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An Approach of Co-Design in Mobile Services in Luxembourg Tourism Context

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1. Introduction

In the Grand Duchy of Luxembourg, after a century of industrialization, time is now to the development of tertiary industry and services. In tourism, the country, with a rich historical past, has a good potential of development based on existing host structures and efficient traveling options. However, if many actors, institutional and private, already offer a lot of solutions, recent developments of ICT lead to the emergence of new services. Moreover, the massive Wi-Fi equipment of cities for data dissemination and the strong interest of users to the latest generation of smartphones accentuate this trend. Yet, according to the new discipline of service science initiated by IBM, any innovative service development requires the respect of the principles of value co-creation, user-centricity and multi-disciplinary. This methodology, not yet widely applied, leads to the mobilization of concerned stakeholders around a common design of the future service. Regarding this issue, CRP Henri Tudor has developed a tool for context aware services rapid prototyping. Based on the results of several research projects, it aimed at reconciling the interests of each party involved in the service system, while promoting creativity.

2. Tourism context and technologies

2.1 Historical situation

From the Romans in the year 60 after Jesus Christ, to the Prussians, all the peoples of Europe have contributed to the richness of cultural heritage, source of tourism quality.

Today, after a century of steel industry, it's time for reconversion of blast furnaces to cultural and tourist purposes. Thus, the CNCI (National Centre for Industrial Culture) has launched a project to transform the two last blasts of Belval into the cultural city of sciences center. This will to convert industrial heritage shows the awareness of the Grand-Duchy to conserve, enhance and promote, its rich industrial heritage as much as it does for its cultural heritage.

Those transformations are done in order to ensure that current and future generations won't forget fundamental values and good governance principles of this country firmly involved in European expansion. Most of the citizens are aware that the culture of such a small country shouldn't lose his uniqueness by suddenly focusing on external influences. And

this, even if the country remains open to international, by developing its capacity to material logistics, digital and tourist services.



Fig. 1. The Grand-Duchy of Luxembourg

The cultural, economic and social diversity that characterize the Luxembourg generate a wide-ranging and varied tourism, and the variety of landscapes is not the only major attraction of the country.

To fully understand the context, it should be noted that the Grand Duchy of Luxembourg has barely more than 500,000 inhabitants. It is as large as the city of Lyon, in France. With more than 40%¹ of foreign origin people, its population is growing strong and fast, due to an intense immigration, mostly from Europe.

If the national language is Luxembourgish since 1984, French, German and English are the other three key languages used in administrative, public and professional contexts. Not less than 170² different nationalities are present and, consistent with national education policy,

¹ <http://www.statistiques.public.lu/catalogue-publications/luxembourg-en-chiffres/luxembourg-chiffres.pdf>

² <http://www.cdaic.lu/pdf/mom/nationalites.pdf>

language learning is promoted in order that young people to communicate easily from the earliest age. In architecture, the neighborhood historic and some Luxembourg-city's fortifications have been declared "world heritage of Unesco" in 1994. This important heritage, combined with its european capital vocation and its financial center qualifications give a cosmopolitan character to the city.

2.2 Tourism context

In 2009 tourism industry represented about 8.3%³ of the GDP (Gross Domestic Product) and kept around 25,000 employed, meaning 11.7%⁴ of the working population. Thus, Luxembourg considers it a key sector and, despite to the economic crisis, still continues its investments. As an economic actor of great notoriety and wide supporter of ecological values, the Grand Duchy of Luxembourg is still concerned by the well-being of its citizens , and attached to ensure high quality welcome to tourists. Through the MICE infrastructure (MICE = Meetings, Incentives, Conferences and Exhibitions), the Ministry of tourism himself, underlines "an international competitive and privileged environment, combining a fast-paced urban lifestyle with vast forests, beautiful landscapes and picturesque historical sites, all accessible within minutes". To remain competitive the Tourism Department has also promoted a main concept named "quality of life and quality of tourism". The vision is to consider the activity as a double perspective of population living conditions improvement as well as a sustainable and quality tourism product offer⁵. This policy is at the origin of different initiatives: set-up of well-known luxury shops in Luxembourg downtown, creation of night bus line, VIP pass to the new airport, distribution of an english-language promotion manual dedicated to international business people, etc.

At another level, the Luxembourg, located between Belgium, east of France and Germany, is sometimes referred as a "country of transit", which operates its privilege by stimulating local economic tourism. Therefore, border people, including 148 000 workers, benefit less taxed products such as tobacco, alcohol, and fuels. Also, it is not surprising that the few Luxembourgish service-stations located on the highway connecting France to Belgium, are the largest in Europe.

2.3 Technological infrastructure

Regarding technological and transport infrastructure dedicated to tourism facilities, public authorities work at national, regional and communal levels to foster Luxembourg's attractiveness, and strengthen the hospitality.

Since the end of the 90s, the growth of new technologies used in all professional sectors is very important. The cultural domain did not depart from this rule, and, gradually, most public institutions have produced some internet websites publishing tourism information with a constant concern of quality. The CNA, (Centre National de l'Audiovisuel) has been the first to produce a website according to a list of graphical recommendations. Such

³ <http://www.352luxmag.lu/?p=edito&a=external&id=107145>

⁴ <http://www.352luxmag.lu/?p=edito&a=external&id=107145>

⁵ Ministère des classes moyennes et du tourisme – Département du tourisme
(<http://www.mdt.public.lu/fr/ministere/index.html>)

requirements based on normalization criteria have then been gathered in a unique charter and used by each public national institution. Despite this effort of standardization, we can notice that, no similar initiative has been taken yet, regarding diffusion on mobile terminals like smartphones or touchpads.

