at least, each login is distant one hour from the previous one. So it can happens that some actions referring, for example, to the login operation, it will be rejected by the community if one hour has not yet passed from the previous instance.

5.2.5 Hypertext model

In this section we depict some WebRatio modeling operations which describe the Web Services and the gamification logic apply to assign the awards, before that we make an introduction about the Web Service.
WebRatio provides all the necessary features for both publishing and interrogating a Web Service. The W3C defines a Web Service as "a software system designed to support interoperable Machine to Machine interaction over a network." Web Services are frequently just Web APIs that can be accessed over a network, such as the Internet, and executed on a remote system hosting the requested services.
The W3C Web Service definition encompasses many different systems, but in common usage the term refers to clients and servers that communicate using XML messages that follow the SOAP standard. Common in both the field and the terminology is the assumption that there is also a machine readable description of the operations supported by the server written in the Web Services Description Language (WSDL). The latter is not a requirement of a SOAP endpoint, but it is a prerequisite for automated client-side code generation in the mainstream Java and .NET SOAP frameworks. The specifications that define Web Services are intentionally modular, and as a

result there is no one document that contains them all. Additionally, there is neither a single, nor a stable set of specifications. There are a few "core" specifications that are supplemented by others as the circumstances and choice of technology dictate.

WebRatio adopts the SOAP specification. It's composed of an XML-based, extensible message envelope format with "bindings" to underlying protocols. The primary protocols are HTTP and HTTPS, although bindings for others, including SMTP and XMPP, have been written. When you publish a Web Service using WebRatio, the tool automatically generates the Web Service description in WSDL (Web Services Description Language). This is an XML format that allows service interfaces to be described along with the details of their bindings to specific protocols. Typically it is used to generate server and client code, and for configuration.

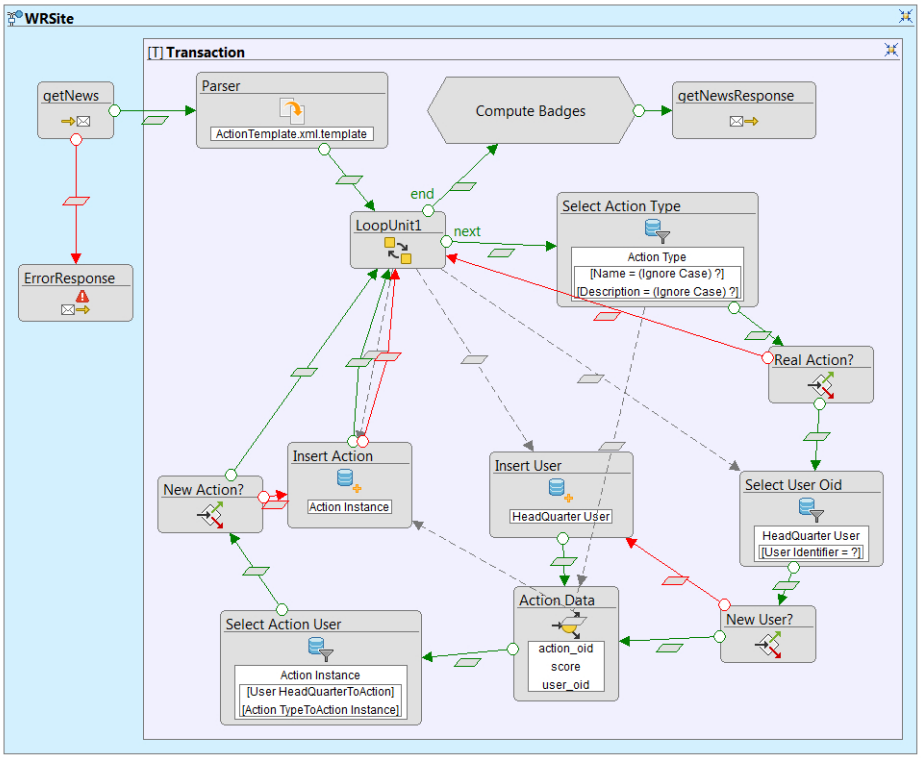


Figure 28.: Web Service to get new actions

The figure above represents the extensions dedicated for the Web domain of the IFML standard of the Web Service used to compute the request coming from the several modules that call the community.
Following the logic path is rather simple because it is enough follow the green arrow in a sequential way starting from the entry point.
The container of all the components is called WRService, it is a WebRatio Port, a Web Service can have different ports, which represents a Web Service Operations container.
The component getNews is called Solicit and represents the entry point to the Web Service operation, it is the start point for each Web service. When the Service is invoked the Solicit component is the first one to be executed,

it receives as input the XML document send by the WebRatio Site. The structure of the SOAP request message looks like the following:

```
<soapenv:Envelope
xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:get="http://www.webratio.com/webservices/getWRnews">
        <soapenv:Header/>
        <soapenv:Body>
            <get:getNews>
                <DATA>
                    <!–1 or more repetitions of actions–>
                    <action>
                        <nickname>user nickname</nickname>
                        <time>2013-12-25 00:00:00</time>
                        <area>Web Site</area>
                        <name>Certificate</name>
                        <description>Modeler Expert</description>
                    </action>
                </DATA>
            </get:getNews>
*</soapenv:Body>
</soapenv:Envelope>
```

The Solicit component receives the XML document and pass it to the Adapter Unit "Parser" that scans the input document and then transform it in a list of tokens which are analyzable from the gamification logic. The result of the Parser is passed to the Loop component designed to iterate over an array of objects. At each iteration the unit provides as output parameters both the current object and the current index. The Loop component must be the source of two distinct OK links: one is followed when the iteration is not finished, and must be marked with the Next link code; the other is followed when the iteration has reached its end, and must be marked with the End link code.
In this case the Loop takes as input all the action send at the Service, divided by type of information.
The next component is the Selector component used to retrieve a list of entity instances, the common usage of the Selector is to retrieve data and pass it to other Web Model elements.
It receives as input the Description and the Name of the action, then search if there is a valid action associated in the dictionary table (Action Type), to check whether the Selector has retrieved some results the output of it, it is passed to the Is Not Null component (Real Action?) that it's used to check whether the value passed to the unit through the parameter is null or not. The unit can follow only two different paths, depending on the result of the unit.
If the result is valid (there is a correspondence in the Action Type dictionary) the flow of the operation continues following the green array otherwise the red arrow (KO Link) is taken.
The KO Link leads the flow again to the Loop component since the data was not valid and the first iteration ended. The OK pass to the another Selector component that check the user through his User Identifier (a special string created automatically during the registration phase). Also after this Selector the community controls through a Is Not Null component (New User?) if

the user is already present inside the Community User table. Whether the user is not present (KO Link) a new instance of User is inserted thanks to a Create component (Insert User), it's used to create instances of an entity. When the Create component is activated it physically creates one or more new rows of the physical table related to the selected entity storing the data received as input.
It is noteworthy that in addition to the red and green arrow there are some dotted arrows which is used only for passing context information from one component to another one.
In this case the Loop component pass to the Create component the User Identifier of the user. After the creation of the user all the data regarding the user and the action instance is passed to a Collector Parameter (Action Data) that is used to store temporarily a set of parameters. The flow control, if the user was already present in the community database, would have passed to the Collector Parameter by the KO Link since the control on the null value of the User (on the Is Not Null New User?) would be negative outcome.
Now the figure represent that the flow control is taken by another Selector component which check if the user has already accomplished this particular action.
This specific inspection is needed for those types of actions which an user can perform multiple times but the community, respecting its gamification policy, want to reward only the first time. For instance, actions as setting the photo profile, social accounts, company, activate a particular version of WebRatio tool, etc... Are all actions that receive the gamification points only the first time when is performed, in this way it is avoided that unjust users can obtain multiple point cheating.
But for other type of events as create a question in the Forum, post an answer, etc... The community can assign directly the points to the user since these types of actions can be executed many times.
In the case on the figure, the Selector (Select Action User) executes the query and pass the result to a Is Not Null component (New Action?) to check if there is already this specific action. Whether the action is already performed, the KO Link is followed and the iteration is ended, otherwise through the green arrow, all the data previously prepared, with the foreign keys about user and action type, both obtain through the Selector Component, is submitted to the Create component (Insert Action) that can create a new row on the Action Instance table.
When the new action is inserted, the iteration ended and a new cycle can start with other data present in the Loop component. After all the data are iterated, the Loop component followed the green arrow End, because no more data is available.
The flow control pass to the Action called Compute Badge, which allow the community to evaluate the reward logic (see the next paragraph to the detailed description).
In the end, Response component (getNewsResponse) is executed to send back the response to the modules or to the bridge application which have invoked the community service.
The Response component can add to the response some parameters to communicate the result of the operation.

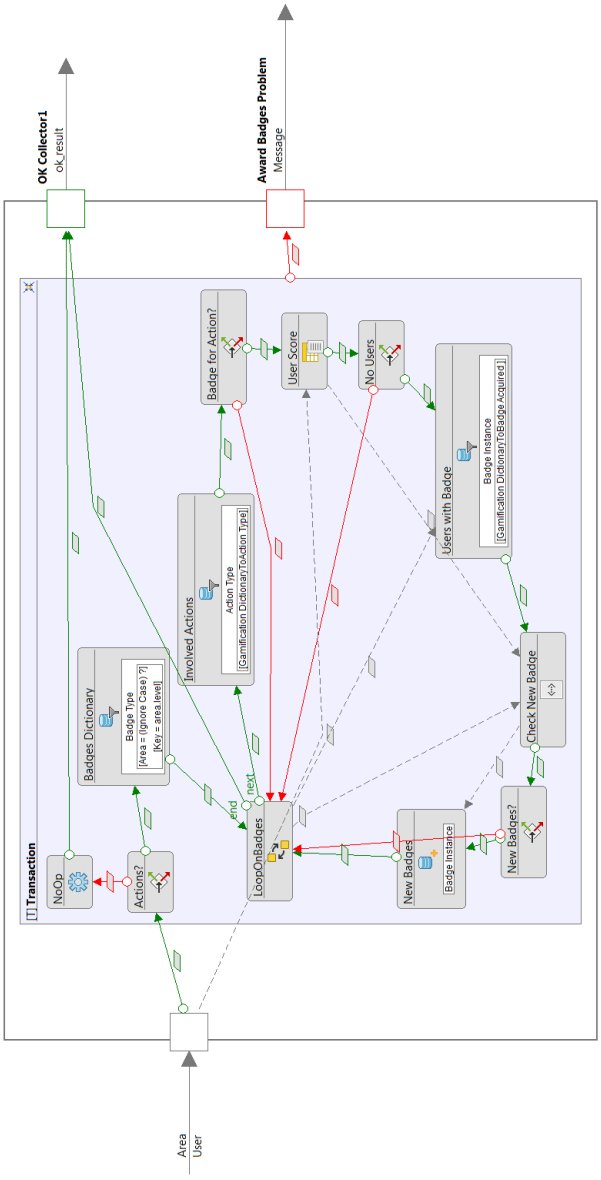


Figure 29.: Action to compute the acquisition of badges

As show in the previous paragraphs, when all the actions received from the community, are evaluated, the action Compute Badges is executed. First of all a definition of action in WebRatio domain is needed. An action is a WebRatio concept that allows you to create patterns and use them everywhere in your Web Project without having to copy all the pattern but just referencing it. The main advantages on use it are: Maintenance Facility, it's possible to easily change the pattern if there are mistakes or you simply want to modify it. If the pattern is replicated everywhere you want to use it in the project, you would have to search each point in which the pattern is placed and replicate the change. Using modules you "centralize" the logic in one point (the module itself) and you have to make changes only in one place, saving time and other errors.
Web Model Readability, using modules you can orient yourself better navigating the Web Model. When you deal with big projects you often have a complex Web Models with many units and pages and finding something in

it may become difficult even using the predefined searches. Moreover you can hardly remember what a complex operation chain does; instantiating a module and giving a name to it clears better what's the purpose of the module and helps you understand and read better the Web Model itself. The entry point of the action receives as input the area where the actions have taken place and the Users Oid who have executed the actions. All the components are in a container called Transaction that has the scope of guarantee the set of properties ACID (Atomicity, Consistency, Isolation, Durability).
The first component to be executed is the Is Not Null component (Action?) that check if there is some actions sent by the last invocation of the Web Service, the control is made by passing the Users Oid. Whether no action was present the Compute Badge action already ended for lack of event (KO Link), otherwise the red arrow is followed and a Selector component (Badge Dictionary) retrieves all the badges assignable with the needed score to obtain them for that particular portal area passing as input (Forum, LMS, Certificates, Store).
All the results found out by the Selector are passed to the Loop component that iterate on all the dataset of badges. The first component in the iteration is a Selector (Involved Actions) that retrieve all the actions which are linked with the first badge, these associations are made by the system administrator in the administration area, where all the data regarding the gamification are manageable. In this case the relationship many to many between Action Type and Badge Type is exploited.
The result of the selection is checked by the Is Not Null component (Badge for Action?) to be sure that there are actions for that particular badge, otherwise the next badge is take in consideration (end of iteration).
Whether there are some valid actions for the badge, the gamification logic computes which users are computed that actions and which are their piled points. To accomplish this task a Query component is used, it permits to execute a custom edited query using the HQL(Hibernate Query Language) or SQL query language. Moreover it can dynamically compose an HQL query depending on the incoming data model identifiers. The Query component (User Score) receive as input all the involved actions and retrieves as output all the users who have performed at least one of those actions with their scores.
To avoid to going on with no data, a Is Not Null component (No User) checks if there is at least one user who has executed those actions. If there is no user the iteration ended (KO Link), otherwise the OK Link is followed and the Selector (Users with Badges) is computed. This Selector finds out which badges, the users obtained from the Query component, are already achieved from the same users (scan the database table Badge Instance).
Obviously this operation is needed since an user can gain one particular instance of badge only one time. When all the data are ready (Users oid, Users scores, Badges oid, Badges Needed scores), the reward logic is executed through the Script component (Check New Badge).
The Script component is a WebRatio component that allow the developer to create a piece of Groovy code inside the Web application. Groovy is an object-oriented programming language for the Java platform, it can be used as a scripting language for the Java Platform, is dynamically compiled to Java Virtual Machine (JVM) bytecode, and interoperates with other Java code and libraries. Groovy uses a Java-like curly-bracket syntax. Most Java code is also syntactically valid Groovy. The code iterates on all the badges and check if the users have enough points to acquire them and if they did

not gain them yet.
As a result the Script retrieves two array where in the first there are new badges acquired and in the second the users who reached them. As usual before to continue the execution flow the results are checked by the Is Not Null component (New Badges?), if there is new badges assigned (OK Link) the Badge instances are inserted into the community database through the Create component (New Badges).
It is possible create multiple instances in a single operation choosing the Bulk option on the component.
Each row inserted into the Badge Instance table has the User oid as foreign key, the Badge Type oid as foreign key, the date of the acquisition (when the gamification logic is executed).
After the creation instances the iteration ended and another badge can go through all the gamification process.
When all the badges are evaluated, the response can be sent to the service invoker.

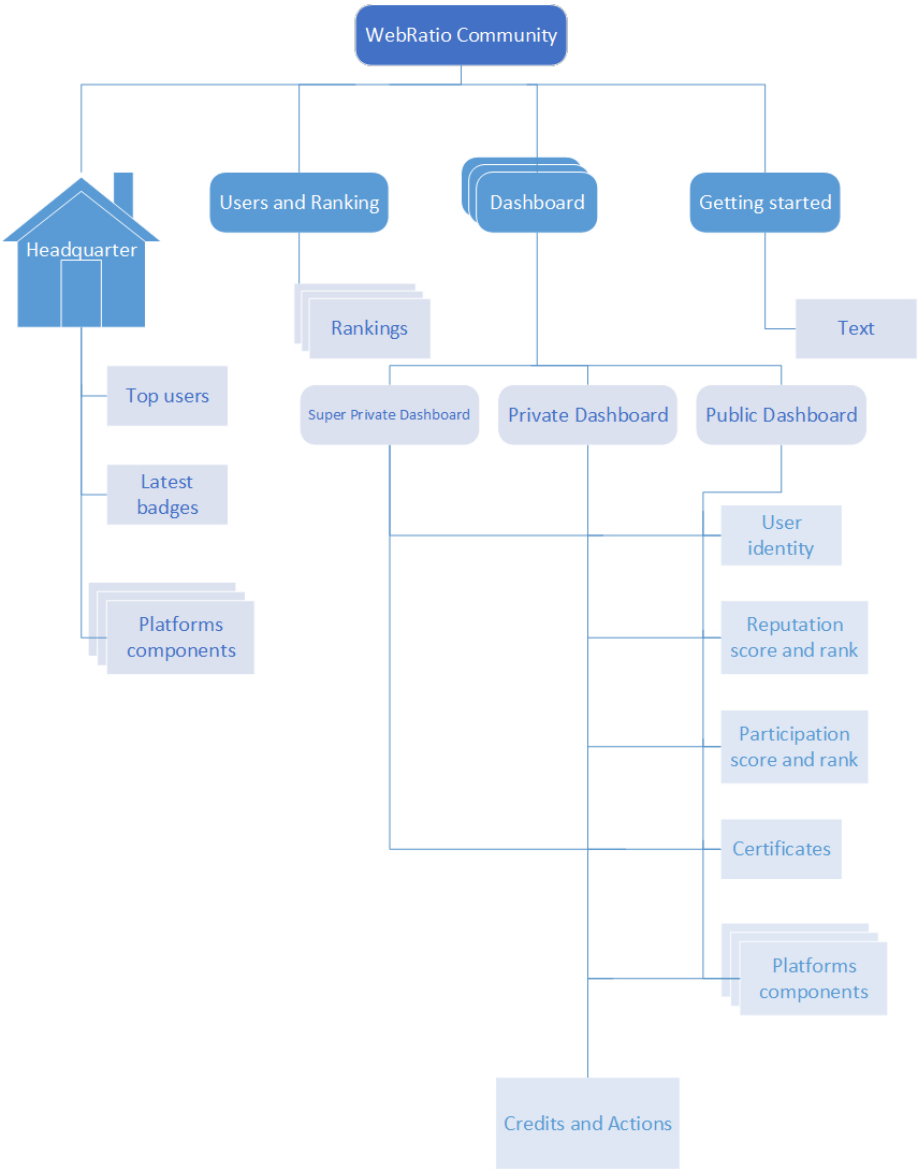


Figure 30.: Site View of WebRatio Community

Now let's describe the structure of the WebRatio Community (Figure 30), the project is composed by four main areas: Home page (Headquarter), Users and Ranking, User Dashboard and Getting Started.

The Getting Started, is a kind of guide page, it composes the picture of the community, it is made by images and texts that describe which are the rules of the community and how is it possible participate.
This type of page where the content is more less static, it is possible use the Details view component, it is a content component used to display the information of a unique instance of a given entity.
In the community, we adopt a table in the database to display some messages according to a key parameter associate (Bundle Data). So passing in input the key, associate to the text of the Getting Started page, the Details view component displays all the content of the page (text and image).
The other three areas are the more significant one in terms of gamification purposes and contents so we describe them in more depth.

Home Page (Headquarter)

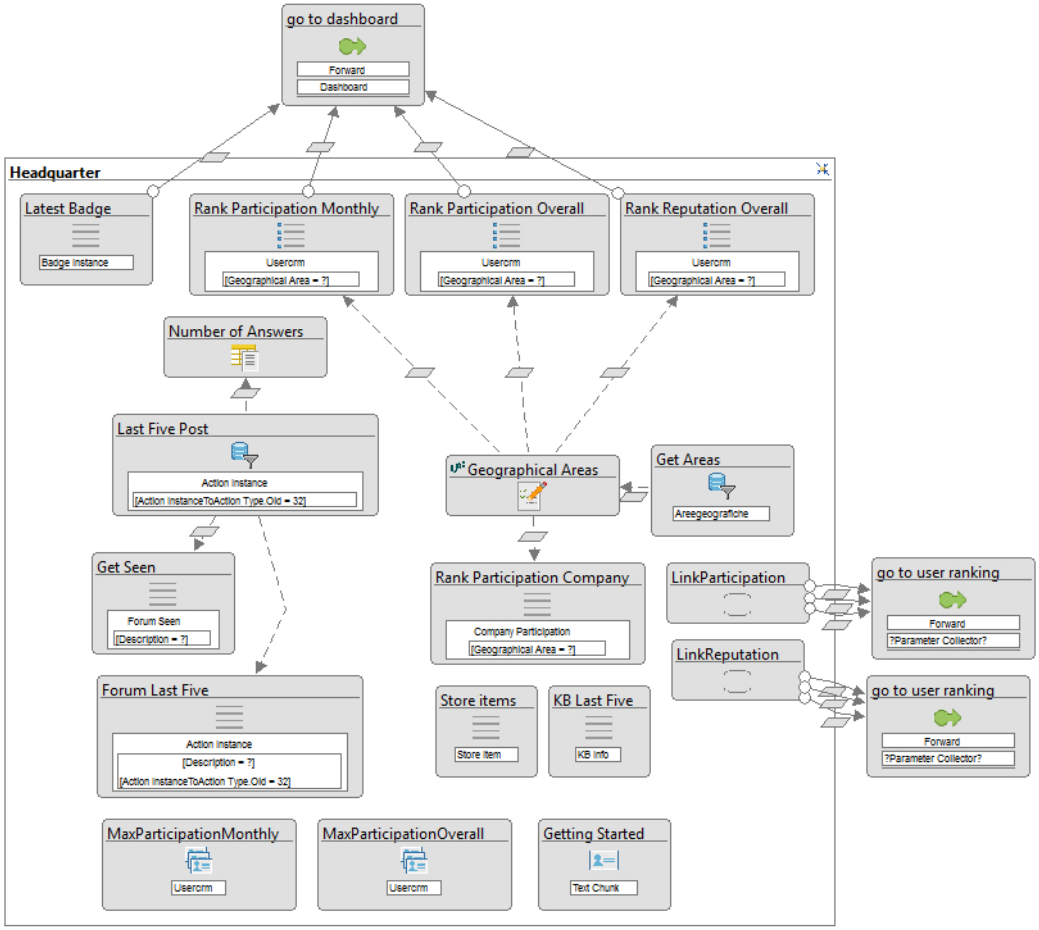


Figure 31.: IFML model of Home page (HeadQuarter)

The above figure depicts the IFML Web model of the community home page (Headquarter). In Headquarter page there are three types of ranks (monthly, overall, companies) which show the users on the top on the community (firsts eight positions), through the view component List which allows to show, in the web pages, a set of instances of a particular entity, in this case of users. Obviously the ranks are ordered according to different types of score.
Only the first eight positions are displayed thanks to the option on the component that allow the developer to set the number of results to retrieve.
The three ranks are organized through a tabs layout, where in the first tab there is the the monthly participation rank (Rank Participation Monthly), the second one the overall rank, that is composed by other two sub tabs which display the Participation rank (Rank Participation Overall) and the Reputation rank (Rank Reputation Overall), the last tab depicts the company rank (Rank Participation Company).
Each ranks in the home page can be sifted through the Geographical field, this field is modeled by a Form view component (Geographical Areas) that is rendered as selection field.
This field is filled up by the value retrieved from the Selector (Get Area) that read the database of the company.
For each user, his nickname or first name and last name are put on view, with the percentage bar regarding the participation and his set of badges acquired (Reputation).
The participation is computed as percentage in relationship with the first in the rank (who obviously has 100% of Participation), this calculation is made possible by the two Multi Details view components which retrieve only the two users (number of results option of the components set on 1), one for the monthly rank (MaxParticipationMonthly) and the other one for the overall (MaxParticipationOverall) who are in the first place on the rank. In this way for each other user, it is possible to compute the participation percentage.
The choice of those attributes is possible because, all view components allow the programmer to select a set of characteristics related to the entity. It can be simple attribute or calculated, derived one through some relationship between entities.
Still, the Latest Badges (the last six), are shown through a view component List that make possible the representation of the user who acquired the recent awards, the name of the user with the image of the reward shape a kind of board where the more deserving customers are displayed.
It is possible to browse the community choosing an user or a latest badge to surf on the User Public Dashboard (described later). The page is closed with three boxes where each one describes some information about its platform components. The three platforms are: Store, LMS and Forum; The Store shows the recent component downloaded or uploaded with the associate tags, the LMS proposes the articles and courses just performed by the community users with the level of complexity and, in the same way, the Forum illustrates the latest discussions debate with number of answers and views.
As the figure shows, basically three List view components are used to retrieve the items for each box. For the Forum box, also the number of the answers present in each question is displayed, to compute this parameter a Query component (Number of Answers) is adopted. The Query component allows the developer to execute a traditional SQL query, with the possibility to set some input parameters (in this case the oid of the questions) and some output values (the results of the execution). Instead the number of views are

evaluated through a specific feature of WebRatio tool which allow to create volatile entity variable with different scopes (session or application).
This entity variable is refreshed frequently reading the Forum database through an automatic job that keep updated the number of views of each Forum topics.
Even the Store takes advantage of the volatile entities, using the Store Item entity (application scope) which is filled with all the updated information regarding the Store activities.
Each items of the three boxes is click-able and it redirects the customer on the page regarding that specific object, this is made possible using the attribute Link presents in the Action Instance table. The homepage philosophy is to attract and strike the user attention with the most recent and hottest topics and activities, in this way immediately the community appears as a place where a lot of events happen and the customers will be encouraged to be in the firsts places in the rank or to acquire badges to come on the community front page.