National strategy broadband

During these same years, the Luxembourg has adopted an active approach to develop its infrastructure, positioning itself among the European leaders in terms of broadband penetration.

Access of all citizens and all companies in the "ultra-high" flow is a key element of the future development of the national economy. To move forward quickly and effectively, the Luxembourg has developed a national strategy to position itself among the leading countries in the future field of "ultra-high" flow. Disposing of a broadband network infrastructure has positive socio-economic impacts. Such technologies allow to reach speeds up to 1 Gigabit per second (Gbps) for fixed networks, and up to 150 megabits per second (Mbps) for mobile networks (the "ultra-high" flow). The success of the diversification of a service economy is heavily dependent on access to competitive cost "ultra-high" flow. According to a first plan of migration, the objective is to ensure coverage of 95% of the population in 2011⁶.

If the deployment of this strategy is supported by the Department of State media and communication services as well as the Ministry of economy and foreign trade, the means implemented do not consist in support plan with public aid, but to act to favourably influence the cost of the deployment (and then and possibly financially assist innovative actors). Thus, competition of technological players enabled to ensure access to diverse and innovative services.

Mobile broadband

The Luxembourg is one of these countries where access to fixed and mobile phone is widespread: Wi-Fi is the most common technology deployed in Grand-Duchy and 75% of households are equipped. And concerning the mobile phone, almost 90% of the population owned a 3G phone in April 2010⁷.

And the Luxembourg is and remains a large market: in 2011, a survey says that the number of mobile subscriptions stood at 727.000 units at the end of 2010, or 145% of the resident population.

Actually, new communication networks based on modern technologies have increased and, as major phone operators are physically located in Luxembourg, professional companies bring new dynamic to the service offers on mobile device.

2.4 Public and private initiatives

The city of Luxembourg is entirely covered by a Wi-Fi mesh, known as the HotCity network. At least around three hundred hotspots distributed in the city of Luxembourg

⁶http://www.mediacom.public.lu/institutions/Institutions_nationales/smc/20100309_ngn/Strategie_nationale_pour_les_reseaux_a_ultra-haut_debit.pdf

⁷<http://www.ITU.int/NET/itunews/issues/2010/03/09-fr.aspx>

cover its entirety. Dedicated to people in situation of mobility, the town offers access to free web services such as “find in the city”. The outdoor location of the user allows him to identify points of interest nearby: administrative buildings, cinemas, restaurants and so on. As another example of offered service is the "Screw - IT" that is a practical guide to the main useful addresses, culture and recreation sites, thematic or custom routes.

In addition the iPass company has developed a specific offer for companies enabling the access to thousands of hotspots in the world and for which payment is based on a pay-per-use model.

If the city of Luxembourg is largely active in the promotion of the city, the municipality wishes to capitalize and leverage its achievements with other municipalities. In 2010, the city of Esch sur Alzette, second largest one of the country, signed an agreement to be equipped and to benefit from experiences and synergies. Other municipalities in the south of the Grand Duchy, or even in the near region of Lorraine in France, have also initiated discussion to take advantage of the Hotcity portal.

In fact, the offer is promising: a Wi-Fi network enables greater efficiency than a 3G network, at least for data connections. Hotcity has the monopoly of urban Wi-Fi operation, with respect to the objectives of public actors: defend a service quality policy and improve the hospitality building.

Technological infrastructures have been developed to promote the digital economy and its growth through a structural and regulated approach. Another significant example is constituted by the tourist information center from Luxembourg city that is an important organization with the aim to promote existing infrastructure and services. In smaller municipalities, natural, cultural and economic attractiveness of territories justifies to some extent that the tourist office are managed on a subsidiary volunteer-based.

Municipal, cantonal and national initiatives are usually deployed for specific user segments. And of course, the intentions in mind are always for the quality of service for the residents and other, at work or on cultural or tourism trip, for young or senior citizens, for valid or people with disability, polyglots or not.

2.5 The iPhone revolution

At the same time, the iPhone⁸ has changed significantly the uses and the ways of thinking, selling, acting and being mobile.

Boon for users, boon to nomadism, boon to mobile marketing, boon to all novices and revolution of design, the iPhone is a huge step in the ergonomic field. In addition it gives back sense to two neglected concepts: simplicity and common sense.

If its economic model imposes specific requirements and strong competitive skills, it helps to consider the design of services with a new point of views: to not target a segment but to offer a service to a client, to delineate the center of interest, to make sequences reduced and to use simplicity to achieve relevant results in less stages: as example, we can take an application giving only the closest restaurants to the user. Even if there are twenty results, the user will be able to choose the one he wants. In contrast, an application that requires

⁸ <http://www.apple.com/iphone/>

information profile, interests, sewer systems, recreation, availability, and so on is considered to be too complex and would become quickly obsolete.

By pushing the technology, the iPhone sets free usual practices, promotes the Web 2.0, allows professionals to be in and generates a less smartly designed offer of smartphones because the economic good sense generally leads to copy concepts.

The importance of penetration of smartphones and the iPhone specifically, demonstrates that this mobile device has become a real economic issue.

Internet access is in the user's pocket and supports, as a result, exchange through social networks; provision of augmented reality applications on the location such as context-based becomes a "life tool" for mobile users.

However, it is a advantage for proximity marketing. 57% of the mobile users own at least a branded application and search for a specific service, promotions, news concerning their orders, the location of stores, games, competitions and information.

That said, in the age of the protection of personal information, users authorize to be located and therefore to be the target of proximity marketing: applications, outdoor and indoor positioning, augmented reality and adapted barcode give the ability to define the outlines of an extension of the marketing field.