Users and Ranking

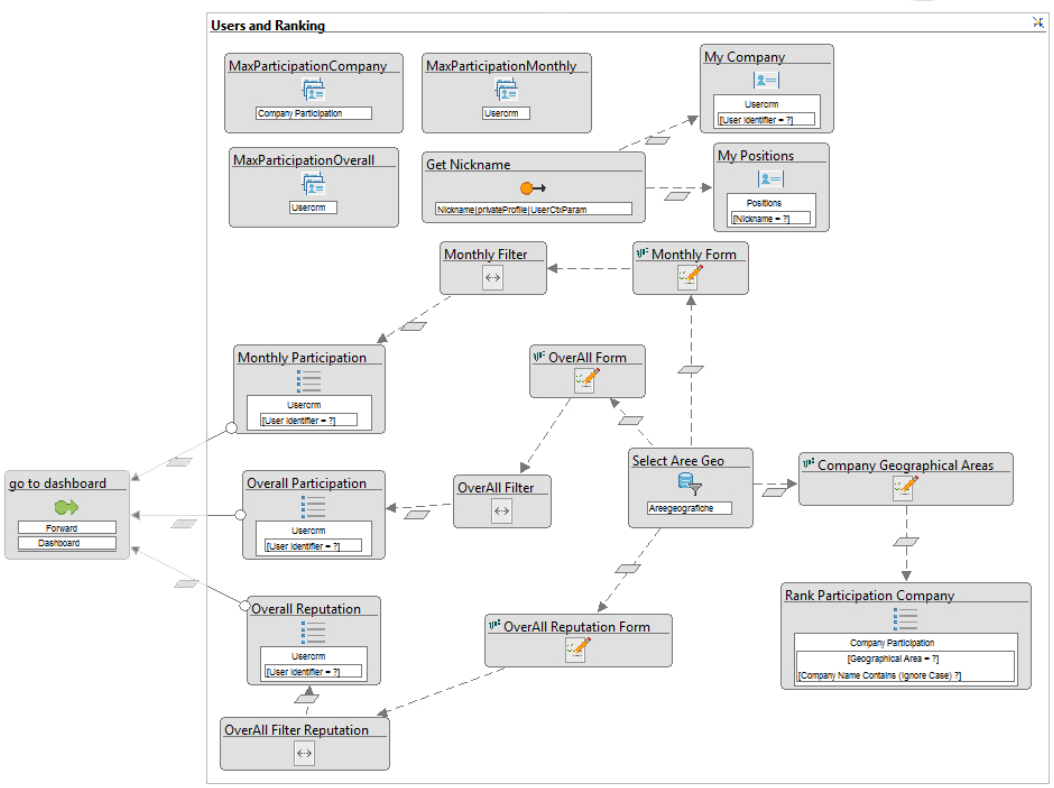


Figure 32.: IFML model of User and Ranking

Users and Ranking is the page where the user can explore all the ranks and make his researches through all the participants thanks to a set of filters provided by the community.
Whether in the rankings on the homepage only the firsts positions are shown, here all the places can be consulted, the tool to modeling the classifications is again a component view List but this time with no limits about

the number of results.
The customer can choose how many results see in a page (15,30,50) and he can scroll the users in sequence or jumping through them. These functionalities are all configurable parameters provided by the List component.
There are a set of filters created with the view component called Form, this component allows the developer to create an HTML classic form with fields of each type (input, selection, checkbox,text area, etc.). In particular it is possible to make researches through a normal input field that filter the user by name, nickname, company or university, otherwise there is a selection field that divided people by their geographical area (as in homepage).
WebRatio decides the division in four geographical areas according to its business goals (Europe, North America, South America and Asia, Africa & Oceania).
A multi selection field (checkbox list) permits to find the customers who have acquired badges in one particular area of the WebRatio world. The areas represent the platforms of WebRatio (Forum, Store, LMS, Certification).
Finally, through a HTML slider, it is feasible show only the users who have achieved an exacting set of badges belonging to a level of importance. The user can choose the minimum and the maximum level thanks to the graphical interface. This feature is achieved to two selection field transformed using jQuery. jQuery is a fast, small, and feature-rich JavaScript library. It makes things like HTML document traversal and manipulation, event handling, animation, and Ajax much simpler with an easy-to-use API that works across a multitude of browsers. With a combination of versatility and extensibility.
All these options can combine together to have a more detailed set of results. To perform these types of researches a normal Selector component is not enough, because we need to create a SQL query using the logical operator AND, both for the different kinds of filters (combined each other) and for the possible values which a single filter can assume.
So a Script component is adopted, in the Script component, one for the monthly rank (Monthly Filters), one for the overall rank (OverAll Filters), it is possible write piece of Groovy code and in this case using a SQL connection, it makes possible to execute a custom database query which retrieves the exactly set of users who have the characteristics chosen through the filters.
The Script components receives as input the values of the filters and returns a set of User Identifiers which are passed to the Lists view component which displays the results.
When the customer is logged over the search fields there is a button that allow the user to go automatically at his rank position without leaf through each page.
The exactly position of the user is retrieved by the Details component (My Position) that returns the user's position for each type of rankings. Every image and picture regarding the badges and awards are completely configurable because they are manageable in the administration area, this is allow to make those features of the community dynamics. To display those types of objects, the community uses the view component Detail which retrieve a specific element receiving as input a special key that is associated in an unique way to an item (first place image, partner logo, etc...).
This part of the community is very important because allows the users to find each other creating a connection between them. In fact each element in the list is click-able and allow to surf into the Public Dashboard (through

a Jump component that has as landing point the Public Dashboard entry point with input parameter the User Identifier).

The third main part of the community is the Dashboard, there are three types of Dashboard, the Public, the Private and the Super Private one.

Public dashboard

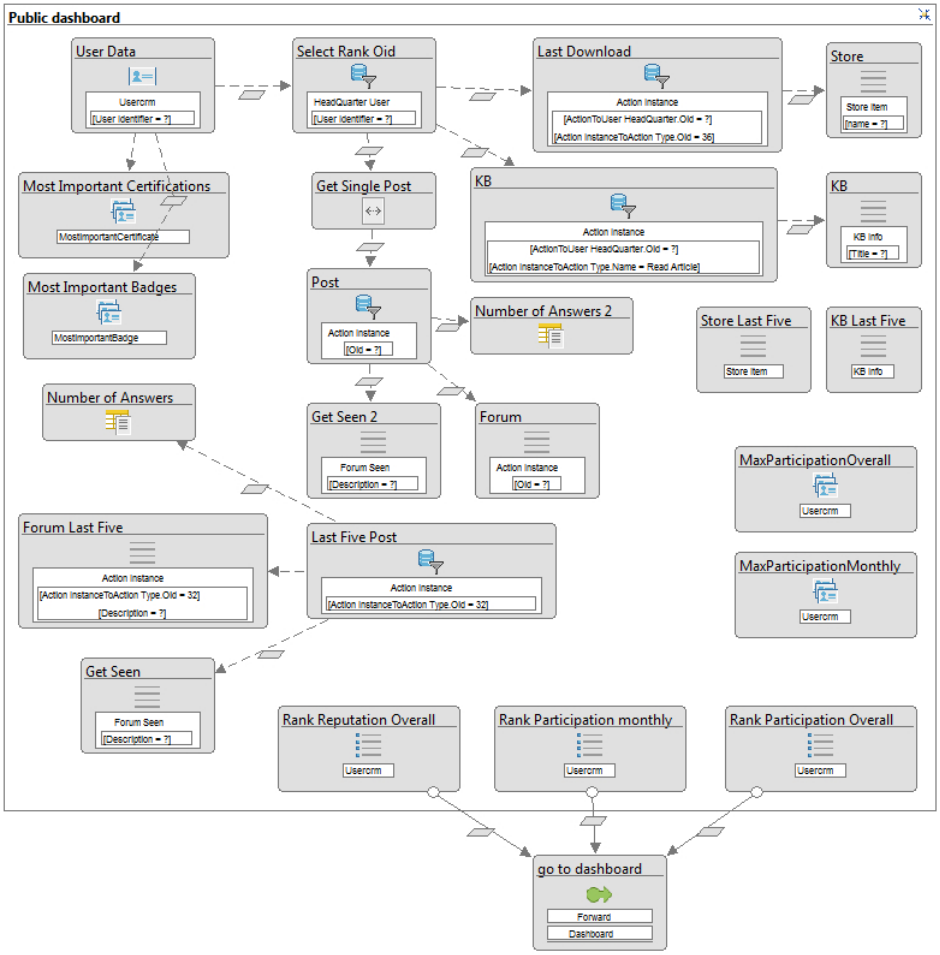


Figure 33.: IFML model of Public Dashboard

The Public Dashboard, depicts in the figure 33, is the page containing the user profile that every user can see, selecting the person, for example in one of the ranks or in the box of latest badges.
It is composed by the User Identity box, where the photo, first name, last name, type of user(student, professor or worker) and company are displayed through a view component Details (User Data) that receives as input parameter the unique attribute User Identifier.
Under the profile data the list of the most important badge acquired from the user is shown through the Multi Details view component (Most Important Badges), computed through the User identifier input passed by the Details view component (User Data) that provide, in the Public Dashboard, to almost all component the input parameters.
The most important badges are exhibited under the photo profile of the user

to give immediately at all the other users a kind of identity card about the customer.
The place of Participation and Reputation is shown with a numerical representation, also the total number of users of the community is displayed (i.e. your ranking is 3 out of 1765). A section of the Participation Monthly, Participation Overall and Reputation rank is presented, for each of these ranks is displayed the classification part about the user position with the users in direct competition with him (the user before him and the next one). As for the other ranking, even these cross section are developed through a List component view (Rank Participation Overall, Rank Participation Monthly, Rank Reputation Overall).
As for the other pages the calculation to compute the participation percentage is made with the first user in the rank of the Participation (both overall and monthly) respect all the other one. These two values are retrieved from the Multi Details view component called: Max Participation Monthly and Max Participation Overall.
The decision to represent those precise section of the ranks (where the user is involved) is a gamification choice, to increase the competition among the users.
Also here, all the customers are click-able through a link modeled by the connection through the ranks and the Jump component that lead the user on the access point of the Public Dashboard.
This cyclical possibility to surf through the user Public Dashboards, is another powerful mean to increase the participation and the activities of the community, moreover provide to the user a wide navigation tool. In addition to the badges (shown as usual in the ranks), the certificates are other important rewards, that symbolize the experience and the knowledge of the customers.
For show these central aspects, we use another Multiple Details view component, which allow to retrieve some several items of the same entity, in this case Certificate Instance.
The component receive as input the user identifier and thanks to the relationship between user and certificate can compute the customer's acquired certifications.
The page ends with the three boxes regarding the latest activities of the portals: Forum, LMS and Store.
In the Public Dashboard and Private Dashboard (next section) unlike the structure presents on the Homepage, each of these boxes have the possibility to choice if displayed, the general suggested topics for the forum, teaching materials for the LMS and components for the store or also all the activities performed in these modules by the user at issue. In this way, other community participants can be tempted to try some other contents and materials which they have not tried yet. Also in this case the hope of the community is to attempt to create a positive and profitable trend which encourage the users to try more and more new things of the WebRatio world.
To modeling the three boxes containing the proposed topics and activities the same structure explained in the Homepage section is adopted. In this case, also the user activities are needed so other components dedicated to the user action is adopted.
For the Store, a List view component (Store) retrieves the components which the customer has downloaded by passing as input the name of the component calculated through a Selector component (Last Download) that parse the Action Instance table checking the User identifier and the Action Type

foreign keys.
For the LMS, also in the Store case, a Selector component retrieves the actions regarding this module and pass to a List view component (KB) that receive as input the titles of the didactic object consulted by the user.
For the Forum, the procedure is a little bit more tricky because the actions which the user can perform are several so more research is needed. When the oid of those actions are founded, they are passed to a List view component (Forum) that displayed the post where the user took part. Obviously, all the tasks to compute views and answers performed for the suggested activities are multiple even for the specific instances of the user.

Private dashboard

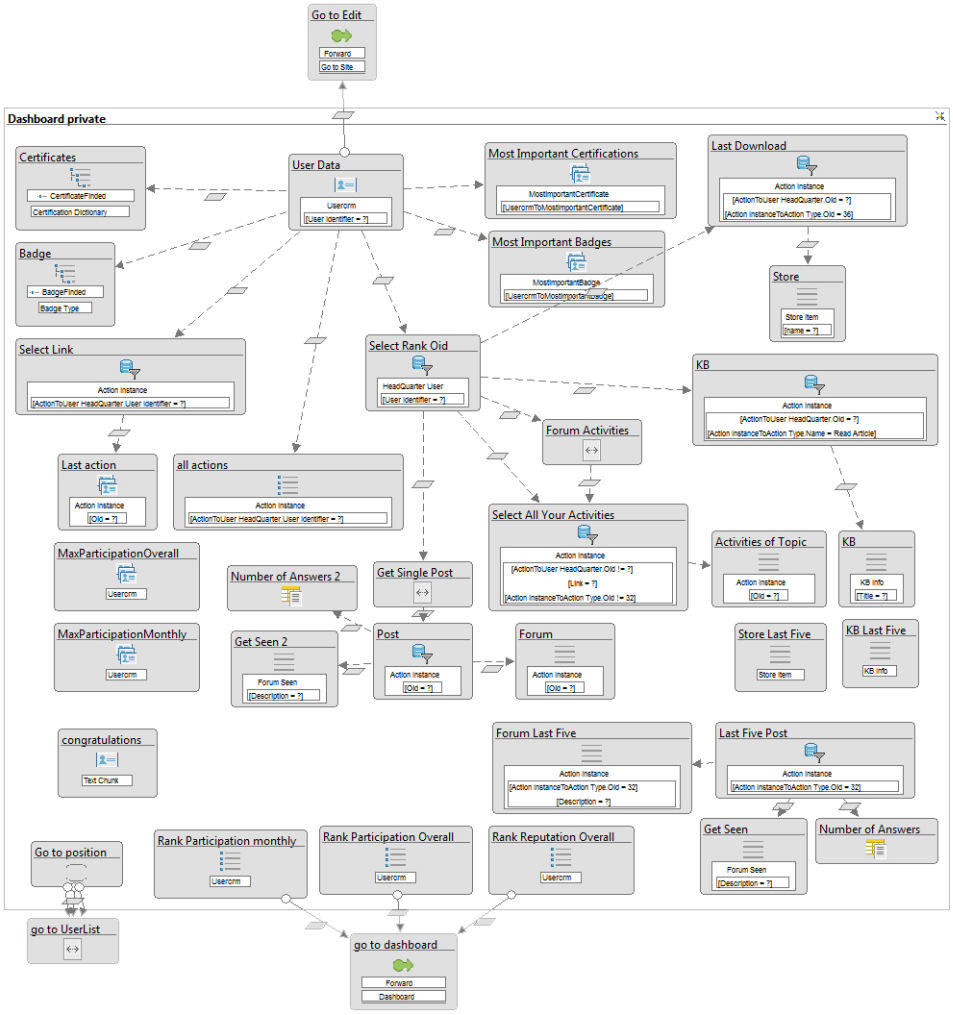


Figure 34.: IFML model of Private Dashboard

When the user is logged inside whatever module of WebRatio can in any time access to his Private Dashboard, selecting the link called My Dashboard alway present on the header bar.
The Private Dashboard has the task of being a base for the user, who inside this page can take under control and consult all his activities and points.
The Private Dashboard has all the features of the Public one and moreover has some particular characteristics to provide again more tools for the user

inside the community.
When the customer access to his Dashboard, a notification message is shown, if from the last entry he has reached new badges. The notification exhibits a congratulation message with the data regarding the badges acquired from the last time. In this way, the user is alway informed about his success inside the community and when the achievements are shown with emphasis, the process of encouragement becomes again more strong and powerful. The congratulation message is contained inside the Detail view component (Congratulations) that reads the particular text to display from the table which contains all the website labels and static text called Text Chunk.
The user can see all his earned credits and the complete list of the activities which have contributed to reach the total amount. As describe in the previous chapters, the credits are virtual moneys which the customers will be spend to purchase some goods. The date and time of the action are displayed with the number of credits gained and a brief description of it.
The user can search inside this list the actions by modules area, by number of credits and with a text free research. This list is modeled by a List view component (All Actions) that receives as input the user identifier passed by the component that displays the user personal data (User Data).
The total number of credits is calculated using the sum SQL aggregate function, this is made possible since all the WebRatio component allow the programmer to compute aggregate function on the entity attributes. From the sections which describe the parts of the classifications where the user is present, it is possible to surf on the whole selected ranking page (Users and Ranking) but already in the same zone where he is present the user.
So the user can explore the rank near his position in a wider way and he can consult all the other users of the community.
This functionality is provided by three navigation links which start from a Component view (Go to Position) and arrive in the Script component (Go to UserList).
The Component view is a component that have not associated entities or attributes but it is used to model hyper-textual links.
The target component of this operation is the Script that receive as input the type of selected ranking and the User Identifier, in this way it is able to lead the customer to the right section of the ranking. Being this page the user base, he can navigate quickly in the manage account page that allow the edit of his personal information. This anchor is situated on the top of the box regarding the personal data, in fact from the model it is possible to see a navigation link between the Detail view component User Data and the Jump Component Go to Edit.
In addition to see the most important badges and certificates, the Private Dashboard allows the user to view all the history of his successes.
All the certificates and badges acquired, are displayed in a table format, where the badges and certificates gained are colored (to highlight the achievement) instead the others one are faded (not yet achieved). The table i
s a kind of list of goals which the user can reach, this graphical way is an incentive to complete all the badges and certificates to obtain a whole colored graph.
These two table are modeled by Hierarchical view component, this component allows the programmer to choose a main entity to display with a set of attributes and several levels of other entities related with it. In this case the main entities are the Badge Type and the Certificate Type. As first level linked with the main entity the instances obtained by the user (badges and

certificates).
The components receive as input the User Identifier passed by the Detail component and produce as output all the certificates and badges acquired by the user with the date and the colored images and all the fade images of the goals not yet reach.
When the user has already acquired at least one certificate, he can download, from his Dashboard, the history table of his certifications in PDF format.
For this purpose, we develop a special HTML page that is the source of the PDF certification and through a Java library called PD4ML, we convert it into a PDF format. PD4ML is a powerful PDF generating tool that uses HTML and CSS as page layout and content definition format. It is written in pure Java, it allows users to easily add PDF generation functionality to end products. As the Public Dashboard, the page is closed with the three boxes which contain the latest activities and information about Store, Forum and LMS. All the functionalities related to the three boxes present in the Public Dashboard are also in the Private one, moreover in the Forum area, for each of last topics where the user took part, it is possible to receive notification regarding the latest events about that particular topic. In this way the user can receive notifications if other users have answered or created a comment. To retrieve those information a List View component is used, which receives as input the Forum posts where the user participated, and provides as output all the events performed by the users who are not the customer at issue. In this way the interaction among the users inside the community is increased and even the relationship between the WebRatio portals and the community is enlarged and strengthened.

Super private dashboard

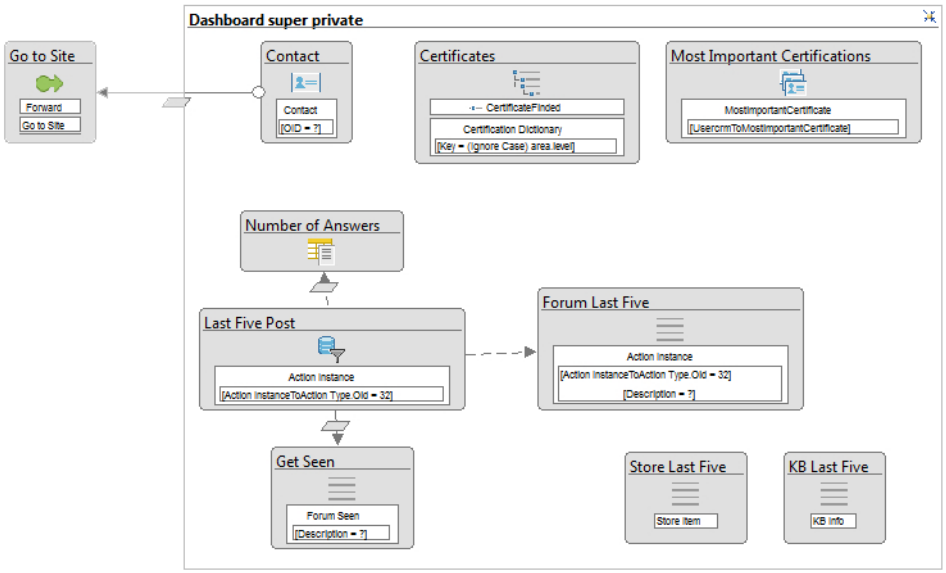


Figure 35.: IFML model of Super Private Dashboard

The last Dashboard represented in the above figure is the Super Private one.

This type of Dashboard is displayed to the user who has set his profile as private. To be part of the community it is mandatory to set the profile as public (this rule is explicitly explains in the Getting Started page).
When the user is logged in the WebRatio portals can access to his Dashboard from the link "My Dashboard" on the header page. In this page the user can consult his personal data (first name, last name, company name, type of customer, city, country and personal photo) with the possibility to jump on the manage account area to update all his data. All those data are displayed through a Details view component (Contact) that takes as input the oid of the user who is logged (the user oid is stored in a session parameter).
The HTML link to edit the account is modeled through a navigation link between the Contact Details view component and the Jump component which allow the developer to set several place in the application where the user can leap.
Each Jump component has a landing point where the flow of the application goes ahead.
The customer can see his most important certificates acquired, the more important by certification area, through a Multi Details view component that using the User Identifier can take under consideration the certificates owned by the user.
These most important certificates are a whole box click-able that allow the user to display through a pop-up windows the history of all his acquisitions.
The history about the certificates of the user is displayed in a table form with the image of the certification with the data. To show this table a Hierarchical view component is adopted, because it permits to display an entity with its attributes and a set of attributes of another entity linked to the main one. In this case the main entity is the Certificate Instance (those which the user have acquired) and the entity of the second level is the Certification Type that consents the visualization of the images. Also in this case through the session parameter User oid the component is computed to retrieve exactly the certificates of the logged user. This type of customer who has his profile private can see also the three boxes on the bottom of the page which describes the latest topics on the Forum, Store and LMS.
As seen previously, the structure of the three boxes is composed by three List view component which retrieve the last five activities from the different modules ordered by decreasing date, in this way the latest one will be more accent.
The other boxes which are present in the other Dashboards (Public and Private), in this case are disabled, because with the profile set as private it is not possible take part of the community.
However to incentive the user to take part in the community, over the disabled boxes there is positioned a wide button with which the user can immediately switch his profile as public and became an active user of the community.

5.3 GAMIFICATION DESIGN

To handle the defined business objectives, the gamified web application has been designed with the goal of managing all the possible operations performed by the users using a common and integrated interface, thus solving the fragmentation of the tools and to create a unique and homogeneous

user experience.
The rules and conflicts of the platform were already defined, since the goal was not introducing new actions in the system but encouraging their effectiveness by rewarding the users. So, the user inside the new community can earn points through the operations that take place in one of the modules of the system, for example, post a question in the forum, complete all profile data, obtain a certification of knowledge, purchase some products from the store.
After having studied all the components present in WebRatio, we draw up a list of possible actions executables.

Table 9.: WebRatio's actions gamified

Module	Action	Points	Participation	Reputation
WebRatio Portal	Get the certification of Trainee-level	400	YES	YES
	Get the certification of Apprentice-level	600	YES	YES
	Get the certification of Professional-level	800	YES	YES
	Get the certification of Expert-level	1200	YES	YES
	Get the certification of Master-level	1500	YES	YES
	Registration completed	50	YES	NO
	Photo profile setted	100	YES	NO
	Social links setted	30	YES	NO
	Bio setted	50	YES	NO
	Company/University setted	200	YES	NO
	Partner/Client serial setted	1000	YES	YES
WebRatio Forum	Question posted	30	YES	NO
	Answer posted	70	YES	NO
	Approval of an answer	70	YES	NO
	Answer approved	150	YES	YES

Module	Action	Points	Participation	Reputation
WebRatio Forum	Like on Question/Answer	15	YES	NO
	Question/Answer liked	15	YES	YES
	Question followed by mail	15	YES	NO
WebRatio Store	Component downloaded	20	YES	NO
	Vote on component	15	YES	NO
	Component voted	50	YES	YES
	Review on component	50	YES	NO
	Someone download user's component	20	YES	YES
	Component published	1000	YES	YES
WebRatio LMS	Article read	100	YES	YES
	Tip published	100	YES	YES
	Trivia a question	100	YES	NO
	Trivia a answer	50	YES	NO
	WBT Certificate of Completion	120	YES	YES

Module	Action	Points	Participation	Reputation
WebRatio LMS	WBT Score above 90%	180	YES	YES
	Sample learning object published	300	YES	NO
	Sample learning object downloaded	60	YES	NO
	Evaluation Form Completed	40	YES	NO
	Social share of learning object	50	YES	NO
	Participation to WR Training Courses	500	YES	YES

As shown above each action provides points to the user, we basically classify the actions in: participation actions and reputation actions. The concept of reputation is adopted in order to express through a numerical value the ability of an user, used as an extrinsic motivator. Higher is the reputation, greater is the ability of the user, so through this parameter all the users can identify which are the more expert into the community and in the use of WebRatio tool. This dynamics leads the user to feel the desire to increase his reputation and become one of the leaders in the community. The reputation points are never shown in the application because they are transformed into badges and awards.(Figure 36 shows all badges)

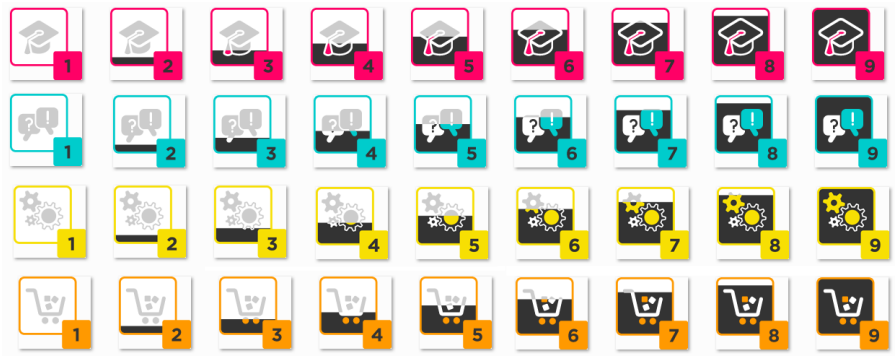


Figure 36.: WebRatio Community badges

Follow the analysis of the platforms we have identified four areas of reputation based on the application: the area of portal or rather the certificates (purple badges), forum (blue badges), store (orange badges) and LMS (yellow badges).

Table 10.: WebRatio's badge levels

Module	Badge title	Score needed
Certificates	Certification Trainee	400
		800
	Certification Apprentice	1200
		1500
	Certification Professional	2500
		4200
	Certification Expert	8000
		10300
	Certification Master	14800
Forum	Forum Starter	400
		800
		1200
		1500
	Forum Expert	2500
		4200
		8000
		10300
	Forum Evangelist	14800

Module	Badge title	Score needed
Store	WR Starter	400
		800
	WR Developer	1200
		1500
	WR Shopmaster	2500
		4200
		8000
		10300
	WR Ambassador	14800
LMS	WR Scholar	400
		800
		1200
	WR Sophomore	1500
		2500
		4200
	WR Advisor	8000
		10300
	WR Professor	14800

As shown above the user after he performed a number of actions and collected a needed score, he automatically earns a badge that prove his abilities and skills in a particular module of the WebRatio world. The set of actions required to achieve one particular award are obviously all actions classified as reputation relevant, because their fulfillment require an objective capability in the use of WebRatio. Instead, user acquires participation points, used as an intrinsic motivator, playing "active life" within the community, for example when the user fills his personal information, reads an article in the E-learning center, logs back into the platform, submit new components in the Store and other similar activities. The parameter of participation is an integer number that can grow up very quickly so it can be meaningless and low user friendly show in the web pages this number, for this reason, the participation is displayed as a perceptual, by using a progress bar, in relationship with the user with the greatest participation points (the first in the rank).

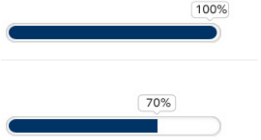


Figure 37.: WebRatio Community progress bar

With this graphical trick, the user can perceive how his participation is increased or decreased acting as spurn to reach the complete progress bar. The sum of all the participation points acquired correspond to the equal number of WebRatio Credits. These, are virtual coins that the user can spends to acquire some particular component of the store, to acquire gadget or support to use the tool. The introduction of these virtual goods is a powerful methodology of reward, that mainly promote and encourage the participation into the community, providing a tangible benefit to all the components of the community.
The application is composed by three important element: a set of ranking, user dashboard and a set of collector element from the other platform.
The set of ranking, shown in the home page in a preview version (only the top positions) and in a page ranking dedicated exclusively to the whole rankings, contains:

- A monthly rank based only on the participation parameter where just the points acquired in the current month are considered.
- An overall rank where it is possible to visualize both the participation and the reputation rank (by progress bar and badges).
- A companies rank, where the companies and the universities are shown through the sum of all the scores of their associates.

This rank that could be secondary, it is very important and powerful because no society would like to be at the bottom of rank or worse behind a direct business opponent. For that reason, the hope of the community is that the companies and the universities will push their employees, students and professors to interact and contribute in the community to enlarge the visibility of the society.

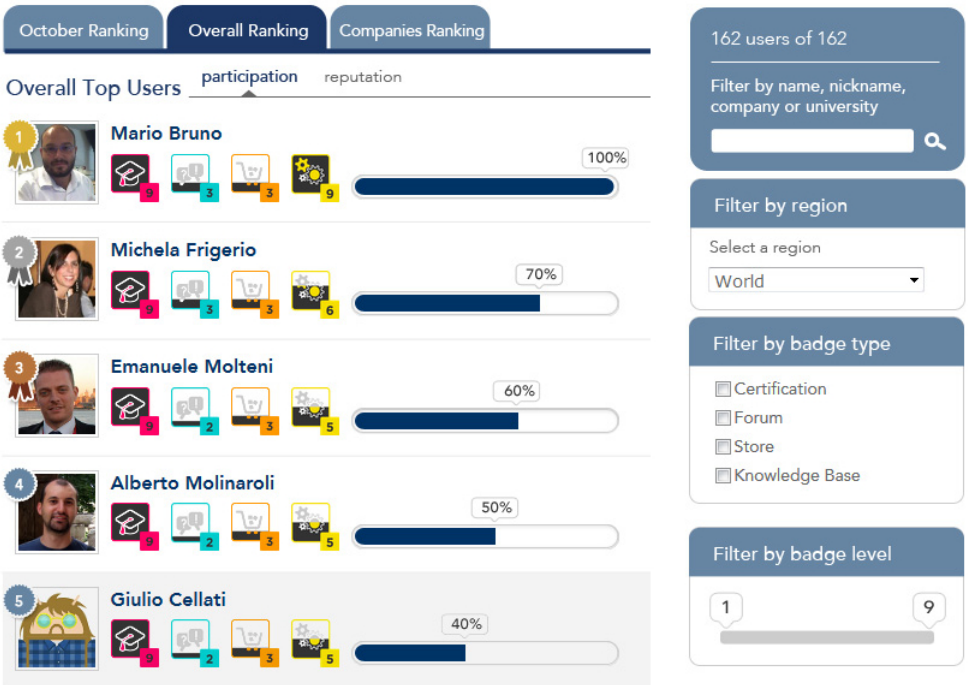


Figure 38.: WebRatio Community leaderboards

One of the most important filter (more the usual filters based on displayed data) that is possible apply at the ranks is the classifications through a geographical field. By default the world ranks are shown but the customer can decide to see only the European, the Latin America, the North America and Asia, Africa and Oceania rank. In this way the user can decide to see only the specific rank of his geographical area without visualize the other users. This choice has been done for the reason that some users can dislike to appear in the same rank with people of other countries, maybe because they could feel the application too far away from them.
Moreover in the home page if the user is logged, the rank show his position and the immediately preceding and following to create competition.
The second element is the user dashboard, that is a page where there all the information related to the user, like the user's badge, the user participation, the post where the user interacted and so on.
The public dashboard is compost by the social information of the user, the most important badge for area acquired by the user, the participation score (with a small rank related to the position to the user), the reputation score (with a small rank related to the position to the user) and a section that show the most important certificate acquired by the user.
The private dashboard is compost by the social information of the user, the most important badge for area acquired by the user, the participation score (with a small rank related to the position to the user), the reputation score (with a small rank related to the position to the user) with the possibility to view the complete history of the acquired badge (not only the most important badge for area), the certification box with the possibility to view the complete history of the acquired certificates and the last section is related to the actions (with the possibility to view the complete list of computed actions) computed by the user that show the total WebRatio credits earned.
In both dashboards the section of participation and reputation showing small ranks have been designed to create sense of competition between users.

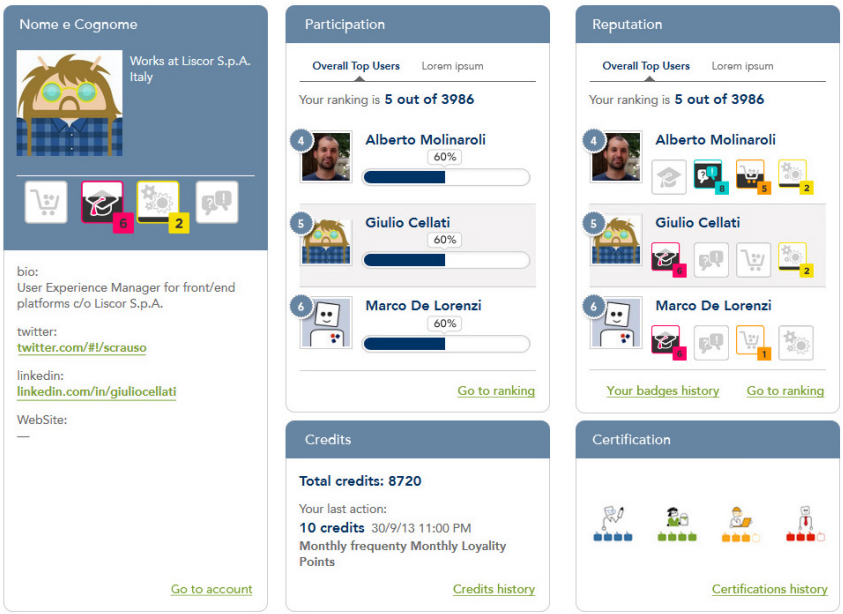


Figure 39.: WebRatio Community dashboard

The third element present in dashboard pages and in the home page is an element that show three boxes related respectively to the Forum, E-learning center and Store showing the topics/articles/components with which the user interacted and topics/articles/components that in general, could be interesting for the user, thus solving the fragmentation of the various platforms and to solve the business objective of create a collector, a starting point for every user.

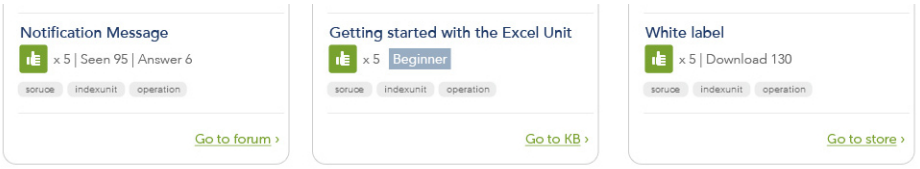


Figure 40.: WebRatio Community collector element

5.4 EXPERIMENTAL RESULTS

After the realization of all the phases of design and development of the product and before launching the community into production and make it accessible to customers, the company has decided to run a test phase of the application.
This decision, as well as allowing a check regarding the stability and quality of the developed software, made possible a first control on the effectiveness of the introduction of the new gamification mechanics; this has allowed also an initial comparison between the results obtained respect to the business goals of WebRatio it has been performed.
WebRatio by following the best practices of software testing decided, at one with all the developing team, to perform the Alpha-Beta testing. The alpha phase of the release life cycle is the first phase to begin software testing (alpha is the first letter of the Greek alphabet, used as the number 1). In this phase, developers generally test the software using white box techniques. White box technique is a method of testing software that tests internal structures or execution of an application, as opposed to its functionality. Additional validation is then performed using black box or gray box techniques, by another testing team. Black box testing is a method of software testing that examines the functionalities of an application (e.g. what the software does) without peering into its internal structures. Moving to black box testing inside the organization is known as alpha release. Alpha software can be unstable and could cause crashes or data loss. The alpha phase usually ends with a feature freeze, indicating that no more features will be added to the software. At this time, the software is said to be feature complete.
Beta, second letter of the Greek alphabet, is the software development phase following alpha. It generally begins when the software is feature complete. Software in the beta phase will generally have many more bugs in it than completed software, as well as speed/performance issues and may still cause crashes or data loss. The focus of beta testing is reducing impacts to users, often incorporating usability testing. The process of delivering a beta version to the users is called beta release and this is typically the first time that the software is available outside of the organization that developed it.

The users of a beta version are called beta testers. They are usually customers or prospective customers of the organization that develops the software, willing to test the software without charge, often receiving the final software free of charge or for a reduced price. Beta version software is often useful for demonstrations and previews within an organization and to prospective customers.
Developers release either a closed beta or an open beta; closed beta versions are released to a restricted group of individuals for a user test by invitation, while open beta testers are from a larger group, or anyone interested.
Beta testing comes after alpha testing and can be considered a form of external user acceptance testing. Versions of the software, known as beta versions, are released to a limited audience outside of the programming team. The software is released to groups of people so that further testing can ensure the product has few faults or bugs. Sometimes, beta versions are made available to the open public to increase the feedback field to a maximal number of future users. During the Alpha testing, the community has been tried by all members of the development team, analyzing bugs and problems. In this phase was deemed unnecessary to collect data about gamification aspects because the number of users was small.
Once this first phase was ended, the software was stabilized, and all the main functions have been finalized. So after the Alpha testing, the Beta testing could begin. WebRatio opted for a closed test in fact it decided to open the test to all employees of each business area and some outside consultants (experts on graphics, usability, accessibility and game mechanics).
Although the test was not open to a very large number of people, it has allowed the collection of several data which have made possible some important considerations and comparisons through the calculation of mathematical metrics.
The community, by its nature, is designed to collect a lot of data about user behavior, while not all the existing portals stored all the events related to the customer. For this reason, some comparisons were not possible for the lack of data coming from the past. Through a set of database query, it has been possible to retrieve several information about the past user activities which were then used as comparison.
Goal of the experimental setting is to understand if business goals clearly stated by means of gamification mechanics in the form of badges and participation points for user comparison through leaderboards could produce a positive gain. Being able to compare one own participation level with others and having a clear indication of what contributes to the participation level requested by the company, improves the amount of activities done on the community platform that has been created. To verify the achievement of corporate objectives, before proceeding with the investigation, a number of hypotheses have been drawn up.
The following table lists the various hypotheses that we analyze in detail later, the second parameter identifies whether as a result of the calculations, the hypothesis benefited from the Gamification.

Table 11.: Hypothesis table

Hypothesis	**Positive results**
Hypothesis 1: Gamification mechanics can improve self-powered customer support through the Forum	
HP 1.1 Participation points increase the use of the community forum to seek for aid (community driven help)	yes
HP 1.2 Participation points increase the will of the user to help other users in the community	yes/no
HP 1.3 Participation points improves the quality of the answers provided in the Forum	no
HP 1.4 The use of badges can induce users to post more meaningful answers	yes/no
Hypothesis 2: Gamification mechanics can improve the ability of the company to identify the customers that use their product and increase the company image by showing more and more companies using WebRatio	
HP 2.1 Participation points can increase the number of users that register within the system	yes
HP 2.2 Participation points can increase the details provided by the users on themselves (photo, social media accounts, biography)	unspecified
HP 2.3 Participation points can increase the involvement of existing enterprise users and identify them (customer/partner serial registration)	unspecified
Hypothesis 3: Gamification mechanics can increase user retention	
HP 3.1 Participation points may induce users to login more often	yes

Hypothesis 4: Gamification mechanics can induce users to produce and select high quality extensions for WebRatio	
HP 4.1 Improved feedback for the components present in the Store	no
HP 4.2 Increased the number of components available	no
HP 4.3 Increased the awareness of the users with respect to the extensibility of the platform	no
Hypothesis 5: Gamification mechanics can induce users to participate and read more tutorial article about the use of WebRatio	
HP 5.1 Increased the number of WebRatio tutorial article read by the users	yes

After the data retrieval and the choice of the hypothesis to test, we studied how to proceed with the analysis.
Having different hypotheses to be compared for the same scenarios (the number of different actions performed by users in the same month, before and after the introduction of game mechanisms), we decided to use the Student's T-Tests, since we have only two groups to contrast. The t-test was developed by a statistician, W.S. Gossett in the 1908.
The t-test is a statistical tool used to infer differences between small samples based on the mean and standard deviation.
In probability and statistics, mean interpreted as arithmetic mean of a sample $(x_1, x_2, x_3, \ldots x_n)$ is the sum the sampled values divided by the number of items in the sample:

$$\mu = \frac{(x_1, x_2, x_3, \ldots x_n)}{n}$$

Before describing the meaning of standard deviation, we introduce a related concept, the variance.
The variance measures how far a set of numbers is spread out. (A variance of zero indicates that all the values are identical.) A non-zero variance is always positive: a small variance indicates that the data points tend to be very close to the mean (expected value) and hence to each other, while a high variance indicates that the data points are very spread out from the mean and from each other.