This change in the user behavior around the world is generated by this new generation of smartphones, but also by the emergence of social networks. And it is clear that the addiction of the user in the Grand-Duchy of Luxembourg seems to be specifically stronger. It is easily understandable regarding to the cosmopolitan context and the constant bubbling of the country. The smartphone is adopted as the terminal device for accessing to the Internet. This evolution in behavior is explained by the multiplication of smartphones, but also by the generalization of unlimited internet offers proposed by the phone operators, and finally thanks to the optimization of web content by major publishers of content.

Before this explosion of uses, the smartphone has affected a wide audience who is finally free to choose what could become his addictions. Mobile operators offers should be broad and address the whole public and not a public in particular and thus tend to allow bulk subscribers, offering a broad and flexible offer to connect, while services and applications are piling up with this potential likelihood of receiving an unexpected public: success will be or will not be. Currently, an average of twenty-seven applications are downloaded on a smartphone, and it is certain that technology trends foreshadow great promise for the mobile sector. For example, the emergence of the QR Code (89% of respondents have already seen a QR Code) and the liberalization of the geo-location (71% of the mobile owners already used the geo-location), should strengthen the impact of the mobile for daily use including the purchase action. If it is not strictly speaking an effusion of new business models for mobile services based on geo-location, these are good reasons to integrate at this moment in time the marketing field at the heart of all promotional campaigns.

2.6 Innovation in services in the city, it is innovate by the new uses

Then this problem rises in strategies to promote tourist cultural institutions and territories in a more widely way. Public institutions are not necessarily in line with these new

technologies regarding the promotion of their services on a broader scale and thus to attract new visitors.

Issues related to the launch of these services are economic, cultural, and societal. But whether in telephony 3G, Wi-Fi or GPS terminals, these new technologies must be adapted to the moving demand and must offer new services to the consumers. If the last few decades have allowed the development of technological infrastructures and have promoted new collaborations between institutional actors, the conditions for the improvement of the tourist attractiveness by innovation in practice are propitious.

However, no innovation is possible without advanced collaboration of stakeholders in tourism: "Office National du Tourisme", Luxembourg city tourism Office, regional tourism centers, inter-communal union for the promotion of township, and so on. Some initiatives and dissemination actions exist, but with a total separation of the implicated actors. It is indeed the mode of sustainable collaboration of implicated partners, which certainly is the solution to make practical research, development and innovation. And the city is a field of experimentation that brings together all the conditions of success for the development of new digital mobile services available to residents, visitors and the people who work there.

But it appears that the push of innovation to this area of mobile services can only come from public actors. There is still some reluctance to imagine the evolution of services for the tourism sector, specifically for a small country where actors are very scattered. The major issues on which persist uncertainties are the evolution of technologies, the lack of control of the application client and the difficulty to adopt a strategy. Indeed, the first two concerns are not necessarily enough challenging to encourage a public institution to go ahead to an in-depth reflection on the interest to integrate new mobile services for the benefit of its users. Then, even if the perception of the potential of context-aware mobile services is good, the difficulty resides in the capacity of public actors to develop a strategy to integrate geo-location services. The innovation actors cannot be then the users themselves.

Simply open a financial newspaper or pay attention to analysts to figure out that this development of the service sector is a general trend in Europe. In this regard, Luxembourg is not an exception. According to Global Finance Magazine⁹, the part of services in the Grand-Duchy represented 87% of GDP (Gross Domestic Product) in 2010. Beyond the tourism sector, it is therefore necessary to consider the characteristics of this activity's area and to examine the conditions for the emergence of new services.

2.7 Service definition

For many years the notion of service is subject to many definitions. Among the most significant it is worth mentioning Lovelock et al.[1] identifying a service as: "An act or performance offered by one party to another. Although the process may be tied to a physical product, the performance is essentially intangible and does not normally result in ownership of any of the factors of production" or Vargo and Lusch [2] stating that "services are the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself." Based on

⁹ <http://gfmag.com>

these two assertions, it appears that services can be recognized as an economic activity, whether remunerated or not, that does not require the creation or transfer of tangible property. As reflected by R. Larson [3] the concept of service is defined by "subtraction" because it refers to "every job that is not directly related to agriculture, manufacturing, or resource extraction and harvesting." It thus appears that we are surrounded of services.

Whether they are banking, administrative or related to health, among others, the world in which we live is based on services, and this for many years. If the modernization launched since the second half of the 20th century has speeded up their development, explaining the appearance of a dedicated sector industry, their nature has not changed dramatically. To consider the examples suggested, completing a transaction with his bank, obtaining a birth certificate, or consulting a doctor remain similar activities as in previous decades. It involves the concepts of particular *skills*, whether financial, administrative or medical, running a number of tasks, described by a specific *procedure*, established in order to meet the demand or need for a *client*, patient or a citizen.

2.8 Information technologies & services

However, if the needs remain the same, the way to address them has changed dramatically. Who, among us, still takes care to get to the bank office to withdraw some cash? Who moves to the town hall to obtain administrative documents easily accessible through the Internet? Who refuses to use the smart card containing his medical records for consulting his doctor or launching the procedure for reimbursement of his drugs as he passes at the pharmacy? If services have remained the same, the massive use of computers and electronic technologies (ICT) has radically changed the way they are executed. Again, according to R. Larson [3] « (...) over the past 60 or so years, (...) in many services, as with telephones, humans have been replaced by technology. In others, such as self-serve gasoline 'service stations,' the consumer has become the server! And in many cases, both changes have happened at once: technology removed the human server and the customer performs the service, as with ATMs and elevators." Nowadays technology has become indispensable and has invaded the world of services, up to become one of the central elements either in their design, their operation or maintenance. Moreover, the rapid adoption and large scale of the new mobile communication means as well as the improvement of their computing capacity have increased the opportunities for automation and promoted their development. Increasingly efficient and sharp the emergence of these new services is now the object of new scientific studies at the intersection of fields or disciplines as economics, sociology or ICT.

2.9 Service system

To consider more accurately each component involved in the implementation and the deployment of services, let's look at the following example: Mr Smith, leaving the Museum of Modern Art in the city of Luxembourg, decides to enjoy the sunny day and stroll a few minutes along the verdant aisles of a near public park. On the way, he chooses to order a packed meal to be delivered on site. He picks up his phone, consults a search engine that forwards his request to a community website dedicated to the evaluation of fast food in the European capitals. Not knowing the exact name of the park, he grants permission to the mobile application to locate himself in order to select a first list of the nearest restaurants and performs his final choice based on the assessment of the community. Then, he then

orders his meal and continues to wander while waiting quietly the delivery. After receiving and tasting, pleased of the assistance of the community, he submits its own rating with a small text of recommendation. Nothing is more usual. Yet, except for the meal itself, which is, as noted above, similar to a tangible product outside of our study, this service involves several complex concepts including:

- *The use of technologies.* In this case, Mr Smith uses his phone for accessing internet, locating the park, and calling the restaurant.
- *The need of know-how.* The preparation of the meal, as well as its delivery, are activities that require the intervention of qualified and specialized people.
- *Information sharing.* The use of a website referencing the restaurants of European capitals, and giving access to ratings from a community is an important added value of the service.
- *Partnership involvement.* The preparation of the meal requires the prior purchase of food from suppliers and the delivery can potentially be outsourced to a company specializing in the field.
- *The implementation of a procedure.* The call made by the customer is the first step of a previously established procedure, starting from receipt of the call and ending to delivery by going through the assembly of the food components, meal packaging and the call to the delivery company.
- *The concept of user experience.* Mr Smith, aware of the assistance the community has provided through its recommendation, has sought to fill up the evaluation form, based on his own perception of the quality of the service provided.
- *The concept of value.* He also realizes the complexity of the service and agrees to pay a fair price in relation to the final product quality and the conditions for obtaining it. As we will see later, the experience of the service itself is also part of the service.

We note that elements constituting the fast food delivery service are concepts common to all services delivered today and can be seen as the components of what is called a *service system*. According to the Cambridge University [4], « A service system can be defined as a dynamic configuration of resources (people, technology, organisations and shared information) that creates and delivers value between the provider and the customer through service. In many cases, a service system is a complex system in that configurations of resources interact in a non-linear way. Primary interactions take place at the interface between the provider and the customer. However, with the advent of ICT, customer-to-customer and supplier-to-supplier interactions have also become prevalent. These complex interactions create a system whose behaviour is difficult to explain and predict.” In addition to the procedure itself, the emphasis is focused on the interactions between the different parts that constitute the service, and especially on those that directly involve the customer. He is definitely the center of the system. Of course, it is necessary to implement the recommendations common to each application software, such as improving the performance or checking availability and security of the data exchanged, but pay attention to the quality of service delivered is also up to worry about the real needs of the user. According to Lewis & Boom [5], this is the heart of the matter. They suggest that the “service quality” which is “a measure of how well a delivered service matches the customers’ expectations” is unavoidable and necessary to the success of any initiative.

Yet is it enough? The number of services made available is so important that it is now suggested to add a notion of "experiential marketing" in order to ensure its promotion. What would be the Starbucks coffees without their specific surrounding? What would be a place of "Crush's coaster" in Disneyland Paris without the heroes of the cartoon Nemo and associated staging? Probably no more than a cup of coffee and a round of classical coaster. It is the customer experience, cleverly orchestrated by marketing elements that bring additional value to the service itself. Pine & Gilmore argue that marketers must orchestrate memorable events for their customers, and that memory itself becomes the product - the "experience".

2.10 Service innovation & service science

Thus, assume the user as the focal point of the system and develop solutions tailored to its situation seems indispensable. This notion of *user centrality* is one of the axes of the new scientific discipline associated with the services. Initiated in May 2004 by IBM, Service Science is defined by Ng & Maull [7] as "an integrative discipline of engineering, technological and, social sciences (including business and law) for the purpose of value co-creation with customers, much like medicine is an integrative discipline of physical and biological sciences for the purpose of healing."

Linked to the concept Service Innovation, Service Science is established on three major principles that emphasize a multidisciplinary approach, respecting the will of value co-creation in order to develop user-centric services. According to these same authors [6], the notion of value co-creation implies customers "abilities to co-create value (e.g. in knowing how to use an ATM, informing the hairdresser how s/he would like his hair cut, understanding how to get around an airport, or a leasing company's ability to operate aircraft), where the word customer is here understood "in the broadest sense (...) e.g. the end customers who actually pay and receive the service or organizations/customers in public services and even customers who use services and do not directly pay for them (e.g. Broadcasting and Google)." Whereas "(...) traditional disciplines are strongly goods-based, more often involving linear supply chain models and linear models from design to manufacture, (...) value co-creation thus demands a major rethink of traditional disciplines from management and technology to the engineering and manufacturing of tangible products."

This mutual design effort, however, can't be conceived without multidisciplinary. The ability to master the technology is no longer the only vector for success, and it is necessary to mobilize other expertise, closer to the human sciences such as marketing, sociology or even psychology.