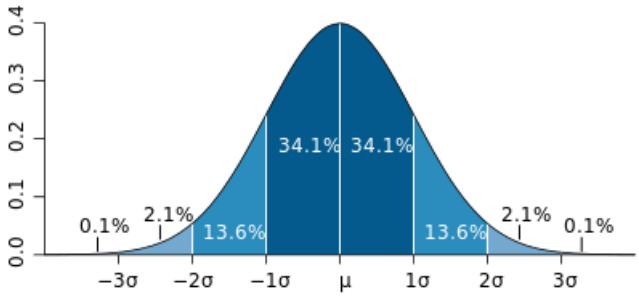
$$Var(X) = \sigma^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \mu)^2$$

The square root of variance is called the standard deviation (represented by the Greek letter sigma) shows how much variation or dispersion from the average exists. A low standard deviation indicates that the data points tend to be very close to the mean (also called expected value); a high standard deviation indicates that the data points are spread out over a large range of values.

$$stdev(X) = \sigma = \sqrt{\sigma^2}$$

In addition to expressing the variability of a population, the standard deviation is commonly used to measure confidence in statistical conclusions. For

example, the margin of error in polling data is determined by calculating the expected standard deviation in the results if the same poll were to be conducted multiple times. The reported margin of error is typically about twice the standard deviation, the half width of a 95 percent confidence interval. In science, researchers commonly report the standard deviation of experimental data, and only effects that fall much farther than one standard deviation away from what would have been expected are considered statistically significant, normal random errors or variations in the measurements are in this way distinguished from causal variation.



The graph taken from [wikipedia(2013e)] shows a Gaussian distribution where the dark blue represents one standard deviation on either side of the mean. For the normal distribution, this accounts for 68.27 percent of the set; while two standard deviations from the mean (medium and dark blue) account for 95.45 percent; three standard deviations (light, medium, and dark blue) account for 99.73 percent; and four standard deviations account for 99.994 percent. The two points of the curve that are one standard deviation from the mean are also the inflection points.

After calculating those metrics from samples of data collected, the problem is: how is it possible to establish whether the differences in the two means are statistically significant or due to chance? First of all we begin by formulating a hypothesis about the difference. These hypothesis states that the two means are equal or the difference between the two means is zero and is called the null hypothesis (H_0). The null hypothesis (H_0) is a hypothesis which we try to disprove, reject or nullify.
The 'null' often refers to the common view of something, while the alternative hypothesis (H_1) is what we really thinks is the cause of a phenomenon. Obviously in our case, the null hypothesis is that the community with all the gamification mechanism has not introduced any benefits. Of course the alternative one (H_1) is that the community has improved all the WebRatio portals.
More commonly the null hypothesis may be stated as follows:

$$H_0 : \mu(before) = \mu(after)$$

which translates into: n. of actions before gamification = n. of actions after gamification.
When the hypothesis are decided, we have to choose the type of t-test more suitable to our case study.
Among the most frequently used t-tests are:

- A one-sample location test of whether the mean of a population has a value specified in a null hypothesis.

- A two-sample location test of the null hypothesis that the means of two populations are equal.
- A test of the null hypothesis that the difference between two responses measured on the same statistical unit has a mean value of zero. For example, suppose we measure the size of a cancer patient's tumor before and after a treatment. If the treatment is effective, we expect the tumor size for many of the patients to be smaller following the treatment. This is often referred to as the paired or repeated measures.

The last case is perfectly suited to test whether the creation of the community has introduced the desired benefits.
The dependent t-test for paired samples is used when the samples are paired. This implies that each individual observation of one sample has a unique corresponding member in the other sample.
Dependent T-Test for Paired Samples has a few background assumptions which need to be satisfied: the samples should be normal, an assumption that can be tested, for instance by the control of the asymmetry of the samples (asymmetry should be included between a range of -2 to +2) and the equality among the mean and the median of the sample (the median is the numerical value separating the higher half of a data sample from the lower half). It has however been shown that minor departures from normality do not affect this test - this is indeed an advantage. The samples should be dependent and it should be possible to identify specific pairs. An obvious requirement is that the two samples should be of equal size.
Once the hypotheses have been framed and the type of test chosen the following steps should be followed:

- Taking the sample of pre and post event that we want to verify (our case: pre gamification and post gamification) and determining the mean and the total sum of each difference couple of paired values:

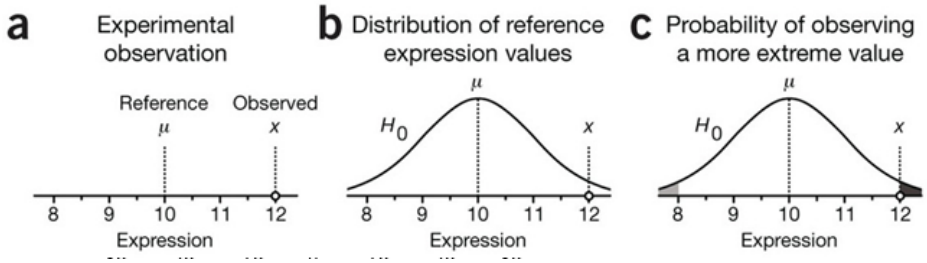
$$\sum_{i=1}^{n}(x_i - y_i)$$
$$\mu_\Delta = \frac{1}{n}\sum_{i=1}^{n}(x_i - y_i)$$

  Where x_i (data after the event) and y_i (data before the event) are the couple of values (paired) of the two samples, and n is the number of survey. Logically speaking, a small sum or a negative one could indicate truth of the null hypothesis. However nothing concrete can be interpreted from it, specifically as to whether intervention did have an impact as it could very well have happened by sheer luck. On the other hand, it could also be the case that the event was indeed useful.

- The variance and consequently the standard deviation of the sample composed by difference couple of paired values with the formulas show above.
- Another parameter is needed for the calculation: standard error. The standard error (s.e.) is the standard deviation of the sample-means's estimate of a population mean. (It can also be viewed as the standard deviation of the error in the sample mean relative to the true mean, since the sample mean is an unbiased estimator). Standard error is usually estimated by the sample estimate of the population standard deviation (sample standard deviation) divided by the square root of the sample size (assuming statistical independence of the values in the sample).

$$s.e. = \frac{\sigma}{\sqrt{n}}$$

- After having calculated the mean and the standard error of the difference between the two samples, we have to compute the t-value to execute the test and extract the p-value. In general a statistical test is based on a value known as reference and another value coming from a sample called observation.

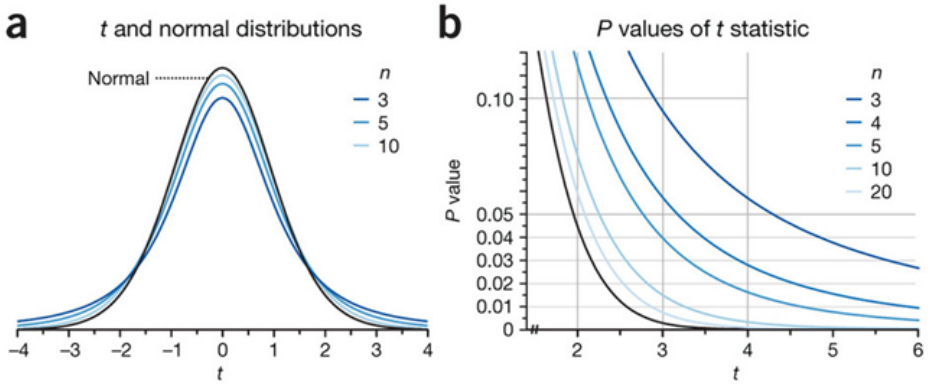


The significance of the difference between observed (x) and reference (μ) values (a) is calculated by assuming that observations are sampled from a distribution (H_0) with mean μ (b). The statistical significance of the observation x is the probability of sampling a value from the distribution that is at least as far from the reference, given by the shaded areas under the distribution curve (c). This is the P value[Krzywinski and Altman(2013)].
Unfortunately, the P value is often misinterpreted as the probability that the null hypothesis (H_0) is true. This mistake is called the 'prosecutor's fallacy', which appeals to our intuition and was so coined because of its frequent use in courtroom arguments. In the process of calculating the P value, we assumed that H_0 was true and that x was drawn from H_0. Thus, a small P value (for example, P = 0.05) merely tells us that an improbable event has occurred in the context of this assumption. The degree of improbability is evidence against Ho and supports the alternative hypothesis that the sample actually comes from a population whose mean is different than μ. Statistical significance suggests but does not imply real-world significance.

$$tobs = \frac{(x-\mu)}{s.e.}$$

Where in our case, x is the mean of the difference between the two samples and μ is the mean of the null hypothesis.
Since we want to demonstrate an increase with respect to the past, the mean of the null hypothesis will be 0 for all the cases.
After computing the t-value of the observation, we need to find the p-value of the experiment, for this reason we compare our t-value with the theoretical one exploiting the t distribution.

The t distribution has higher tails that take into account that most samples will underestimate the variability in a population. The distribution is used to evaluate the significance of a t statistic derived from a sample of size n and is characterized by the degrees of freedom, $d.f. = n - 1$. (b) When n is small, P values derived from the t distribution vary greatly as n changes.
The relationship between t and P is shown in figure b and can be used to express P as a function of the quantities on which t depends (D, sx, n), where D is the difference between the mean of sample to test and the reference value $(x - \mu)$.
Now to convert the t-value calculated in a probability, we have to choose what level of significance we want for our experiments. The significance

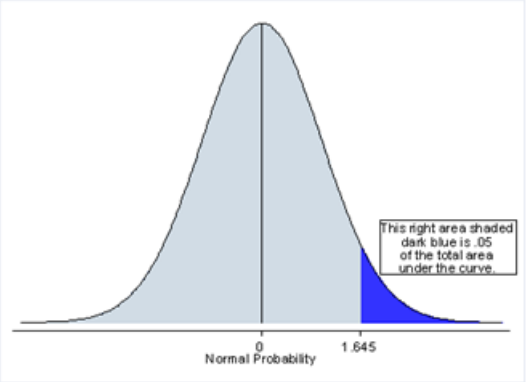


level (α) of a statistical hypothesis test is a fixed probability of wrongly rejecting the null hypothesis H_0, if it is in fact true[Krzywinski and Altman(2013)]. It is the probability of a type I error and is set by the investigator in relation to the consequences of such an error. That is, we want to make the significance level as small as possible in order to protect the null hypothesis and to prevent, as far as possible, the investigator from inadvertently making false claims. Usually, the significance level is chosen to be 0.1 or 0.05 (equivalently to 10% and 5%).
In statistic there are two type of error performing an experiment: type I error occurs when the null hypothesis is rejected when it is in fact true; that is, H_0 is wrongly rejected and type II error occurs when the null hypothesis H_0, is not rejected when it is in fact false.

Truth/Decision	Reject H_0	Do not Reject H_0
H_0	*Type I Error*	*Right Decision*
H_1	*Right Decision*	*Type II Error*

For all our experiments we choose a level of significance of $\alpha = 0.1$ (10%) , now we have to select if we need a two-tailed test or only one-tailed test.
Given α (for example 0.1) level of significance a two-tailed test allots half of your alpha to testing the statistical significance in one direction and half of your alpha to testing statistical significance in the other direction. This means that 0.05 is in each tail of the distribution of your test statistic. When using a two-tailed test, regardless of the direction of the relationship you hypothesize, you are testing for the possibility of the relationship in both directions.
Instead, a one-tailed test allots all of your alpha to testing the statistical significance in the one direction of interest. This means that 0.1 is in one tail of the distribution of your test statistic. When using a one-tailed test, you are testing for the possibility of the relationship in one direction and completely disregarding the possibility of a relationship in the other direction. The one-tailed test provides more power to detect an effect in one direction by not testing the effect in the other direction [Idre(2013)].

Since we want to verify that the gamification and all the game mechanisms have introduced some benefits, we will use a one-tailed test because we need to prove a thesis only in one direction. In figure there is represented the t-critical value (1.645) for α =0.05 this value correspond, graphically, to the probability of falling inside the dark blue area. In our experiment we will check, as first step, the statistical significance for $\alpha = 0.1$, in case of success we will try to execute the test also for $\alpha = 0.05$. For a one-tailed test



with 29 degrees of freedom (we will to compare samples collected in one month) the t-critical value for α =0.1 is :

$$tcrit = 1.311$$

This value will be used to all the practical experiments illustrated in the next chapter.Then, we confront the t-critical value with the t-value of the observation and if:

$$tobs > tcrit$$

Our calculated value is greater than critical one, so the value of the experiment falls inside the accepting area (dark blue) and we can reject the null hypothesis and accept the alternative hypothesis, in other words, the results of the experiments are not due to chance.
Otherwise if tobs is smaller than the t-critical value we can not reject the null hypothesis, because the calculated value falls inside the middle area of the student distribution, in this case, the results can be due to chance or it is a congruent value respect to the population mean.

After this explanation of the theory and formulas applied to the examination of the beta testing results, we want to study the hypothesis individually and check whether the assumptions made during the design phase were true.
For each hypothesis, we will illustrate the data collected from the experiment and the calculated metrics. A hypothesis can have more actions associated to it so to clarify the procedure, before performing the testing phase, we will depict the summary table with the data and the graph.

- Hypothesis 1: Gamification mechanics can improve self-powered customer support through the Forum.
  - HP 1.1 Participation points increase the use of the community forum to seek for aid (community driven help).

    Post a question analysis

    In the Forum, the company would like to improve the participation of the user, making the WebRatio tool more clear.
    If the forum is well populated, a customer who uses WebRatio will be confident in asking his questions or problems because he will perceive that the Forum is a place where it is possible to learn and clarify some issues easily.
    To prove that the gamification has led the users into a greater desire to publish questions, thus making the Forum attended and

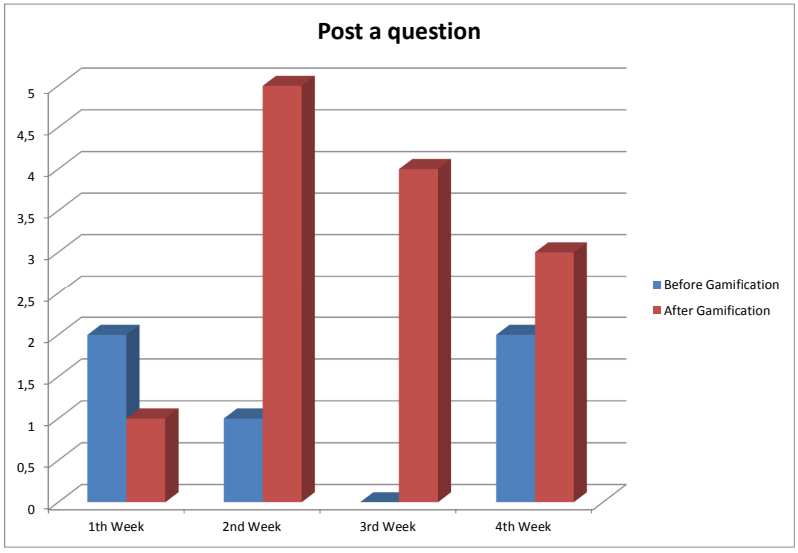


Figure 41.: Post a question graph

Post a question	Before Gamification	Ater Gamification	Difference
Sum	5	13	8
Daily Mean	0.166	0.433	0.266
Weekly Mean	2.1	3.25	1.15
Variance	0.143	0.391	0.547
Standard deviation	0.379	0.626	0.739
Asymmetry	1.884	1.171	0.615

Table 12.: Post a question information table

full of active "life" regarding WebRatio, we want to compare the amount of daily questions created in September 2012, compared to September 2013 (month of the community Beta testing).
The data have been collected daily and thirty days after several metrics were calculated. In the same way, we recovered the number of question published day by day regarding September 2012. In the table above, there are illustrations of all the calculated metrics. In detail were calculated: the total sum of questions published, the daily average, variance, standard deviation and asymmetry of the data collected.
After that, to verify scientifically the effects caused by gamification, we performed a Dependent T-Test for Paired Samples. As illustrated in the previous chapter, The dependent t-test for paired samples is used when we want to compare the samples of two groups which are paired. This implies that each individual observation of one sample has a unique corresponding member in the other sample. In our case, each day of September 2012 has a unique corresponding in September 2013.

From the T-Test theorem, we have to decide which is the null hypothesis (H_0), and which is the alternative hypothesis (H_1). Since we want to prove that the gamification has introduced an increase in the number of questions created in the Forum, we chose as null hypothesis:

$$H_0 : \mu = 0$$
any differences in number of questions is due to chance.

and as alternative hypothesis:

$$H_1 : \mu > 0; \text{the induction of gamification bring a benefit.}$$

Where μ is the mean of the difference between the number of question in September 2012 and September 2013.
To compute the mean of the difference between the two periods, we have to calculate the difference of each single day (last column in the table).

Difference = number of questions (day 2013) - number of questions (day 2012)
($\forall$ day in September)

So the for the column Difference, all the metrics are evaluated (sum, mean, variance, derivation standard, asymmetry).
With these metrics we can make the following calculations to execute the T-Test:

$$s.e. = \frac{stddev}{\sqrt{n}} = \frac{0.7396}{\sqrt{30}} = 0.135$$
$$tobs = \frac{(x-\mu)}{s.e.} = \frac{(0.267-0)}{0.135} = 1.978$$

Where s.e. is the standard error for that estimate and tobs is the T-Test value of the observation (as we have seen in the introduction).
Now, we have to compare our t-value with the t-value critical one. As we have seen in the theoretical part, to consider the result of a test statistically relevant, we have to obtain a percentage (P level of significance) that is less or equal than 10%.
Consulting the table of values from Student's t-distribution of one-tail (since we are testing for the possibility of the relationship in one direction, increase of number of question, and completely disregarding the possibility of a relationship in the other direction), we search for the 0.1 critical value for 29 degrees of freedom (degrees of freedom = number of observations -1) corresponding to:

t crit=1.311

Since tobs > tcrit our calculated value is larger than the tabled critical value at α=0.1, so we reject the null hypothesis and accept the alternative hypothesis, namely, that the difference in number of question published is likely the result of the gamification effects and not the result of chance variation. Moreover the t-value calculated is also greater than the critical t-value at α=0.05 (tcrit = 1.699), thus there is evidence, at the 5% level of significance

that the gamification has introduced an increase of questions published in the WebRatio Forum.
The difference between the weekly and daily mean, shown in the table, illustrate a percentage increase of questions published of +43,2% (daily) and +51,5% (weekly), highlighting how the game mechanisms have encouraged users to take an active part in the Forum life.

– HP 1.2 Participation points increase the will of the user to help other users in the community.

Post an answer analysis

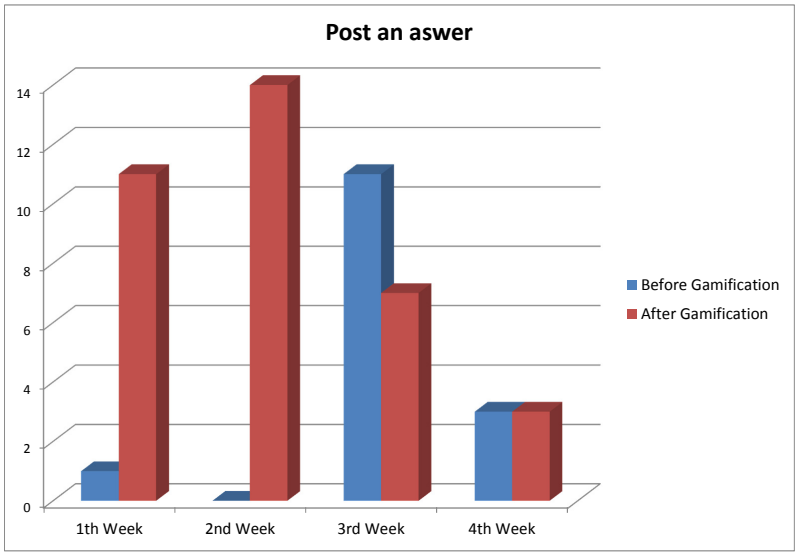


Figure 42.: Post an answer graph

Post an answer	Before Gamification	Ater Gamification	Difference
Sum	15	35	20
Daily Mean	0.5	1.166	0.666
Weekly Mean	3.75	8.75	5
Variance	2.12	3.247	5.609
Standard deviation	1.456	1.801	2.368
Asymmetry	3.624	1.779	0.377

Table 13.: Post an answer information table

Webratio created the community in an attempt to introduce more feedbacks and more collaboration among the users, in this case in the Forum.
According to the gamification theories, the user inserted into the game mechanisms, he tends to want to collect points to win the awards in this way is encouraged to participate more, providing his skills and knowledge to others.
Since we want to prove that the community has driven the people to actively contribute, in this case through the number of replies in the Forum, we chose as null hypothesis:

$$H_0 : \mu = 0$$
any differences in number of replies is due to chance.

and as alternative hypothesis:

$$H_1 : \mu > 0;$$
through the game mechanisms the number of replies has increased.

Exploiting the metrics we can compute the T-Test equations:

$$s.e. = \frac{stddev}{\sqrt{n}} = \frac{2.368}{\sqrt{30}} = 0.432$$
$$tobs = \frac{(x-\mu)}{s.e.} = \frac{(0.667-0)}{0.432} = 1.543$$

Since tobs > tcrit our calculated value is larger than the tabled critical value at α=0.1, so we reject the null hypothesis and accept the alternative hypothesis, namely, that the difference in number of replies published in the Forum is likely the result of the gamification effects and not the result of chance variation.