According to R. Larson [3], "the sub-sciences of what we might call Service Science are analogous to the constituent sciences of the physical sciences or of the social sciences. The good news is that each is accomplished, usually with great reputation. The bad news is that these fields are often over specialized, sometimes becoming deep narrow canyons of knowledge whose arcane vocabularies are so obscure that only a few hundred people in the world would understand them." J. Spohrer [8], from IBM, points out that this approach will lead to "curricula, training, and research programs that are designed to teach individuals to apply scientific, engineering, and management disciplines that integrate elements of computer science, operations research, industrial engineering, business strategy,

management sciences, and social and legal sciences, in order to encourage innovation in how organisations create value for customers and stakeholders that could not be achieved through such disciplines working in isolation.”

It would thus lead to the formation of specialists able to understand and assemble assets of each discipline in order to make innovation happen. Usually called T-people - skilled in traditional disciplines (from the vertical of the T) and in applications-oriented interdisciplinary analysis (the horizontal part) - the future development of these skills is presented as the main issue of service science in the coming years.

2.11 Architecture tour, an instance of service

Designed with corporate partners of the Centre Henri Tudor from the construction sector, the example of the "architectural tour" service is a good illustration. The scenario is based on the use of a shared database between architects of the "Grande Region". Made up of business data of the domain, such as facades, roof structures, or any other noticeable item relating to architecture, this database is the result of years of collecting noteworthy assets on buildings from the eastern region of France, Belgium Wallonia, and Grand Duchy of Luxembourg.

The purpose of the service is simple: it offers each architect making a trip - business or leisure - a list of interesting buildings close to his ride. Accessible from his smartphone, the system relies on the GPS device and calculates the presumed optimal path at each moment of the travel. Combined with a profiling mechanism, it dynamically performs a selection based on various elements of the context such as the weather, the opening schedule of buildings to visit, or the user preferences. During his trip, the traveller can also improve the database by inserting his own remarks on the building components discovered and retrospectively share his impressions with the community of architects.

Through this simple example the three concepts from the principles of Service Science and Service Innovation appear:

First, the *multidisciplinary* aspect: The design of such a service is the result of crossing many stakeholders perspectives including the community of architects, as the main customer, the IT company, in charge of mobile application's development, ergonomists from cognitive science, to produce a GUI adapted to each user's profile, a public entity, as the main client, representing the territorial authorities, a telephone operator and even a reseller of mobile terminals supporting the service. Even if this list is not exhaustive (not taking into account any research aspects, for instance), it shows that, each one having its own interests, service designers must report solid T-skills in order satisfy all the stakeholders requirements.

Second, the *user-centric* approach: Even if the service uses advanced geo-location terminal capacity similar to TomTom® or Garmin® for car navigation, it is by no means a generic service sold to a wide clientele. As a real context aware service, the target is much more limited and takes into account specific aspects of the architects job, the specificities of the Grande Region, and the business interest of the traveller.

Finally, the principle of *value co-creation*: In addition to the tangible financial aspects related to the sale of digital terminals and the operation of the service itself, other activities like

knowledge sharing with a community, GUI configuration based on preferences or advanced requests in a professional database, involve the user in the service system and increase its value. We are far from simple consumption of a product for the only financial benefit of one supplier.

2.12 Service Innovation & creativity

The complexity of such a service system becomes obvious: The large number of stakeholders involved in multiple issues - financial or not - the information being shared between the users, the mobilization of digital communities and the use of very new technologies with a low degree of maturity are key factors to the success. Therefore, how to create such innovation? Who is in charge of initiating its design? Is this the telephone operator or IT solution provider? Both have financial interests in the operation of such an application. But none of them is able to deeply understand the content of the delivered information. Is it rather the territorial authority managing the public data? It might be, as a part of its mission is to address the recommendations of open-data initiatives¹⁰ from European Community. It would be thus recognized as the main actor to foster the operation of this public information. But this kind of application can only be considered as a seamless cross-border service, and requires a mobilization of several neighboring countries working together. Such spontaneous initiative in favour of a common project appears to be slightly utopian.

So what about the users themselves? According to the paradigm of service science discipline, they are at the center of the system. Who could, better than the customer himself, express the needs of a future user-centric service? It then amounts to applying the traditional methods of requirement engineering. First step of any software realization, the activity aims to capture the needs of users in order to analyze and formalize them, before forwarding them to developers. They are then responsible for producing an IT solution best suited to the expression of the initial needs. This methodology is widely used in companies. Commonly referred to as Business-IT alignment, the main idea is to improve the agility of the deployed IT solutions. In other words, the objective is to promote a dynamic adaptation of the IT solution to the changing needs of a business in perpetual mutation. Besides some exceptions, the concept of agility is widely accepted as to apply on a top-down one-way basis. While digital technologies are developing faster and faster, it is regrettable that those emerging solutions are not taken into account at the business level. The main difficulty lies in poor communication between IT professionals - insensitive to the business needs - and business professionals - ignoring the rapid development of technological capacity-. This gap can be generalized. In our example of service, it is difficult to require from mobile solutions developers a deep knowledge of the architecture domain. At the opposite, can we reasonably expect from an architect to perfectly know the latest in ICT?