Post a comment analysis

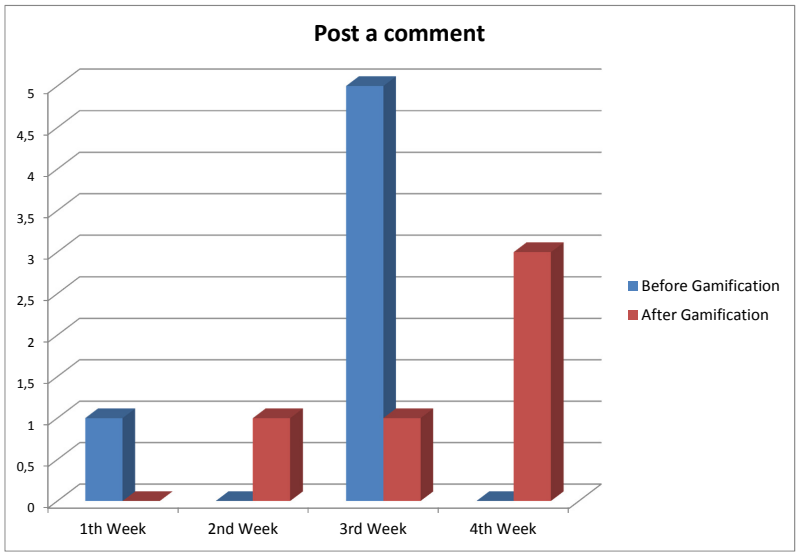


Figure 43.: Post a comment graph

Post a comment	Before Gamification	Ater Gamification	Difference
Sum	6	5	-1
Daily Mean	0.2	1.166	-0.033
Weekly Mean	1.5	1.25	-0.25
Variance	0.579	0.143	0.722
Standard deviation	0.761	0.379	0.85
Asymmetry	4.665	1.884	-3.539

Table 14.: Post a comment information table

As shown in the table and graph, the number of comments made by users on the Forum in the month of Beta testing was lower than the number of those registered in September 2012.
So the difference is negative, but only for one point. We note that in September 2012, only the third week had five comments, this value is higher than the classical average, so that week makes the month of September 2012, a month over the mean. The amount of comments is numerically low, because users prefer to use the response mechanism than the comment action.
In conclusion we can say that the gamification has not changed the balance regarding the comments on the Forum.

– HP 1.3 Participation points improves the quality of the answers provided in the Forum.

Forum Vote up analysis

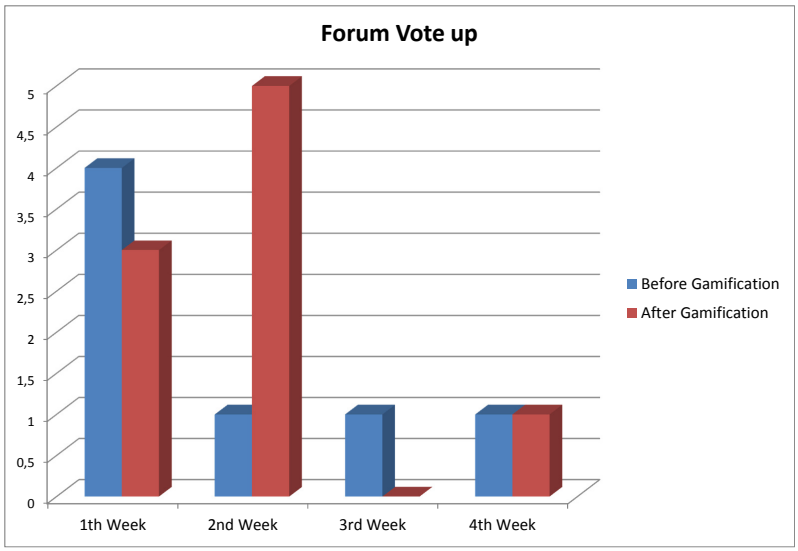


Figure 44.: Forum voteup graph

Forum voteup	Before Gamification	Ater Gamification	Difference
Sum	7	9	2
Daily Mean	0.233	0.3	0.066
Weekly Mean	1.75	2.25	0.5
Variance	0.598	0.562	1.305
Standard deviation	0.773	0.749	1.142
Asymmetry	4.341	2.588	-0.732

Table 15.: Forum voteup information table

The community has the goal to make know the product WebRatio to many potential customers, but above all to improve the quantity and quality of the content published on its platforms.
For this reason, it is believed that the number of vote up, applicable to both questions and answers in the Forum is an important parameter to track the results both qualitative and quantitative.
Since we want to prove that the community has introduced more quality in all the activities which the users perform inside the WebRatio platforms, we chose as null hypothesis:

$$H_0 : \mu = 0$$

any differences in number of vote up is due to chance.

and as alternative hypothesis:

$$H_1 : \mu > 0;$$

through the game mechanisms the number of vote up has increased.

Exploiting the metrics we can compute the T-Test equations:

$$s.e. = \frac{stddev}{\sqrt{n}} = \frac{1.142}{\sqrt{30}} = 0.208$$
$$tobs = \frac{(x-\mu)}{s.e.} = \frac{(0.067-0)}{0.208} = 0.322$$

Since tobs < tcrit our calculated value is smaller than the tabled critical value at α=0.1, we can not reject the null hypothesis.
This result was predictable because the difference in vote up is definitely minimal.
As shown in the graph in the third week of beta testing (September 2013) has not been registered any action that probably, it is not allowed to the beta testing to obtain a higher difference. So we can not say that the difference between the number of vote up before and after the gamification is statistically significant.

Answer approved analysis

When an user has been approved one of his responses on the Forum, he gains participation and especially reputation points, for this reason it is one of the most important actions of the community.
Unfortunately, the data obtained for this particular case are not

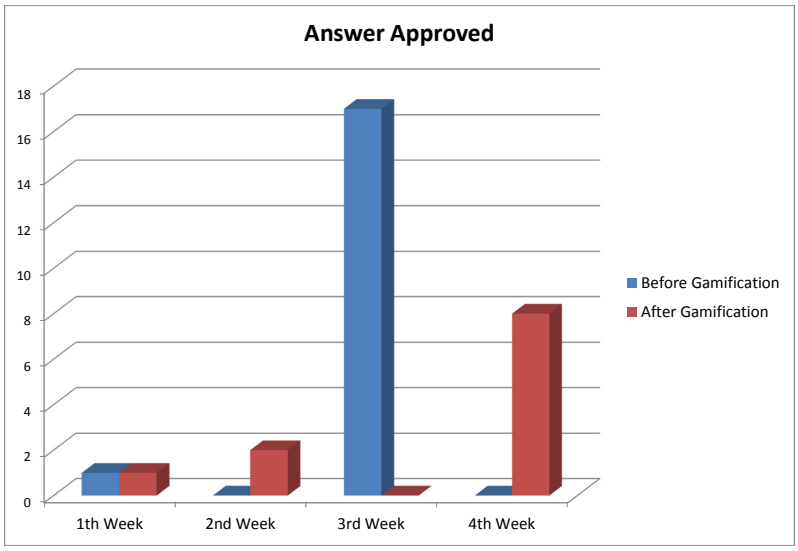


Figure 45.: Forum answer approved graph

Forum answer approved	Before Gamification	Ater Gamification	Difference
Sum	18	11	-7
Daily Mean	0.6	0.366	-0.233
Weekly Mean	4.5	2.75	-1.75
Variance	5.696	1.067	7.219
Standard deviation	2.386	1.033	2.686
Asymmetry	5.174	3.196	-3.675

Table 16.: Forum answer approved information table

positive, because in September 2012 the number of approved answers was greater than those in the beta testing period (September 2013). As shown in the graph, in the third week of September 2012, there were seventeen responses accepted, this from the Forum point of view is an exception that transformed September 2012 to an abnormal month.
In the remaining weeks, the number of responses approved is similar, actually, in the fourth week of September 2013 there are eight accepted answers against zero.
Another key to understanding the data may be that users realizing that approving answers bring points to other users, they prefer to not accept them tactically (no provide points to other users). If this phenomenon was confirmed, the system administrator should intervene accepting correct answers.

– HP 1.4 The use of badges can induce users to post more meaningful answers and more questions.

Best User Forum Questions & Answers analysis

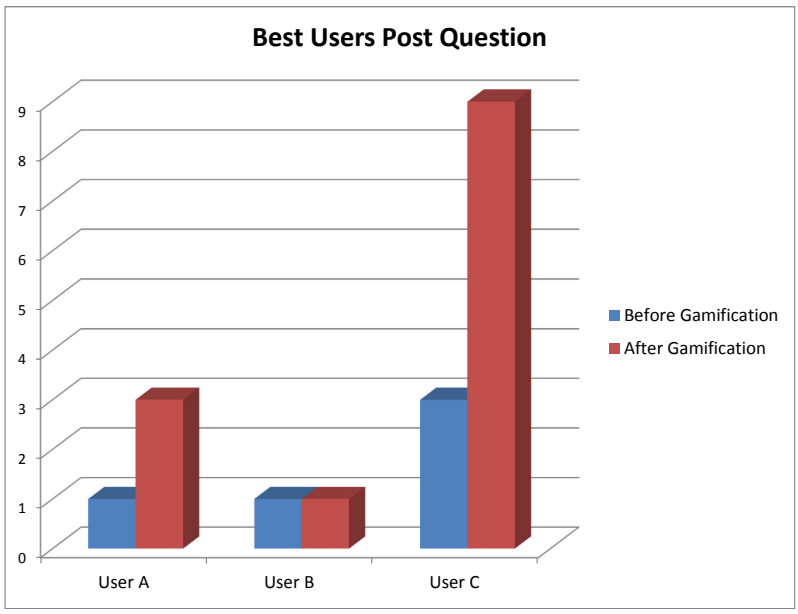


Figure 46.: Best User Forum Questions graph

User A	Before Gamification	Ater Gamification	Difference
Sum	1	3	2
Daily Mean	0.033	0.1	0.066
Weekly Mean	0.25	0.75	0.5
Variance	0.033	0.093	0.133
Standard deviation	0.182	0.305	0.365
Asymmetry	5.477	2.809	0.924

Table 17.: Best User Forum Questions User A information table

The objectives of these tests are to studying how the community can attract new users and mainly the goal of analyzing the behavior of those already were present in the WebRatio world.
In this case we want to study how the mechanism of rewards based on the badges system has extended the attitude of the users who usually perform more actions in the Forum area. The actions considered are the questions created and the approval of the answers. In the tables above are illustrated the data collected during the testing phase for the three users who have performed more action in the Forum (post a question and his answer approved).
We have three users, User A, B and C, as first thing we can say that the User B has performed the same quantity of actions both the last year (September 2012) and in the beta testing (September 2013). So based on the data collected User B has not affected from the gamification and the system of badges.
For the other two users, who have a positive difference between the number of actions performed in September 2013 and those in September 2012 we can proceed with the t-test.

User B	Before Gamification	Ater Gamification	Difference
Sum	1	1	0
Daily Mean	0.033	0.033	0
Weekly Mean	0.25	0.25	0
Variance	0.033	0.033	0.068
Standard deviation	0.182	0.182	0.262
Asymmetry	5.477	5.477	0

Table 18.: Best User Forum Questions User B information table

User C	Before Gamification	Ater Gamification	Difference
Sum	3	9	6
Daily Mean	0.1	0.3	0.2
Weekly Mean	0.75	2.25	1.5
Variance	0.093	0.355	0.51
Standard deviation	0.305	0.595	0.714
Asymmetry	0	1.906	0.899

Table 19.: Best User Forum Questions User C information table

Since we want to study if there was a positive change of user behavior after that the community has been created with the reward through the badges system, we chose as null hypothesis:

$$H_0 : \mu = 0$$

any differences in number of actions is due to chance.

and as alternative hypothesis:

$$H_1 : \mu > 0;$$

the creation of the badges system bring more number of actions (in this case Forum).

User A:

$$s.e. = \frac{stddev}{\sqrt{n}} = \frac{0.365}{\sqrt{30}} = 0.067$$
$$tobs = \frac{(x-\mu)}{s.e.} = \frac{(0.067-0)}{0.067} = 1$$

User C:

$$s.e. = \frac{stddev}{\sqrt{n}} = \frac{0.714}{\sqrt{30}} = 0.130$$
$$tobs = \frac{(x-\mu)}{s.e.} = \frac{(0.2-0)}{0.130} = 1,538$$

For the User A tobs < tcrit so our calculated values are smaller than the tabled critical value at α=0.1, so we can not reject the null hypothesis instead for the User C tobs > tcrit so we can reject the null hypothesis and declare that for the only User C, there

is α=0.1 statistically significant that the badges system introduce benefits.

- Hypothesis 2: Gamification mechanics can improve the ability of the company to identify the customers that use their product and increase the company image by showing more and more companies using WebRatio.
  - HP 2.1 Participation points can increase the number of users that register within the system.

User Registration analysis

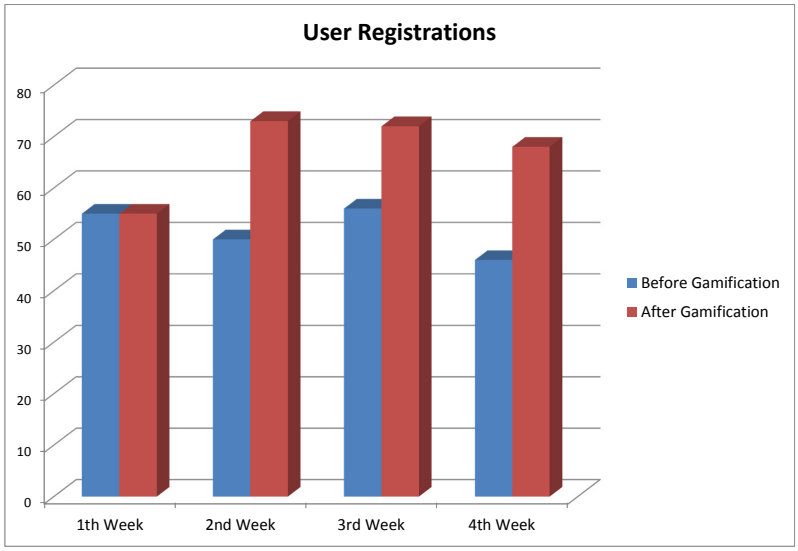


Figure 47.: User Registration graph

User Registration	Before Gamification	Ater Gamification	Difference
Sum	207	268	61
Daily Mean	6.9	8.933	2.033
Weekly Mean	51.57	67	15.43
Variance	19.265	26.064	39.826
Standard deviation	4.389	5.105	6.31
Asymmetry	0.868	1.835	1.109

Table 20.: User Registration information table

The number of users who are registered in WebRatio portal, it is a very important parameter, because one of the main goals of the company is to increase its number of clients, making the product most known and famous among the industry professionals.
The table above illustrates the daily number o registration in September 2012, compared to September 2013 (month of the community Beta testing).

As we can see immediately there is a decided increase in the number of registrations.
Since we want to prove that the gamification has transformed all the WebRatio portals, making them, more attractive, bringing a increased number of participant users, we chose as null hypothesis:

$$H_0 : \mu = 0$$

any differences in number of registrations is due to chance.

and as alternative hypothesis:

$$H_1 : \mu > 0;$$

the induction of gamification bring more user registrations.

Exploiting the metrics we can compute the T-Test equations:

$$s.e. = \frac{stddev}{\sqrt{n}} = \frac{6.310}{\sqrt{30}} = 1.152$$
$$tobs = \frac{(x-\mu)}{s.e.} = \frac{(2.034-0)}{1.152} = 1,765$$

Since tobs > tcrit our calculated value is larger than the tabled critical value at α=0.1, so we reject the null hypothesis and accept the alternative hypothesis, namely, that the difference in number of registration is likely the result of the gamification effects and not the result of chance variation.
Moreover the t-value calculated is also greater than the critical t-value at α=0.05 (tcrit = 1.699), thus there is evidence, at the 5% level of significance that the gamification has introduced an increase of users in the WebRatio portals.

- HP 2.2 Participation points can increase the details provided by the users on themselves (photo, social media accounts, biography).
- HP 2.3 Participation points can increase the involvement of existing enterprise users and identify them (customer/partner serial registration).

User Setting Data analysis

Unfortunately, all kinds of information related to the data that the user could set in his account, before the creation of the community, were not tracked by the system so it is not possible know when an user had set or change his profile data.
For this reason we have no an history with which to compare the number of actions which occurred during the first month of gamification.
However, we can note that, despite the beta testing has been performed only with people who in one way or another already knew and used WebRatio, many of them have updated and enriched their personal information so that they can receive points which the community assigns for these types of action.
A key to understanding this behavior is undoubtedly the desire to increase their own scores to climb the ranks of the community.