In the early 20th century, Henry Ford, said about his Ford T: "If I listened to people, I would have made the horses run faster and longer". More recently, Steve Jobs [9] from apple stressed: « It's really hard to design products by focus groups. A lot of times, people don't know what they want until you show it to them. » In other words, if the design of user-centric services is an interesting recommendation, it would be dangerous to identify

¹⁰ http://ec.europa.eu/information_society/policy/psi/open_data/index_en.htm

innovation opportunities from the unique user needs expression. Similarly, relying only on the latest digital inventions to propose an innovation, regardless of the operating environment, is also a strategy doomed to failure. The truth probably lies in the middle. Hence, the design approach based on prototyping may appear as one of possible solutions. It consists of a rapid development of a first concrete draft, fully functional, to reconcile the views of each stakeholder, prior to the real development of the service itself. Return to the instance of service architectural tour. Gathered around a demonstrator, the client public entity as well as architects customers can validate the relevance of features and ensure the prototype meets their initial expectations, while taking really aware of the potential of the application. This step allows them to adjust their level of requirement and directly discuss the technical feasibility of new applications with the designers. Sometimes called "technology push", this approach, which promotes creativity through technical innovation, is behind the development of a rapid prototyping tool of context services at the Centre Henri Tudor.

This tool, tested on around ten people, is a good example of the added value for the users themselves of being able to prototype a mobile service, by using a co-design approach.

3. Co-design approach for service design

[10] define the co-design approach as « a collective creativity as it is applied across the whole span of a design process » and the co-creation as « any act of collective creativity, i.e. creativity that is shared by two or more people ». These two new concepts have acquired a certain reputation of efficiency as well as popularity in many business and organizations as highlighted by [11]. Before to describe in details the framework and the associated authoring tool developed at Centre Henri Tudor, advantages and benefits of adopting such approach in designing services will be presented through a review of the past studies during the last ten years. In this section, we are in line with the definition of "service design" given by [12] as a reference of "planning and organizing people, infrastructure, communication and material components of a service, with the goal of improving the service's quality, the interactions between a provider and its customers, and the customer's experiences".

A first study, conducted in 2002 by [13], identified three ways of interaction process with users and customers: « say », « do » and « make ». The co-design approach is in the third one with the apport of help to organize creativity by treating as distinct the « say » and « do » actors. This way of doing enables the observation of what other people « do » and their manner of using products or services, with the aim to jointly extract, in creative workshops, the « making » of future services and solutions. [14] studied in deep the benefits linked to the user involvement in the design of a service. It highlighted that such user's implication improve the quality of system requirements, the system quality in itself and reduce the gap between the system and user's needs and give to the users or customers a best satisfaction. [15] identified the following benefits: reduction of development time, education of users regarding the use, attributes and specifications of a new service, quick spreading and better market acceptance, improved public relations and better long-term relationships between service providers and customers. Others studies [16,17] make attention of various participatory design methods and practices with some interesting results such as: improving mutual learning and understanding, combining and integrating different people's ideas, enhancing communication and cooperation between different people, and joint creation of

new ideas. A significant result, highlighted by [18], was that the users have ideas that have more useful inputs for service innovation (in this case of mobile ICT domains) than the professional developers ones. However this study expressed that the professional developer's ideas are more technologically feasible, in terms of "productibility", than the ideas of the users. Users should also be recognized as experts – experts of their experiences, their « social circumstances, habits and behavior, attitudes to risk, values and preferences - as explained in [19]. Others benefits such as access to customer's or user's experiences, increase speed to market, better quality of products, higher satisfaction of customers and users, best loyalty of customers or users and lower costs have been also identified by [20]. In addition, [21] identified advantages of a co-design approach by the improvement of the efficiency or effectiveness by the possibility to substitute the professionals apport by the users one and by facilitating the continuous improvement of products and services and by a better adequacy between user's needs and final products.

To conclude this literature review, it seems that adopting a co-design approach is essential and even necessary to assure the success of innovative service design.

4. OSAMI authoring tool

In most cases service providers do not have necessarily the technical knowledge, but do have the domain knowledge. Also, the idea is to provide them with a tool that stimulates their creativity for designing services without being hampered by technical feasibility. In the literature, most proposals focus on services compositions and validation from a technical point of view, like [22] [23], but only few of them propose a rapid prototyping of mobile services. Among them, we can find tools for design and deployment of services for specific domains, in particular the telecommunication and rich multimedia content domains: [23] proposes a service creation tool for mobile devices in order to provide rich content media, [24] and [25] are dedicated to the telecommunication services: the first one provides a tool generating services based on templates; the second one proposes an automated support for testing when desirable to speed the service verification phase and to increase the completeness of the set of test cases. Finally, two of them allow to quickly creating a service prototype. First, Google App Inventor¹¹ provides a graphical tool aimed at designing and testing an application, dedicated to the mobiles running on Android. Second, Yahoo Pipes¹² proposes a graphical tool allowing to design a service that uses some other remotely available services (like RSS, JSON, KML) as well as geo-coding.

The authoring tool, co-financed by the European Regional Development Fund through its "Competitivité Régionale et Emploi 2007-2013", involved in the phases of service innovation and exploration, proposes to combine some of the previous elements: a tool that anyone can use, to rapidly and graphically prototype a service (which can be a composition of services, remote or not), deploy it, test it and finally validate its functionalities. While Google App Inventor proposes to do a complete application, only for Android mobiles, and Yahoo pipe gives the way to use rapidly some services available on internet; the authoring tool is able to generate a prototype testable on several mobiles and with specific services according to domain or business case. The authoring tool, whose goal is to support the design of mobile

¹¹ Google App Inventor, <http://appinventor.googlelabs.com>

¹² Yahoo Pipes, <http://pipes.yahoo.com>

services, is a graphical tool composed of two main parts: a toolbox and a creation space. The description of this tool and associated services is based on the work done by [26].

4.1 Services

The toolbox proposes a set of reusable services that the service designer can decide to use in the creation space. These services are then configured and composed to constitute the final service. The sequence of reusable services is represented in the form of a graph, inspired from BPMN¹³.

As shown on Fig. 1, this view has been adapted to the targeted users: it has been simplified and each “box” provides a synthesis of the reusable service instance and its configuration. Moreover, configuration of reusable services has been reduced: no need to configure variable names, nor visual result, as the user interface aspect does not need to be covered at this stage.

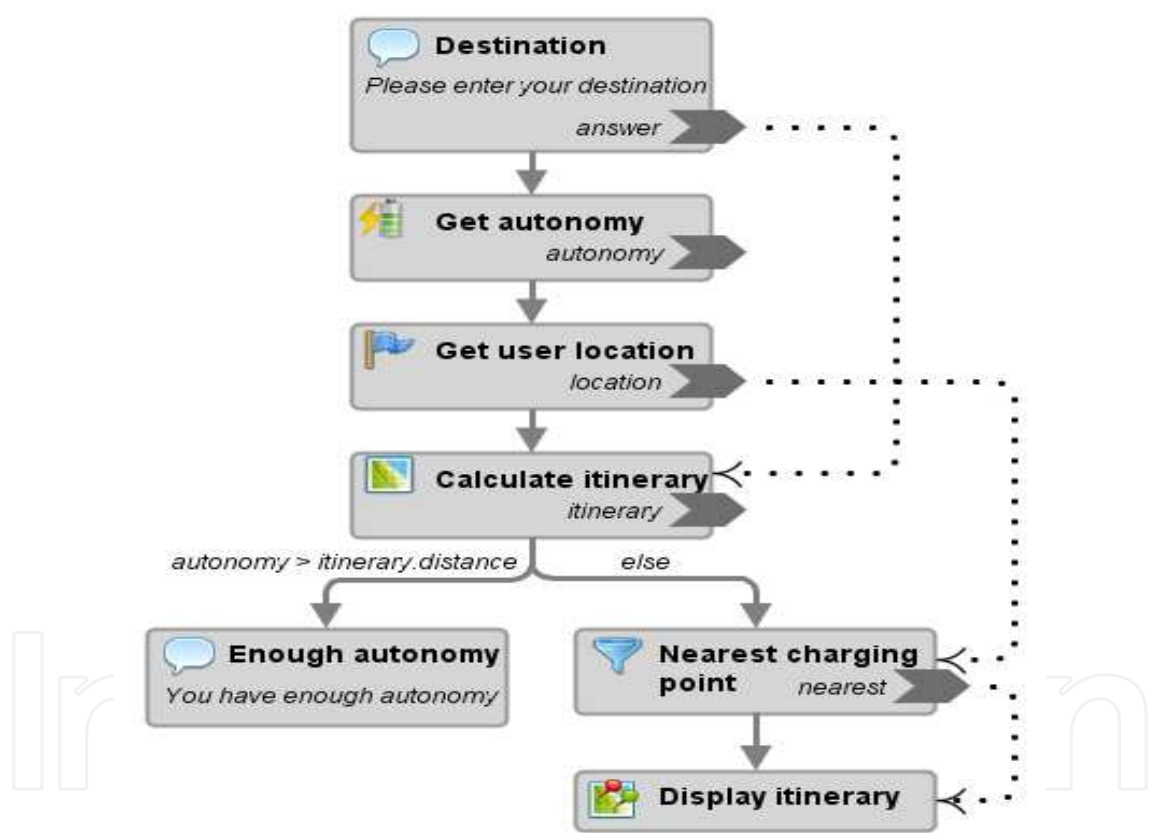


Fig. 2. Basic service (electric car sharing) modeling

The service designed is about a company wishing to propose to its employees an infrastructure for electric cars sharing: when an employee needs a car for a business trip, he/she asks the system for an available car, for a given duration or itinerary. A mobile device installed in the car provides some facilities. For instance, a service proposes the nearest electric charge point if there is not enough battery to execute the travel and displays

¹³ Business Process Model and Notation - <http://www.omg.org/spec/BPMN/>

the route that allows going to the charging point. Each “box” (represented by a rectangle) corresponds to a step within the service, and the arrows indicate the sequence between these steps. A step can be for instance sending a message to the end user or using an existing service. Thus, the first step here is to ask to the user the destination of his/her travel, the expected answer (output of the step) being indicated in the lower right of the box. Then a service is called to calculate the remaining autonomy of the car, another one gets the user location and the itinerary is calculated. Several arrows starting from a box mean that the condition on the arrow must be true for the path to be taken. The next activity thus depends on the remaining autonomy: if the car has enough battery to execute the travel, there is no need to find the nearest charging point, otherwise the service looks for it and indicates it to the user.

Three types of reusable services are currently proposed:

- **Basic** services: simple services like message displaying or question asking,
- **Advanced** services: more complex services like access to web services or RSS¹⁴ feeds,
- **Context** services: services giving access to any information about the final user’s context.

The list of reusable services shown on Fig. 2 is obviously not exhaustive, as the authoring tool has been developed as a proof-of-concept, but the idea is to provide to the user all the cards to create an innovative service and maybe generate new ideas, by providing him a view of what is technically feasible.



Fig. 3. Reusable services provided by the tool

Once modeled, this service is deployed on an execution platform, of which a technical view is presented below.

4.2 Technologies used

The generated services are deployed on an execution platform, on which they need to be independent from each other and it must be possible to add a new one without a restart. Moreover, these services have to be easily accessible from mobile devices.

¹⁴ Really Simple Syndication

4.2.1 Back-end technologies

The OSGi¹⁵ framework is a service platform specification for the Java programming language. In this framework, the applications or components (called bundles) can be remotely installed, started, stopped, updated and uninstalled without requiring a reboot. This is why we chose to use it, by providing each reusable service as an OSGi bundle.