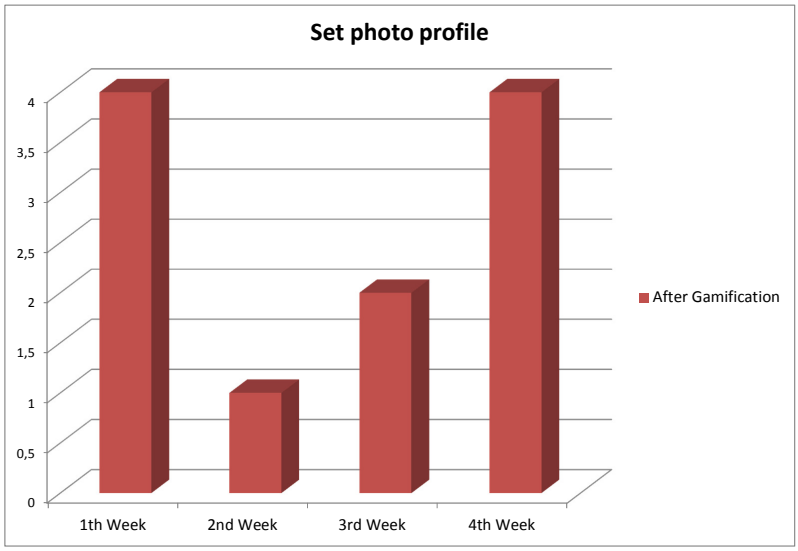


Figure 48.: Set photo graph

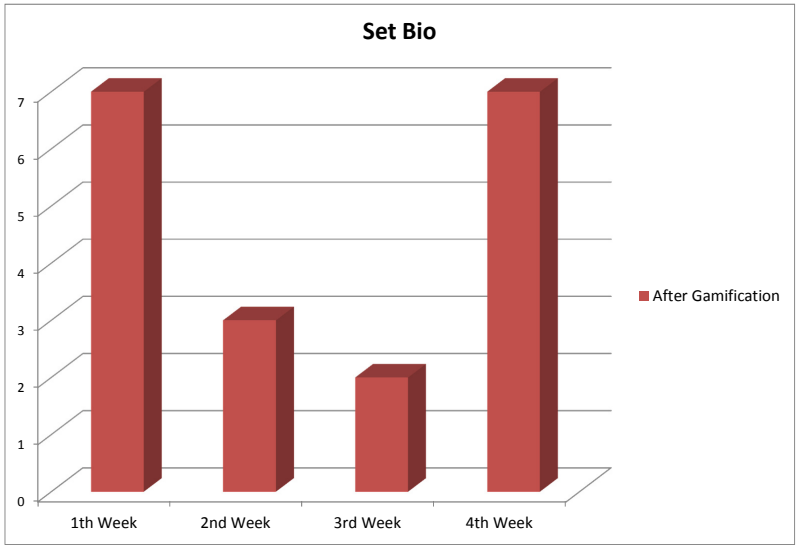


Figure 49.: Set bio graph

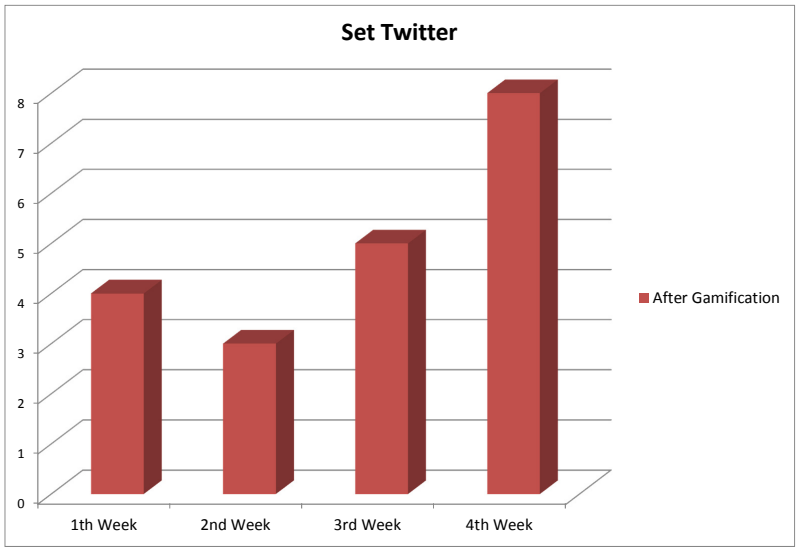


Figure 50.: Set Twitter graph

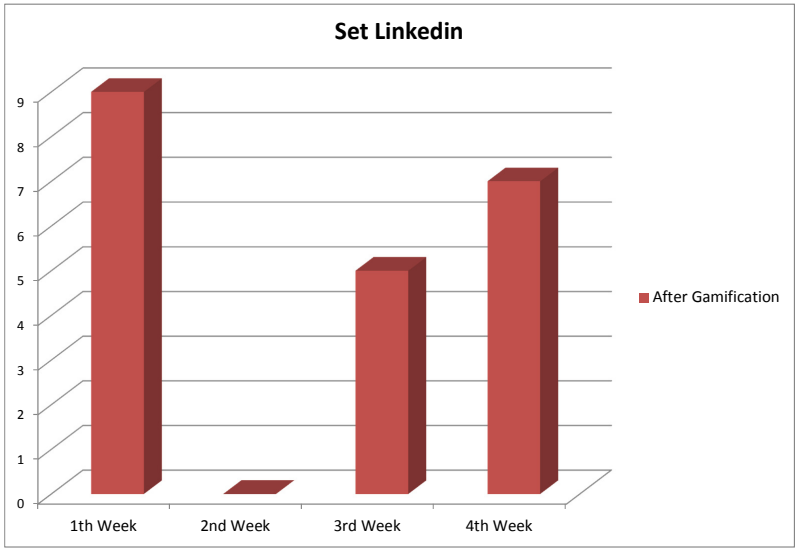


Figure 51.: Set Linkedin graph

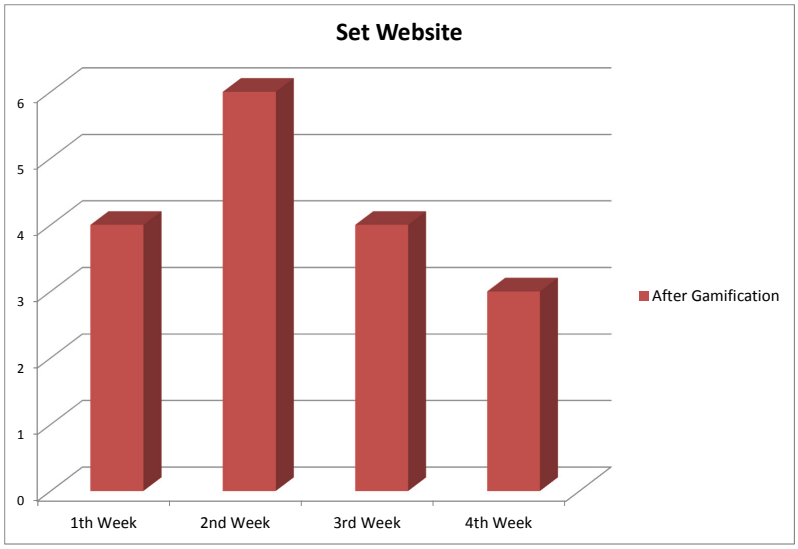


Figure 52.: Set Website graph

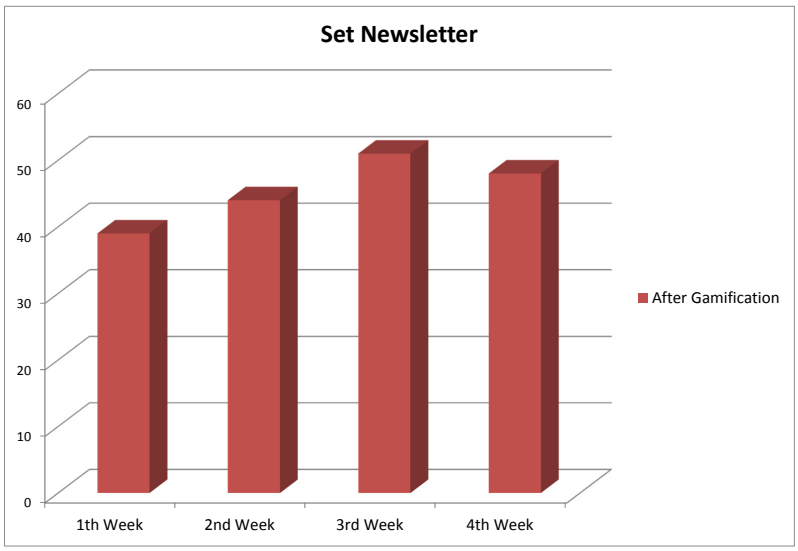


Figure 53.: Set Newsletter graph

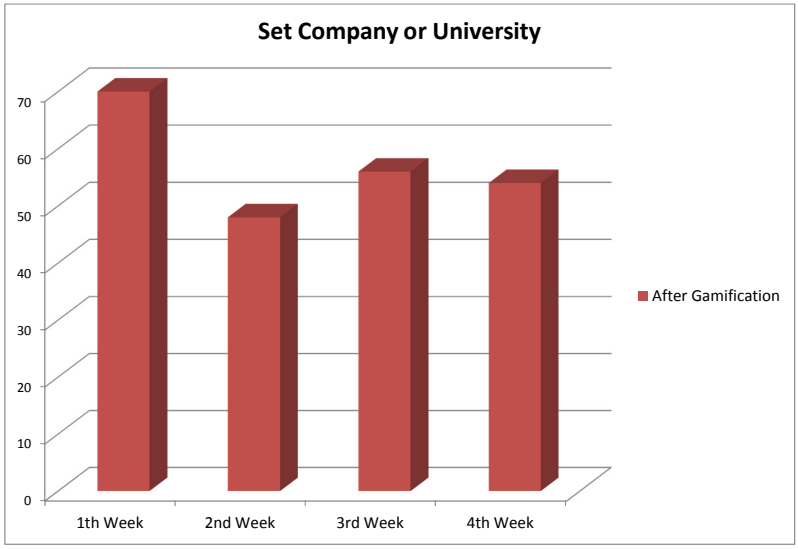


Figure 54.: Set Company/University graph

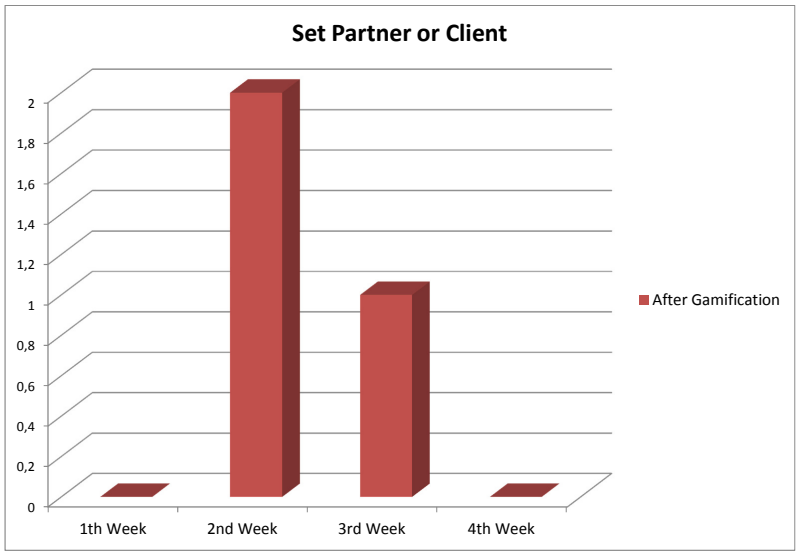


Figure 55.: Set Client/Partner graph

Action	Before Gamification	Ater Gamification
n.Photo	No numerable	13
n.Bio	No numerable	19
n.Twitter	No numerable	20
n.Linkedin	No numerable	21
n.Website	No numerable	17
n.Newsletter	No numerable	182
n.Company/University	No numerable	228
n.Clients/Partners	No numerable	3
Tot	No numerable	503

Table 21.: Setting data information table

- Hypothesis 3: Gamification mechanics can increase user retention.
  - HP 3.1 Participation points may induce users to login more often.

Forum Login analysis

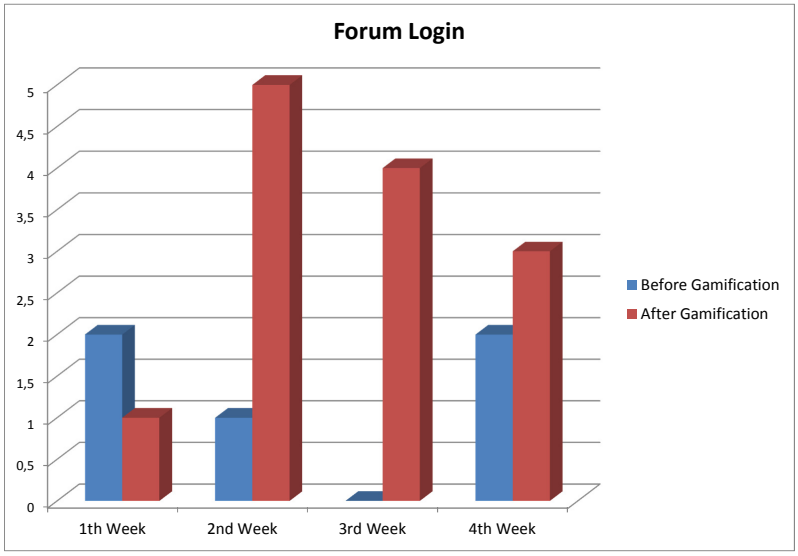


Figure 56.: Forum login graph

One of the key point of the community is to involve users in the WebRatio world. It has the aim of creating a kind of virtuous circle that causes people to be often on the platform in a consistent manner. To verify that this objective has been achieved, we want to control the number of logins that users have made in the Forum, so as to determine whether, in general they changed their habits and how it has changed the trend.
From the T-Test theorem, we have to decide which is the null hypothesis (H_0), and which is the alternative hypothesis (H_1).

Forum login	Before Gamification	Ater Gamification	Difference
Sum	24	33	9
Daily Mean	0.8	1.1	0.3
Weekly Mean	6	8.25	2.25
Variance	1.337	2.162	4.01
Standard deviation	1.156	1.47	2.002
Asymmetry	1.707	1.559	-0.112

Table 22.: Forum login information table

Since we want to prove that the participation points which the community assigns, encourage the users to participate more and to increase their visits on the portals, we chose as null hypothesis:

$$H_0 : \mu = 0$$
any differences in number of login is due to chance.

and as alternative hypothesis:

$$H_1 : \mu > 0;$$
the induction of gamification bring more login into the portals (in this case Forum).

Exploiting the metrics we can compute the T-Test equations:

$$s.e. = \frac{stddev}{\sqrt{n}} = \frac{2.002}{\sqrt{30}} = 0.3655$$
$$tobs = \frac{(x-\mu)}{s.e.} = \frac{(0.3-0)}{0.3655} = 0.82$$

In this case tobs < tcrit so the t-value of the experiment is less than the t critical value, in this situation we can not reject the null hypothesis (H_0) then it is not possible to assert that the increase of number Forum login is statistically significant.
In other worlds, the meaning of the t-test result is that there is not enough difference between the two samples to express with high level of significance that it has been a benefit. According to the t-test results this small increase it could be also due only to a random event.

Best User Forum Login analysis

An interesting analysis which allows to study how the introduction of game mechanisms have changed the behavior of users was made. This research has been made by tracking the number of Forum login of the three users (participants in beta testing) who in the past have carried out the higher number of Forum logins over all other users.
In the tables above are illustrated the data collected during the testing phase for the three users more involved (User A, User B, User C).
As first observation, we can note that the User B, not only did not increase the number of logins executed in the Forum, but wors-

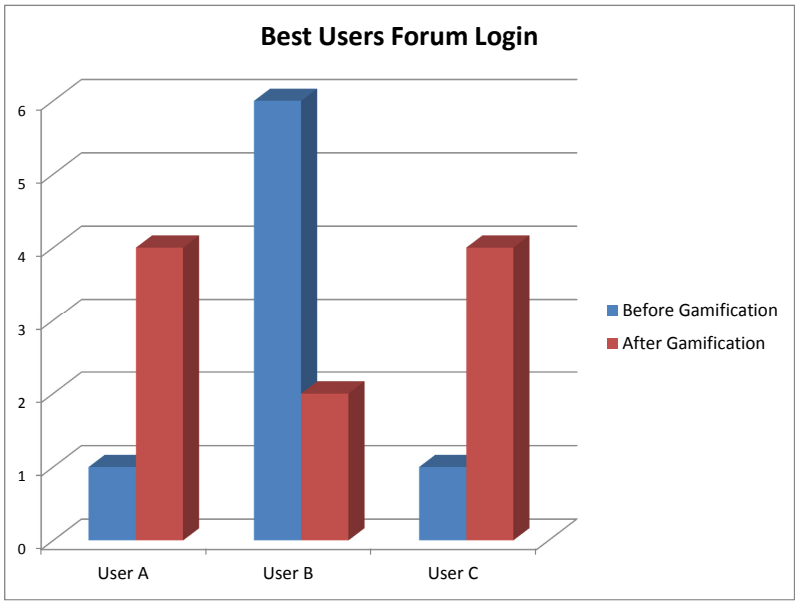


Figure 57.: Best User Forum Login graph

User A	Before Gamification	Ater Gamification	Difference
Sum	1	4	3
Daily Mean	0.033	0.133	0.1
Weekly Mean	0.25	1	0.75
Variance	0.033	0.119	0.162
Standard deviation	0.182	0.345	0.402
Asymmetry	5.477	2.272	0.883

Table 23.: Best User Forum Login User A information table

ened the quantity, since it was signed in September 2012 six times while in September 2013 only two times. So for the User B the t-test is superfluous, as probably the small number of actions performed during the month of beta testing is due to chance. Thus we can consider this as outliers in the test (In statistics, an outliers is an observation point that is distant from other observations).
For the other two users, who have a positive difference between the number of logins performed in September 2013 and those in September 2012 we can proceed with the t-test.
Since we want to study if there was a positive change of user behavior after that the community has been created, we chose as null hypothesis:

$$H_0 : \mu = 0$$

any differences in number of login is due to chance.

and as alternative hypothesis:

$$H_1 : \mu > 0;$$

User B	Before Gamification	Ater Gamification	Difference
Sum	6	2	-4
Daily Mean	0.2	0.066	-0.133
Weekly Mean	1.5	0.5	-1
Variance	0.303	0.064	0.326
Standard deviation	0.55	0.253	0.571
Asymmetry	2.758	3.659	-2.405

Table 24.: Best User Forum Login User B information table

User C	Before Gamification	Ater Gamification	Difference
Sum	1	4	3
Daily Mean	0.033	0.133	0.1
Weekly Mean	0.25	1	0.75
Variance	0.033	0.119	0.093
Standard deviation	0.182	0.345	0.305
Asymmetry	5.477	2.272	2.809

Table 25.: Best User Forum Login User C information table

the induction of gamification bring more login into the portals (in this case Forum).

User A:

$$s.e. = \frac{stddev}{\sqrt{n}} = \frac{0.40}{\sqrt{30}} = 0.073$$
$$tobs = \frac{(x-\mu)}{s.e.} = \frac{(0.1-0)}{0.073} = 1,369$$

User C:

$$s.e. = \frac{stddev}{\sqrt{n}} = \frac{0.305}{\sqrt{30}} = 0.055$$
$$tobs = \frac{(x-\mu)}{s.e.} = \frac{(0.1-0)}{0.055} = 1,818$$

For both the users tobs > tcrit so our calculated values are larger than the tabled critical value at α=0.1, so we reject the null hypothesis and accept the alternative hypothesis, namely, that the gamification has increase the number of login of the users who already have an high frequency of login in the Forum. This result is very important since it demonstrates that the introduction of game mechanism has brought improvement also in the customers who already have an active and frequent life in WebRatio world.

The graph and tables illustrate how the daily and weekly means are changed from the period before gamification and after it. As already declared in the previous phase, the User B has a worsening in his mean instead the other two have both increase their value significantly.

This result is very encouraging because if users who already attend with good consistency the WebRatio portals have increased their numbers, the game mechanisms could have even better benefits, with users who usually are less present in WebRatio.

Website Login analysis

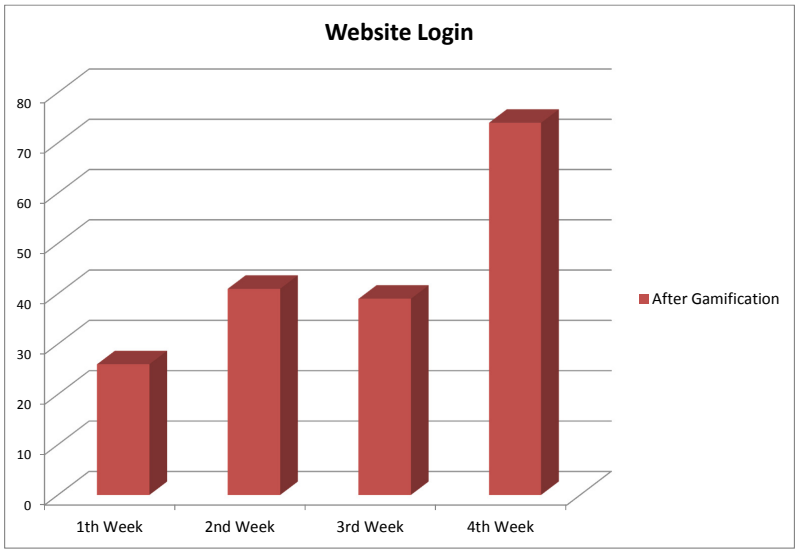


Figure 58.: Website Login graph

Website Login	Before Gamification	Ater Gamification
Sum	No numerable	180
Daily Mean	No numerable	6
Weekly Mean	No numerable	45
Variance	No numerable	16.413
Standard deviation	No numerable	4.051
Asymmetry	No numerable	0.686

Table 26.: Website Login information table

Also the number of logins performed in WebRatio website was tracked. Unfortunately, in the past were not recorded logins by users, so we can not make a comparison. We can see, thanks to the graph, as in the four weeks of September 2013, the number of logins has been constant and evenly distributed.

Follow Forum Topic analysis

Assign participation points to users who decide to follow a forum topic, enabling the receiving of notification emails, to be constantly updated on the forum news, is a strong incentive that WebRatio tries to give to reach the goal of have people who are

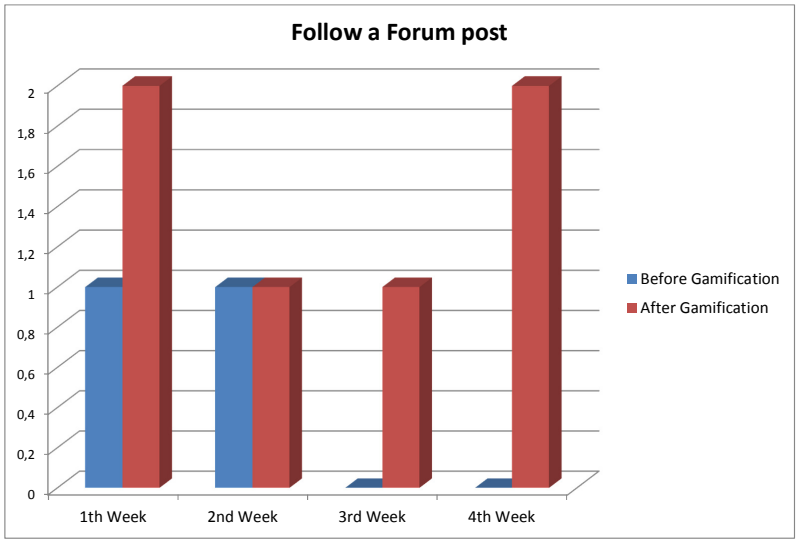


Figure 59.: Follow Forum Topic graph

Follow Forum Topic	Before Gamification	Ater Gamification	Difference
Sum	2	6	4
Daily Mean	0.066	0.2	0.133
Weekly Mean	0.5	1.5	1
Variance	0.064	0.165	0.257
Standard deviation	0.253	0.406	0.507
Asymmetry	3.659	1.58	0.266

Table 27.: Follow Forum Topic information table

more tempted to visit very frequently the Forum.
We have monitored the subscription in the month of Beta testing and we want to compare that result with the data belonging to the same month of the year before.
Since we want to prove that assign participation points for follow Forum topics, encourage the users to subscribe the notification system and as consequence to be more present and active in the WebRatio "life", we chose as null hypothesis:

$$H_0 : \mu = 0$$

any differences in number of subscriptions is due to chance.

and as alternative hypothesis:

$$H_1 : \mu > 0;$$

the induction of gamification increase the number of subscriptions.

Exploiting the metrics we can compute the T-Test equations:

$$s.e. = \frac{stddev}{\sqrt{n}} = \frac{0.507}{\sqrt{30}} = 0.092$$
$$tobs = \frac{(x-\mu)}{s.e.} = \frac{(0.134-0)}{0.092} = 1.456$$

Since tobs > tcrit our calculated value is larger than the tabled critical value at α=0.1, so we reject the null hypothesis and accept the alternative hypothesis, namely, that the difference in number of subscription is likely the result of the gamification effects and not the result of chance variation.
The t-value is statistically relevant only at α=0.1 because the t-value computed is smaller then the critical t-value at α=0.05 (tcrit = 1.699), thus we can assert that the gamification has increased the Forum topic subscription at 10% of significance but not at 5%.
As we can see from the calculation of the daily and weekly mean, and from the graph, in September 2013, the number of Forum post subscription has been higher than the year before. Even the t-test has confirmed that the introduction of the game mechanism has created benefits.

- Hypothesis 4: Gamification mechanics can induce users to produce and select high quality extensions for WebRatio.
  - HP 4.1 Improved feedback for the components present in the Store.

Rating a component analysis

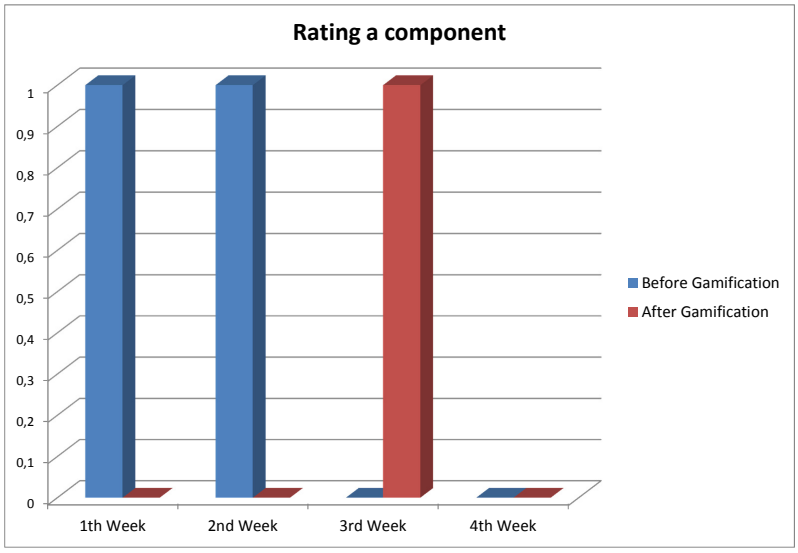


Figure 60.: Rating a component graph

Historically, the rating a component action is an activity that users do not practice very often because they pass immediately to the download phase and once installed the component they does not come back on the portal to leave their rates and comments.

Rating a component	Before Gamification	Ater Gamification	Difference
Sum	2	1	-1
Daily Mean	0.066	0.033	-0.33
Weekly Mean	0.5	0.25	-0.25
Variance	0.064	0.033	0.102
Standard deviation	0.253	0.182	0.319
Asymmetry	3.659	5.477	-0.792

Table 28.: Rating a component information table

In fact, the data collected confirm this trend, where in the month of beta testing, only one user has performed a vote.
From this point of view, and in this area the company will have to work hard to promote this type of action that can be informative both for the feedbacks for the company itself but also for other users so that they immediately identify the components most appreciated and valid.

– HP 4.2 Increased the number of components available.

Upload a component analysis

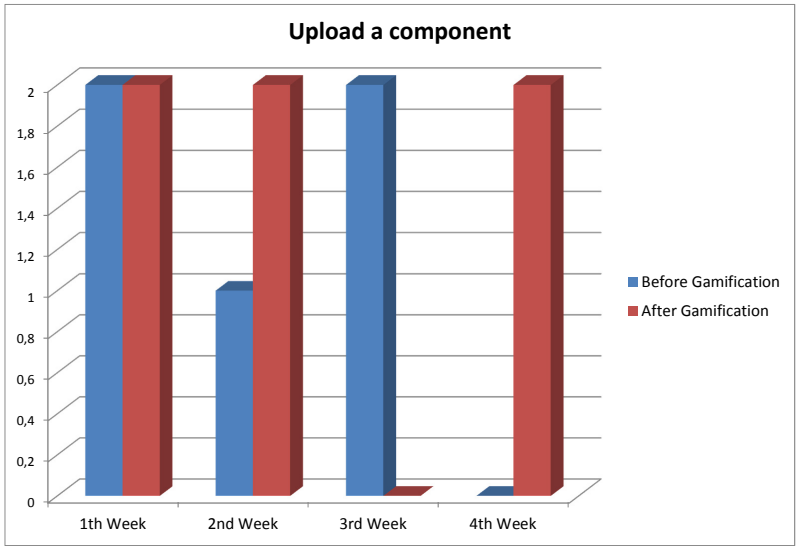


Figure 61.: Upload a component graph

As indirect consequence of the diffusion of the WebRatio product can be the birth of developers who dedicate at the production of components that extend and expand the functionality of WebRatio tool.
For this reason it is important for the company tracks how the creation of new components is evolving, moreover because Webratio, for new components developed by users, can obtain a remarkable

Upload a component	Before Gamification	Ater Gamification	Difference
Sum	5	6	1
Daily Mean	0.166	0.2	0.033
Weekly Mean	1.25	1.5	0.25
Variance	0.143	0.234	0.447
Standard deviation	0.379	0.484	0.668
Asymmetry	1.884	2.498	0.704

Table 29.: Upload a component information table

business advantage.
Since we want to prove that the community has introduced more quality in all the activities which the users perform inside the WebRatio platforms, we chose as null hypothesis:

$$H_0 : \mu = 0$$
any differences in number of components uploaded is due to chance.

and as alternative hypothesis:

$$H_1 : \mu > 0;$$
the gamification increased the number of components uploaded.

Exploiting the metrics we can compute the T-Test equations:

$$s.e. = \frac{stddev}{\sqrt{n}} = \frac{0.668}{\sqrt{30}} = 0.121$$
$$tobs = \frac{(x-\mu)}{s.e.} = \frac{(0.034-0)}{0.121} = 0.280$$

Since tobs < tcrit our calculated value is smaller than the tabled critical value at α=0.1, we can not reject the null hypothesis.

– HP 4.3 Increased the awareness of the users with respect to the extensibility of the platform.

Download a component analysis

Download a component	Before Gamification	Ater Gamification	Difference
Sum	397	265	-132
Daily Mean	13.233	8.833	-4.4
Weekly Mean	99.25	66.25	-33
Variance	313.012	29.454	320.8
Standard deviation	17.692	5.427	17.91
Asymmetry	2.108	0.474	-2.119

Table 30.: Download a component information table

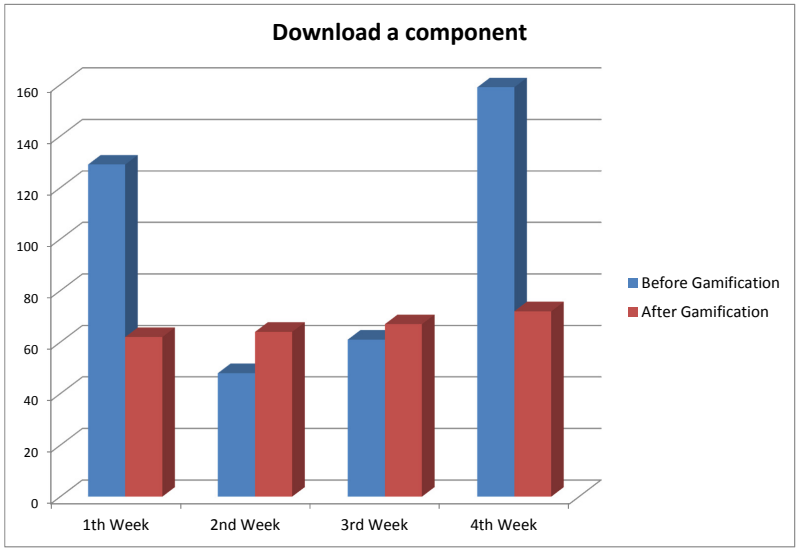


Figure 62.: Download a component graph

The test with the worst results was, how we can immediately note, that relative to the component download.
However this negative result, has some rational explanations. First of all the downloads of the elements which extend the functionalities of WebRatio depends a lot on what components were released in that commercial moment. So it is clear that in a period where new components were released the number of downloads tend to be higher, instead a moment without any new release will undergo a stalemate. As in other cases the fact that beta testing has been open only to users who are already familiar with the WebRatio world has definitely affected because these people, using the tool they had probably already installed several components, so they did not need to download any other. However, the store is a crucial area, and in the future will be a place where the company will prepare some improvements.

- Hypothesis 5: Gamification mechanics can induce users to participate and read more tutorial article about the use of WebRatio.
  - HP 5.1 Increased the number of WebRatio tutorial article read by the users.

    Read an article analysis

    LMS is an upgrade of the Knowledgebase platform that was created last year in the August 2012, and at that time the only feature it was to provide a set of educational articles and tutorials related of the use of WebRatio tool.
    As we can see at first glance, the results are extremely positive, because the comparison with the month of September 2012 is quite misleading, since the platform of e-learning had just been published on-line.
    For the purpose of completeness, we perform the t-test. Since

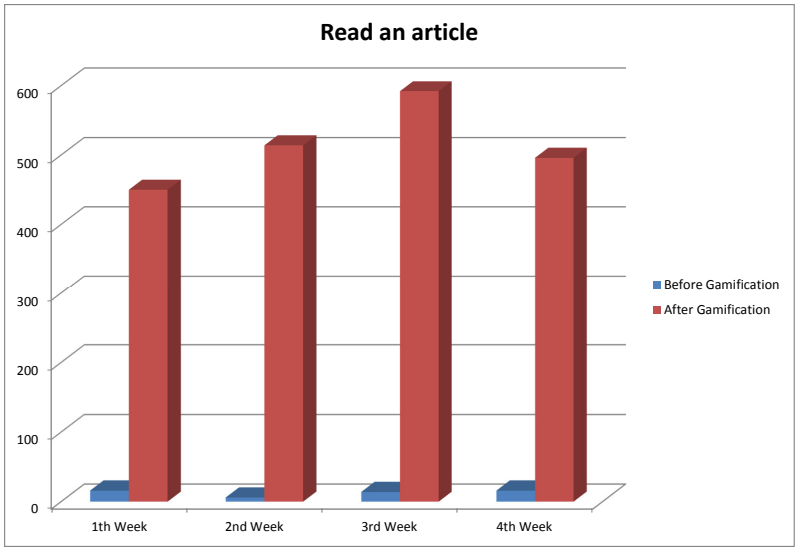


Figure 63.: Read an article graph

Read an article	Before Gamification	Ater Gamification	Difference
Sum	52	2052	2000
Daily Mean	1.733	68.4	66.666
Weekly Mean	13	513	500
Variance	17.857	791.627	795.54
Standard deviation	4.225	28.135	28.205
Asymmetry	2.675	-0.056	-0.021

Table 31.: Read an article information table

we want to prove that the competition among the users that the community has created, push the customers to be more prepared and more interested to learn as much as possible the WebRatio features, we chose as null hypothesis:

$$H_0 : \mu = 0$$

any differences in number of article read is due to chance.

and as alternative hypothesis:

$$H_1 : \mu > 0;$$

the competition in the community increased the number article read.

Exploiting the metrics we can compute the T-Test equations:

$$s.e. = \frac{stddev}{\sqrt{n}} = \frac{28.2}{\sqrt{30}} = 5.148$$
$$tobs = \frac{(x-\mu)}{s.e.} = \frac{(66.67-0)}{5.148} = 12.95$$

Since tobs > tcrit our calculated value is larger than the tabled critical value at α=0.1, so we reject the null hypothesis and accept the alternative hypothesis, namely, that the difference in number of article read is likely the result of the gamification effects and not the result of chance variation. Moreover the t-value calculated is also widely greater than the critical t-value at α= 0.0005 (tcrit = 3.6594), thus there is evidence, at the 0.05% level of significance that the gamification has introduced an increase of article read in the WebRatio learning system.

As widely expected, the t-test showed a statistically significant increase, it should be remembered, that September 2012 was the first month of the e-learning. However, it is considerable the number of articles read in September 2013, an average of more than sixty-eight articles is really high, especially remembering that the beta testing was not open to a large public.

6 CONCLUSION AND FUTURE WORK

In this thesis we have presented the creation of a innovative community based on gamification.
WebRatio Community is not the usual platform where the users can interact in commons ways, but, through a set of game mechanisms, a unique experience where productivity and games are joined together can be fostered.
The results of Beta testing (illustrated in the previous chapter) are very encouraging, almost all WebRatio goals in the several areas have been achieved, with the hope that the results can improve once the community will be published on-line. In detail, after the testing of the community, we can say that WebRatio, thanks to the new platform based on gamification, has achieved: an increase in users participation in the Forum and LMS modules, further information regarding costumers and an increase on the overall quality of the content published especially in the Forum area.
After the realization of the phase of design, development and testing (with encouraging results) we can state that gamification adopted in the enterprise applications brings several advantages and benefits, among them the most clear are: the increase of loyalty regarding the existing customers, wide spread of the corporate brand with consequent widening of the clients, the general improvement of how the users can use and access content that the company exposes to the public, great opportunity to increase participation, reward commitment and build a sense of connection with users and customers.
Gamification approach marries interaction design, psychology, and data analysis to enable personalized challenges, social competition, group collaboration, and meaningful rewards that truly motivate and engage. This leads to more sales, stronger collaboration, better ROI (Return On Investment), deeper loyalty, higher customer satisfaction and more[Bunchball(2013)].

6.1 FUTURE WORK

The community that has been defined can be expanded with more features, also based on the feedbacks provided by the customers. Future improvements will involve:

- Upgrade of the tracking system about the actions that the user performs inside the community, for example, control the number of views of user Public Dashboard controlling which actions are performed after that view.
- Implementation of more social features in the community.
- Additional promotion of gamification and game mechanisms within the WebRatio portals.
- Creation of live contests about the development of software with WebRatio tool.

- Continue to monitor the results once the community will be officially published online to check the improvements respect the past.
- Expansion of the administration area, to manage a bigger number of badges and actions, and all the dynamics about the contest (creation, registration, evaluation).
- Allow users to associate each other through relations of various nature (work, friendship, region).
- Creation of a dynamic and interactive bulletin board for the publication of tenders and proposals for work.
- Develop a special version of the community for only WebRatio's employees, where the participants will be only the internal people. In this way, the company will also promote dynamics and mechanisms of gamification to improve the internal processing.
- Create a management area for consulting in real time of the results which the community is reaching, being able to see how users are interacting with it. Development of graphs, reports, statistics that the administrator can view and store in real time.

A EXPERIMENTAL RESULT TABLES

Action Name	Date	Before Gamification 2012	After Gamification 2013
Post a question	1-Sep	0	0
	2-Sep	0	0
	3-Sep	0	0
	4-Sep	0	0
	5-Sep	1	1
	6-Sep	1	0
	7-Sep	0	0
		2	**1**
	8-Sep	0	2
	9-Sep	0	0
	10-Sep	0	1
	11-Sep	0	0
	12-Sep	1	1
	13-Sep	0	1
	14-Sep	0	0
		1	**5**
	15-Sep	0	1
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	0	2
	19-Sep	0	1
	20-Sep	0	0
	21-Sep	0	0
	22-Sep	0	0
		0	**4**
	23-Sep	0	0
	24-Sep	0	1
	25-Sep	1	0
	26-Sep	0	0
	27-Sep	1	0
	28-Sep	0	0
	29-Sep	0	1
	30-Sep	0	1
		2	**3**

Figure 64.: Post a question table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Post an answer	1-Sep	0	0
	2-Sep	0	0
	3-Sep	1	0
	4-Sep	0	4
	5-Sep	0	1
	6-Sep	0	6
	7-Sep	0	0
		1	**11**
	8-Sep	0	0
	9-Sep	0	5
	10-Sep	0	6
	11-Sep	0	1
	12-Sep	0	0
	13-Sep	0	1
	14-Sep	0	1
		0	**14**
	15-Sep	0	2
	16-Sep	0	1
	17-Sep	0	2
	18-Sep	0	0
	19-Sep	7	2
	20-Sep	3	0
	21-Sep	1	0
	22-Sep	0	0
		11	**7**
	23-Sep	0	0
	24-Sep	3	0
	25-Sep	0	0
	26-Sep	0	2
	27-Sep	0	1
	28-Sep	0	0
	29-Sep	0	0
	30-Sep	0	0
		3	**3**

Figure 65.: Post an answer table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Post a comment	1-Sep	0	0
	2-Sep	0	0
	3-Sep	0	0
	4-Sep	0	0
	5-Sep	1	0
	6-Sep	0	0
	7-Sep	0	0
		1	**0**
	8-Sep	0	1
	9-Sep	0	0
	10-Sep	0	0
	11-Sep	0	0
	12-Sep	0	0
	13-Sep	0	0
	14-Sep	0	0
		0	**1**
	15-Sep	0	0
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	0	0
	19-Sep	1	1
	20-Sep	0	0
	21-Sep	4	0
	22-Sep	0	0
		5	**1**
	23-Sep	0	0
	24-Sep	0	0
	25-Sep	0	1
	26-Sep	0	1
	27-Sep	0	1
	28-Sep	0	0
	29-Sep	0	0
	30-Sep	0	0
		0	**3**

Figure 66.: Post a comment table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Forum Vote up	1-Sep	0	0
	2-Sep	0	2
	3-Sep	0	0
	4-Sep	0	1
	5-Sep	4	0
	6-Sep	0	0
	7-Sep	0	0
		4	**3**
	8-Sep	0	0
	9-Sep	0	3
	10-Sep	0	0
	11-Sep	1	0
	12-Sep	0	0
	13-Sep	0	2
	14-Sep	0	0
		1	**5**
	15-Sep	0	0
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	0	0
	19-Sep	1	0
	20-Sep	0	0
	21-Sep	0	0
	22-Sep	0	0
		1	**0**
	23-Sep	0	0
	24-Sep	0	0
	25-Sep	1	0
	26-Sep	0	0
	27-Sep	0	1
	28-Sep	0	0
	29-Sep	0	0
	30-Sep	0	0
		1	**1**

Figure 67.: Forum voteup table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Answers Approved	1-Sep	0	0
	2-Sep	0	0
	3-Sep	0	0
	4-Sep	0	0
	5-Sep	1	0
	6-Sep	0	1
	7-Sep	0	0
		1	**1**
	8-Sep	0	0
	9-Sep	0	1
	10-Sep	0	0
	11-Sep	0	0
	12-Sep	0	0
	13-Sep	0	0
	14-Sep	0	1
		0	**2**
	15-Sep	0	0
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	13	0
	19-Sep	2	0
	20-Sep	1	0
	21-Sep	1	0
	22-Sep	0	0
		17	**0**
	23-Sep	0	0
	24-Sep	0	0
	25-Sep	0	0
	26-Sep	0	4
	27-Sep	0	4
	28-Sep	0	0
	29-Sep	0	0
	30-Sep	0	0
		0	**8**

Figure 68.: Forum answer approved table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Post a question User A	1-Sep	0	0
	2-Sep	0	0
	3-Sep	0	0
	4-Sep	0	0
	5-Sep	1	0
	6-Sep	0	0
	7-Sep	0	0
		1	**0**
	8-Sep	0	0
	9-Sep	0	1
	10-Sep	0	0
	11-Sep	0	0
	12-Sep	0	0
	13-Sep	0	0
	14-Sep	0	0
		0	**1**
	15-Sep	0	0
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	0	0
	19-Sep	0	0
	20-Sep	0	1
	21-Sep	0	0
	22-Sep	0	0
		0	**1**
	23-Sep	0	0
	24-Sep	0	0
	25-Sep	0	1
	26-Sep	0	0
	27-Sep	0	0
	28-Sep	0	0
	29-Sep	0	0
	30-Sep	0	0
		0	**1**

Figure 69.: Best User Forum Questions User A table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Post a question User B	1-Sep	0	0
	2-Sep	0	0
	3-Sep	0	0
	4-Sep	0	0
	5-Sep	0	0
	6-Sep	0	0
	7-Sep	0	0
		0	**0**
	8-Sep	0	0
	9-Sep	0	0
	10-Sep	0	0
	11-Sep	0	0
	12-Sep	0	0
	13-Sep	0	0
	14-Sep	0	0
		0	**0**
	15-Sep	0	0
	16-Sep	0	1
	17-Sep	0	0
	18-Sep	0	0
	19-Sep	0	0
	20-Sep	0	0
	21-Sep	0	0
	22-Sep	0	0
		0	**1**
	23-Sep	0	0
	24-Sep	0	0
	25-Sep	0	0
	26-Sep	0	0
	27-Sep	1	0
	28-Sep	0	0
	29-Sep	0	0
	30-Sep	0	0
		1	**0**

Figure 70.: Best User Forum Questions User B table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Post a question User C	1-Sep	0	0
	2-Sep	0	0
	3-Sep	0	0
	4-Sep	0	0
	5-Sep	0	1
	6-Sep	0	0
	7-Sep	0	0
		0	**1**
	8-Sep	0	2
	9-Sep	1	0
	10-Sep	0	1
	11-Sep	0	0
	12-Sep	0	0
	13-Sep	0	0
	14-Sep	0	0
		1	**3**
	15-Sep	0	1
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	1	2
	19-Sep	0	1
	20-Sep	0	0
	21-Sep	0	0
	22-Sep	0	0
		1	**4**
	23-Sep	1	0
	24-Sep	0	1
	25-Sep	0	0
	26-Sep	0	0
	27-Sep	0	0
	28-Sep	0	0
	29-Sep	0	0
	30-Sep	0	0
		1	**1**

Figure 71.: Best User Forum Questions User C table

Action Name	Date	Before Gamification 2012	After Gamification 2013
User Registrations	1-Sep	3	2
	2-Sep	2	10
	3-Sep	5	9
	4-Sep	9	7
	5-Sep	19	15
	6-Sep	10	8
	7-Sep	7	4
		55	**55**
	8-Sep	7	2
	9-Sep	3	10
	10-Sep	13	6
	11-Sep	10	11
	12-Sep	6	28
	13-Sep	7	9
	14-Sep	4	7
		50	**73**
	15-Sep	5	9
	16-Sep	5	6
	17-Sep	10	9
	18-Sep	13	10
	19-Sep	13	15
	20-Sep	4	11
	21-Sep	2	6
	22-Sep	4	6
		56	**72**
	23-Sep	2	17
	24-Sep	7	10
	25-Sep	4	11
	26-Sep	14	8
	27-Sep	4	9
	28-Sep	10	2
	29-Sep	5	5
	30-Sep	0	6
		46	**68**

Figure 72.: User Registration table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Set photo profile	1-Sep	unknown	0
	2-Sep	unknown	2
	3-Sep	unknown	0
	4-Sep	unknown	0
	5-Sep	unknown	2
	6-Sep	unknown	0
	7-Sep	unknown	0
		0	**4**
	8-Sep	unknown	0
	9-Sep	unknown	1
	10-Sep	unknown	0
	11-Sep	unknown	0
	12-Sep	unknown	0
	13-Sep	unknown	0
	14-Sep	unknown	0
		0	**1**
	15-Sep	unknown	0
	16-Sep	unknown	0
	17-Sep	unknown	0
	18-Sep	unknown	0
	19-Sep	unknown	2
	20-Sep	unknown	0
	21-Sep	unknown	0
	22-Sep	unknown	0
		0	**2**
	23-Sep	unknown	1
	24-Sep	unknown	0
	25-Sep	unknown	2
	26-Sep	unknown	0
	27-Sep	unknown	1
	28-Sep	unknown	0
	29-Sep	unknown	0
	30-Sep	unknown	0
		0	**4**

Figure 73.: Set photo table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Set Bio	1-Sep	unknown	1
	2-Sep	unknown	1
	3-Sep	unknown	0
	4-Sep	unknown	1
	5-Sep	unknown	4
	6-Sep	unknown	0
	7-Sep	unknown	0
		0	**7**
	8-Sep	unknown	0
	9-Sep	unknown	0
	10-Sep	unknown	0
	11-Sep	unknown	1
	12-Sep	unknown	0
	13-Sep	unknown	2
	14-Sep	unknown	0
		0	**3**
	15-Sep	unknown	0
	16-Sep	unknown	0
	17-Sep	unknown	0
	18-Sep	unknown	0
	19-Sep	unknown	1
	20-Sep	unknown	1
	21-Sep	unknown	0
	22-Sep	unknown	0
		0	**2**
	23-Sep	unknown	4
	24-Sep	unknown	0
	25-Sep	unknown	1
	26-Sep	unknown	0
	27-Sep	unknown	1
	28-Sep	unknown	0
	29-Sep	unknown	1
	30-Sep	unknown	0
		0	**7**

Figure 74.: Set bio table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Set Twitter	1-Sep	unknown	1
	2-Sep	unknown	1
	3-Sep	unknown	1
	4-Sep	unknown	0
	5-Sep	unknown	1
	6-Sep	unknown	0
	7-Sep	unknown	0
		0	**4**
	8-Sep	unknown	0
	9-Sep	unknown	1
	10-Sep	unknown	0
	11-Sep	unknown	0
	12-Sep	unknown	2
	13-Sep	unknown	0
	14-Sep	unknown	0
		0	**3**
	15-Sep	unknown	0
	16-Sep	unknown	0
	17-Sep	unknown	1
	18-Sep	unknown	0
	19-Sep	unknown	3
	20-Sep	unknown	1
	21-Sep	unknown	0
	22-Sep	unknown	0
		0	**5**
	23-Sep	unknown	3
	24-Sep	unknown	1
	25-Sep	unknown	1
	26-Sep	unknown	1
	27-Sep	unknown	2
	28-Sep	unknown	0
	29-Sep	unknown	0
	30-Sep	unknown	0
		0	**8**

Figure 75.: Set Twitter table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Set Linkedin	1-Sep	unknown	5
	2-Sep	unknown	1
	3-Sep	unknown	0
	4-Sep	unknown	0
	5-Sep	unknown	3
	6-Sep	unknown	0
	7-Sep	unknown	0
		0	**9**
	8-Sep	unknown	0
	9-Sep	unknown	0
	10-Sep	unknown	0
	11-Sep	unknown	0
	12-Sep	unknown	0
	13-Sep	unknown	0
	14-Sep	unknown	0
		0	**0**
	15-Sep	unknown	0
	16-Sep	unknown	0
	17-Sep	unknown	1
	18-Sep	unknown	0
	19-Sep	unknown	2
	20-Sep	unknown	1
	21-Sep	unknown	0
	22-Sep	unknown	1
		0	**5**
	23-Sep	unknown	4
	24-Sep	unknown	1
	25-Sep	unknown	0
	26-Sep	unknown	1
	27-Sep	unknown	1
	28-Sep	unknown	0
	29-Sep	unknown	0
	30-Sep	unknown	0
		0	**7**

Figure 76.: Set Linkedin table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Set Website	1-Sep	unknown	1
	2-Sep	unknown	1
	3-Sep	unknown	0
	4-Sep	unknown	1
	5-Sep	unknown	1
	6-Sep	unknown	0
	7-Sep	unknown	0
		0	**4**
	8-Sep	unknown	0
	9-Sep	unknown	3
	10-Sep	unknown	0
	11-Sep	unknown	0
	12-Sep	unknown	1
	13-Sep	unknown	2
	14-Sep	unknown	0
		0	**6**
	15-Sep	unknown	0
	16-Sep	unknown	0
	17-Sep	unknown	1
	18-Sep	unknown	0
	19-Sep	unknown	2
	20-Sep	unknown	1
	21-Sep	unknown	0
	22-Sep	unknown	0
		0	**4**
	23-Sep	unknown	2
	24-Sep	unknown	1
	25-Sep	unknown	0
	26-Sep	unknown	0
	27-Sep	unknown	0
	28-Sep	unknown	0
	29-Sep	unknown	0
	30-Sep	unknown	0
		0	**3**

Figure 77.: Set Website table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Set Newsletter	1-Sep	unknown	1
	2-Sep	unknown	3
	3-Sep	unknown	8
	4-Sep	unknown	4
	5-Sep	unknown	13
	6-Sep	unknown	6
	7-Sep	unknown	4
		0	**39**
	8-Sep	unknown	2
	9-Sep	unknown	7
	10-Sep	unknown	3
	11-Sep	unknown	10
	12-Sep	unknown	12
	13-Sep	unknown	6
	14-Sep	unknown	4
		0	**44**
	15-Sep	unknown	8
	16-Sep	unknown	3
	17-Sep	unknown	6
	18-Sep	unknown	5
	19-Sep	unknown	10
	20-Sep	unknown	9
	21-Sep	unknown	4
	22-Sep	unknown	6
		0	**51**
	23-Sep	unknown	13
	24-Sep	unknown	8
	25-Sep	unknown	6
	26-Sep	unknown	7
	27-Sep	unknown	5
	28-Sep	unknown	1
	29-Sep	unknown	2
	30-Sep	unknown	6
		0	**48**

Figure 78.: Set Newsletter table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Set Company or University	1-Sep	unknown	29
	2-Sep	unknown	2
	3-Sep	unknown	8
	4-Sep	unknown	5
	5-Sep	unknown	14
	6-Sep	unknown	8
	7-Sep	unknown	4
		0	**70**
	8-Sep	unknown	2
	9-Sep	unknown	8
	10-Sep	unknown	4
	11-Sep	unknown	11
	12-Sep	unknown	13
	13-Sep	unknown	6
	14-Sep	unknown	4
		0	**48**
	15-Sep	unknown	8
	16-Sep	unknown	3
	17-Sep	unknown	6
	18-Sep	unknown	8
	19-Sep	unknown	11
	20-Sep	unknown	9
	21-Sep	unknown	5
	22-Sep	unknown	6
		0	**56**
	23-Sep	unknown	16
	24-Sep	unknown	9
	25-Sep	unknown	7
	26-Sep	unknown	7
	27-Sep	unknown	6
	28-Sep	unknown	1
	29-Sep	unknown	2
	30-Sep	unknown	6
		0	**54**

Figure 79.: Set Company/University table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Set Partner or Client	1-Sep	unknown	0
	2-Sep	unknown	0
	3-Sep	unknown	0
	4-Sep	unknown	0
	5-Sep	unknown	0
	6-Sep	unknown	0
	7-Sep	unknown	0
		0	**0**
	8-Sep	unknown	0
	9-Sep	unknown	2
	10-Sep	unknown	0
	11-Sep	unknown	0
	12-Sep	unknown	0
	13-Sep	unknown	0
	14-Sep	unknown	0
		0	**2**
	15-Sep	unknown	0
	16-Sep	unknown	0
	17-Sep	unknown	1
	18-Sep	unknown	0
	19-Sep	unknown	0
	20-Sep	unknown	0
	21-Sep	unknown	0
	22-Sep	unknown	0
		0	**1**
	23-Sep	unknown	0
	24-Sep	unknown	0
	25-Sep	unknown	0
	26-Sep	unknown	0
	27-Sep	unknown	0
	28-Sep	unknown	0
	29-Sep	unknown	0
	30-Sep	unknown	0
		0	**0**

Figure 80.: Set Client/Partner table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Forum Login	1-Sep	0	0
	2-Sep	0	0
	3-Sep	0	0
	4-Sep	0	0
	5-Sep	1	1
	6-Sep	1	0
	7-Sep	0	0
		2	**1**
	8-Sep	0	2
	9-Sep	0	0
	10-Sep	0	1
	11-Sep	0	0
	12-Sep	1	1
	13-Sep	0	1
	14-Sep	0	0
		1	**5**
	15-Sep	0	1
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	0	2
	19-Sep	0	1
	20-Sep	0	0
	21-Sep	0	0
	22-Sep	0	0
		0	**4**
	23-Sep	0	0
	24-Sep	0	1
	25-Sep	1	0
	26-Sep	0	0
	27-Sep	1	0
	28-Sep	0	0
	29-Sep	0	1
	30-Sep	0	1
		2	**3**

Figure 81.: Forum login table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Forum Login User A	1-Sep	0	0
	2-Sep	0	0
	3-Sep	0	0
	4-Sep	0	0
	5-Sep	0	0
	6-Sep	0	0
	7-Sep	0	0
		0	**0**
	8-Sep	0	0
	9-Sep	0	0
	10-Sep	0	0
	11-Sep	0	0
	12-Sep	0	0
	13-Sep	0	0
	14-Sep	0	0
		0	**0**
	15-Sep	0	0
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	0	0
	19-Sep	0	0
	20-Sep	0	1
	21-Sep	0	0
	22-Sep	0	1
		0	**2**
	23-Sep	0	0
	24-Sep	0	1
	25-Sep	0	0
	26-Sep	0	1
	27-Sep	1	0
	28-Sep	0	0
	29-Sep	0	0
	30-Sep	0	0
		1	**2**

Figure 82.: Best User Forum Login User A table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Forum Login User A	1-Sep	0	0
	2-Sep	0	0
	3-Sep	0	0
	4-Sep	0	0
	5-Sep	0	0
	6-Sep	0	0
	7-Sep	0	0
		0	**0**
	8-Sep	0	0
	9-Sep	0	0
	10-Sep	0	0
	11-Sep	0	0
	12-Sep	0	0
	13-Sep	0	0
	14-Sep	0	0
		0	**0**
	15-Sep	0	0
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	0	0
	19-Sep	0	0
	20-Sep	0	1
	21-Sep	0	0
	22-Sep	0	1
		0	**2**
	23-Sep	0	0
	24-Sep	0	1
	25-Sep	0	0
	26-Sep	0	1
	27-Sep	1	0
	28-Sep	0	0
	29-Sep	0	0
	30-Sep	0	0
		1	**2**

Figure 83.: Best User Forum Login User B table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Forum Login User A	1-Sep	0	0
	2-Sep	0	0
	3-Sep	0	0
	4-Sep	0	0
	5-Sep	0	0
	6-Sep	0	0
	7-Sep	0	0
		0	**0**
	8-Sep	0	0
	9-Sep	0	0
	10-Sep	0	0
	11-Sep	0	0
	12-Sep	0	0
	13-Sep	0	0
	14-Sep	0	0
		0	**0**
	15-Sep	0	0
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	0	0
	19-Sep	0	0
	20-Sep	0	1
	21-Sep	0	0
	22-Sep	0	1
		0	**2**
	23-Sep	0	0
	24-Sep	0	1
	25-Sep	0	0
	26-Sep	0	1
	27-Sep	1	0
	28-Sep	0	0
	29-Sep	0	0
	30-Sep	0	0
		1	**2**

Figure 84.: Best User Forum Login User C table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Website Login	1-Sep	unknown	0
	2-Sep	unknown	5
	3-Sep	unknown	2
	4-Sep	unknown	7
	5-Sep	unknown	7
	6-Sep	unknown	1
	7-Sep	unknown	4
		0	**26**
	8-Sep	unknown	1
	9-Sep	unknown	6
	10-Sep	unknown	10
	11-Sep	unknown	11
	12-Sep	unknown	8
	13-Sep	unknown	4
	14-Sep	unknown	1
		0	**41**
	15-Sep	unknown	3
	16-Sep	unknown	2
	17-Sep	unknown	5
	18-Sep	unknown	6
	19-Sep	unknown	4
	20-Sep	unknown	9
	21-Sep	unknown	4
	22-Sep	unknown	6
		0	**39**
	23-Sep	unknown	7
	24-Sep	unknown	12
	25-Sep	unknown	4
	26-Sep	unknown	11
	27-Sep	unknown	16
	28-Sep	unknown	14
	29-Sep	unknown	8
	30-Sep	unknown	2
		0	**74**

Figure 85.: Website Login table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Follow a Post	1-Sep	0	1
	2-Sep	0	0
	3-Sep	0	1
	4-Sep	1	0
	5-Sep	0	0
	6-Sep	0	0
	7-Sep	0	0
		1	**2**
	8-Sep	0	1
	9-Sep	0	0
	10-Sep	0	0
	11-Sep	0	0
	12-Sep	0	0
	13-Sep	0	0
	14-Sep	1	0
		1	**1**
	15-Sep	0	0
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	0	0
	19-Sep	0	0
	20-Sep	0	0
	21-Sep	0	0
	22-Sep	0	1
		0	**1**
	23-Sep	0	0
	24-Sep	0	1
	25-Sep	0	0
	26-Sep	0	0
	27-Sep	0	0
	28-Sep	0	1
	29-Sep	0	0
	30-Sep	0	0
		0	**2**

Figure 86.: Follow Forum Topic table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Rating a component	1-Sep	0	0
	2-Sep	0	0
	3-Sep	0	0
	4-Sep	1	0
	5-Sep	0	0
	6-Sep	0	0
	7-Sep	0	0
		1	**0**
	8-Sep	0	0
	9-Sep	0	0
	10-Sep	0	0
	11-Sep	0	0
	12-Sep	0	0
	13-Sep	0	0
	14-Sep	1	0
		1	**0**
	15-Sep	0	0
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	0	0
	19-Sep	0	0
	20-Sep	0	0
	21-Sep	0	0
	22-Sep	0	1
		0	**1**
	23-Sep	0	0
	24-Sep	0	0
	25-Sep	0	0
	26-Sep	0	0
	27-Sep	0	0
	28-Sep	0	0
	29-Sep	0	0
	30-Sep	0	0
		0	**0**

Figure 87.: Rating a component table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Upload a component	1-Sep	0	0
	2-Sep	0	0
	3-Sep	0	0
	4-Sep	0	0
	5-Sep	0	2
	6-Sep	1	0
	7-Sep	1	0
		2	**2**
	8-Sep	0	0
	9-Sep	0	0
	10-Sep	0	1
	11-Sep	0	1
	12-Sep	1	0
	13-Sep	0	0
	14-Sep	0	0
		1	**2**
	15-Sep	0	0
	16-Sep	0	0
	17-Sep	0	0
	18-Sep	0	0
	19-Sep	0	0
	20-Sep	1	0
	21-Sep	1	0
	22-Sep	0	0
		2	**0**
	23-Sep	0	0
	24-Sep	0	1
	25-Sep	0	0
	26-Sep	0	1
	27-Sep	0	0
	28-Sep	0	0
	29-Sep	0	0
	30-Sep	0	0
		0	**2**

Figure 88.: Upload a component table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Download a component	1-Sep	1	1
	2-Sep	1	2
	3-Sep	6	8
	4-Sep	7	7
	5-Sep	35	19
	6-Sep	4	19
	7-Sep	75	6
		129	**62**
	8-Sep	0	6
	9-Sep	0	11
	10-Sep	4	7
	11-Sep	24	3
	12-Sep	6	19
	13-Sep	9	10
	14-Sep	5	8
		48	**64**
	15-Sep	3	2
	16-Sep	1	7
	17-Sep	13	18
	18-Sep	9	10
	19-Sep	8	6
	20-Sep	17	9
	21-Sep	9	7
	22-Sep	1	8
		61	**67**
	23-Sep	8	15
	24-Sep	27	12
	25-Sep	30	12
	26-Sep	2	4
	27-Sep	55	13
	28-Sep	35	1
	29-Sep	1	2
	30-Sep	1	13
		159	**72**

Figure 89.: Download a component table

Action Name	Date	Before Gamification 2012	After Gamification 2013
Read an article	1-Sep	0	82
	2-Sep	0	51
	3-Sep	16	44
	4-Sep	0	32
	5-Sep	0	48
	6-Sep	0	64
	7-Sep	0	129
		16	**450**
	8-Sep	0	114
	9-Sep	0	74
	10-Sep	5	85
	11-Sep	0	104
	12-Sep	0	39
	13-Sep	1	45
	14-Sep	0	53
		6	**514**
	15-Sep	0	28
	16-Sep	0	86
	17-Sep	2	72
	18-Sep	0	79
	19-Sep	1	88
	20-Sep	11	79
	21-Sep	0	74
	22-Sep	0	86
		14	**592**
	23-Sep	0	91
	24-Sep	0	10
	25-Sep	0	36
	26-Sep	2	28
	27-Sep	14	102
	28-Sep	0	76
	29-Sep	0	64
	30-Sep	0	89
		16	**496**

Figure 90.: Read an article table

BIBLIOGRAPHY

[Au(2011)] James Au. Facebook's top 5 games by dau as a percentage of mau, 2011. URL http://www.insidesocialgames.com/2011/11/21/facebooks-top-5-games-by-dau-as-a-percentage-of-mau/.

[Badgeville(2013)] Badgeville. Badgeville, 2013. http://badgeville.com/.

[Barber(2011)] John Barber. 12 gamification platforms and the start of a 1.6b industry, 2011. URL http://johnbarberblog.com/?p=278.

[BigDoor(2013)] BigDoor. Bigdoor, 2013. URL http://bigdoor.com/.

[Bozzon et al.(2013)Bozzon, Fraternali, Galli, and Karam] A. Bozzon, P. Fraternali, L. Galli, and R. Karam. Modeling crowdsourcing scenarios in socially-enabled human computation applications, 2013.

[Breezedill et al.(2013)Breezedill, RockyRaccoon, BR, and jaysheel] Breezedill, RockyRaccoon, BR, and jaysheel. How to motivate your sales team, 2013. URL http://www.wikihow.com/Motivate-Your-Sales-Team.

[Brown(2013)] Morgan Brown. How to design for viral growth [infographic], 2013. URL http://www.dtelepathy.com/blog/design/design-viral-growth.

[Brunstein(2013)] Svenja Brunstein. Cost model for the sap gamification platform, 2013.

[Buchball(2010)] Buchball. An introduction to the use of game dynamics to influence behavior, 2010.

[Bunchball(2013)] Bunchball. Bunchball website, 2013. www.bunchball.com.

[Conference(2012)] Joint Working IEEE/IFIP Conference. *Software Architecture (WICSA) and European Conference on Software Architecture (ECSA)*. 2012.

[Crowdtwist(2013)] Crowdtwist. Crowdtwist, 2013. http://crowdtwist.com/.

[Crunchbase(2013)] Crunchbase. Crunchbase, 2013. http://www.crunchbase.com/company/gamify.

[Curley(2010)] Vince Curley. Achievements unlocked, 2010.

[Deterding et al.(2011)Deterding, O'Hara, Sicart, Dixon, and Nacke] S. Deterding, Kenton O'Hara, M. Sicart, D. Dixon, and L. Nacke. Gamification: Using game design elements in non-gaming contexts, 2011.

[Drachen(2012)] Anders Drachen. What are game metrics?, 2012. URL http://blog.gameanalytics.com/blog/what-are-game-metrics.html.

[Fitz-Walter(2013)] Zachary Fitz-Walter. Gamification - defining, designing and using it, 2013.

[Gabe Zichermann(2011)] Cristopher Cunningham Gabe Zichermann. *Gamification by Design*. 2011.

[Galli and Fraternali(2013a)] L. Galli and P. Fraternali. Achievement systems explained, 2013a.

[Galli and Fraternali(2013b)] L. Galli and P. Fraternali. Games with a purpose and application gamification: a uni

fied view, 2013b.

[gamification(2013)] Enterprise gamification. Enterprise gamification, 2013. http://www.enterprise-gamification.com.

[gamification.org(2013)] gamification.org. Gamification.org, 2013. URL http://gamification.org/.

[Gamify(2013)] Gamify. Gamify, 2013. http://gamify.com/platform.

[Gigya(2013)] Gigya. Gigya, 2013. http://www.gigya.com/.

[HADEN(2013)] JEFF HADEN. Best way to track customer retention, 2013. URL http://www.inc.com/jeff-haden/best-way-to-calculate-customer-retention-rate.html.

[Hoover(2012)] Ryan Hoover. Mobile games: How do you define lifetime value (ltv) of a mobile game player?, 2012. URL http://www.quora.com/Mobile-Games/How-do-you-define-Lifetime-Value-LTV-of-a-mobile-game-player.

[IActionable(2013)] IActionable. Iactionable, 2013. URL http://iactionable.com/.

[Idre(2013)] Idre. What are the differences between one-tailed and two-tailed tests?, 2013. URL http://www.ats.ucla.edu/stat/mult_pkg/faq/general/tail_tests.htm.

[jefftee(2009)] jefftee. Top 10 social gaming metrics, 2009. URL http://www.slideshare.net/jefftee/top-10-social-gaming-metrics-2353273#btnNext.

[Kevin Werbach(2012)] Dan Hunter Kevin Werbach. *For the win*. 2012.

[Krzywinski and Altman(2013)] M. Krzywinski and N. Altman. Points of significance: Significance, p values and t-tests, 2013. URL http://www.nature.com/nmeth/journal/v10/n11/full/nmeth.2698.html.

[Manumatix(2013)] Manumatix. Manumatix, 2013. URL http://www.manumatix.com/.

[MATT(2010)] MATT. The secret glossary of social games analytics, 2010. URL http://www.wavedash.net/2010/04/the-secret-glossary-of-social-games-analytics/.

[panthos(2012)] panthos. Internet user defined: A user by any other name..., 2012. URL http://guidedlaunch.com/blog/2012/internet-user-defined/.

[Petersen(2011)] Laurie Petersen. Q&a: Gabe zichermann on gamification, fun and metrics, 2011. URL http://econsultancy.com/it/blog/7283-q-a-with-gabe-zichermann-on-gamification-fun-and-metrics.

[Ries(2008)] Eric Ries. Engagement loops: beyond viral, 2008. URL http://www.startuplessonslearned.com/2008/12/engagement-loops-beyond-viral.html.

[RJMetrics(2013a)] RJMetrics. Churn rate 101, 2013a. URL http://www.churn-rate.com/.

[RJMetrics(2013b)] RJMetrics. Cohort analysis 101, 2013b. URL http://cohortanalysis.com/.

[Sawant(2013)] Vijaya Sawant. Game design techniques, 2013. URL http://www.slideshare.net/vsawant/game-design-techniques.

[Schwartz(2013)] Barry Schwartz. The tyranny of choice, 2013. URL http://www.swarthmore.edu/SocSci/bschwar1/Sci.Amer.pdf.

[Schwendimann(2010)] Beat Schwendimann. What is the difference between a toy and a game?, 2010. URL http://proto-knowledge.blogspot.it/2010/12/what-is-difference-between-toy-and-game.html.

[S.Deterding et al.(2011)S.Deterding, Khaled, Dixon, and Nacke] S.Deterding, R. Khaled, D. Dixon, and L. Nacke. Gamification: Toward a definition, 2011.

[S.Deterding et al.(2013)S.Deterding, Dixon, Khaled, and Nacke] S.Deterding, D. Dixon, R. Khaled, and L. Nacke. From game design elements to gamefulness:defining “gamification”, 2013.

[SHARLEEN(2010)] SHARLEEN. The power of virtual gifts in a gamified world, 2010. URL http://stratsynergy.wordpress.com/2010/09/23/the-power-of-virtual-gifts-in-a-gamified-world/.

[Sheeley(2013)] Michael Sheeley. Defining "active user" and the dau to mau ratio, 2013. URL http://www.makegreatsoftware.com/2013/09/defining-active-and-dau-to-mau-ratio.html.

[Sridharan et al.(2012)Sridharan, Hrishikesh, and Raj] M. Sridharan, A. Hrishikesh, and L. Sunali Raj. An academic analysis of gamification, 2012.

[SWALLOW(2012)] ERICA SWALLOW. How three businesses scored big with gamification, 2012. URL http://www.entrepreneur.com/article/223039.

[thisiswhatgoodlookslike(2013)] thisiswhatgoodlookslike. Gartner says get gamification working for you, 2013. URL http://thisiswhatgoodlookslike.com/tag/gartner-says-get-gamification-working-for-you/.

[Walther(2003)] Bo Kampmann Walther. Playing and gaming - reflections and classifications, 2003. URL http://www.gamestudies.org/0301/walther/.

[Werbach(2013)] Kevin Werbach. Gamification course, 2013. URL https://www.coursera.org/course/gamification.

[wikipedia(2013a)] wikipedia. Churn rate, 2013a. URL http://en.wikipedia.org/wiki/Churn_rate.

[wikipedia(2013b)] wikipedia. Cohort analysis, 2013b. URL http://en.wikipedia.org/wiki/Cohort_%28statistics%29.

[wikipedia(2013c)] wikipedia. Customer engagement, 2013c. URL http://en.wikipedia.org/wiki/Customer_engagement.

[wikipedia(2013d)] wikipedia. Average revenue per user, 2013d. URL http://en.wikipedia.org/wiki/Average_revenue_per_user.

[wikipedia(2013e)] wikipedia. Standard deviation, 2013e. URL http://en.wikipedia.org/wiki/Standard_deviation.

[wikipedia.org(2013)] wikipedia.org. Customer lifetime value, 2013. URL http://en.wikipedia.org/wiki/Customer_lifetime_value.

[Xu(2012)] Yongwen Xu. Literature review on web application gami cation and analytics, 2012.