The authoring tool service composition introduces the aspect of logical sequence between services, that is managed by OBE¹⁶, an open source workflow engine written in Java. OBE supports workflow definitions expressed in XPDL¹⁷, a standardized format to interchange business process definitions. In order for the authoring to provide XPDL definitions as output, serialization Java classes were generated from an Ecore¹⁸ model, itself generated from the XPDL XML schema definition. Thus, each generated service prototype is expressed as an XPDL process by the authoring tool, and then OBE, embedded in an OSGi bundle, executes these processes

4.2.2 HTML 5

Each step of the process generates an HTML5¹⁹ page that will allow testing the designed service, by interacting with the end user. HTML5 is currently under development, but this tends to be the next major revision of HTML and should be largely used in a near future. Moreover, HTML5 provides among others a geo-location API, being an important feature in the domain of context services. Finally, the use of HTML allows also testing of the designed service on different mobiles, having a compatible HTML5 browser. Some tests have been fulfilled with an iPhone coming with such a browser.

4.3 Technical overview of the OSAMI platform

The architecture of our platform is basically constructed around two main components: the authoring tool itself and the OSGi-based framework, as shown by the Fig. below.

The authoring tool is basically composed of three main components: **Authoring tool GUI** : that is the user interface to create a service as a workflow, which will be then deployed on a mobile platform to be tested. **XPDL generator** that generates data in XPDL format, corresponding to the workflow modeled by the user. This piece of software is a OSGi bundle. **Server linker** that makes the connection to the server that contains the workflow engine and HTML pages that will be generated to test the service created by the user.

The back-end framework is composed of the following main components: **Data** that contains all the data necessary for the processing tasks of the workflow. A backup mechanism is set up to feed the data directory. **Data receiver** that makes the link to the authoring tool, in order to receive the XPDL data and build the service user bundle. **Server bundles** representing external and/or reusable services that can be used in the service created by the user. These services can be OSGi bundles or web services. **Bundle**

¹⁵ Open Services Gateway initiative - <http://www.osgi.org/>

¹⁶ Open Business Engine - <http://obe.sourceforge.net/>

¹⁷ XML Process Definition Language - <http://www.wfmc.org/xpdl.html>

¹⁸ EMF (Core) - <http://www.eclipse.org/modeling/emf/>

¹⁹ <http://www.w3.org/TR/html5/>

generator that generates the OSGI bundle service created by the user. The created workflow is launched in an OSGi bundle. The generation of this bundle provides thus the (static) generation of the Java code of the bundle, and the Manifest required for its proper functioning. **XML tool generator** for generating the XML files needed for the functioning of the workflow. Indeed, most engines of workflow generating of XPDL, extend this format in order to provide additional tools and features. These extensions can be used with XML files. **HTML generator**: This component, a OSGi bundle too, generates the HTML pages to test the service created by the user. **HTML pages**: These are the pages HTML that display workflow items created by the user.

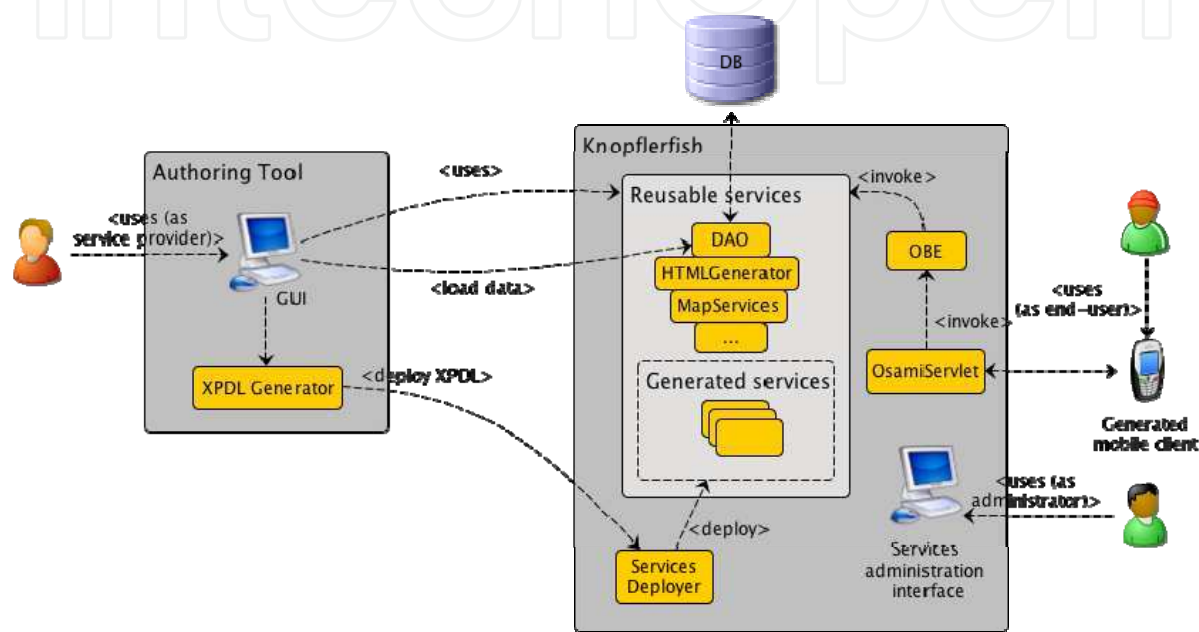


Fig. 4. Overview of the OSAMI tool architecture

The Figure below gives an overview of the structure and the communication between these components.

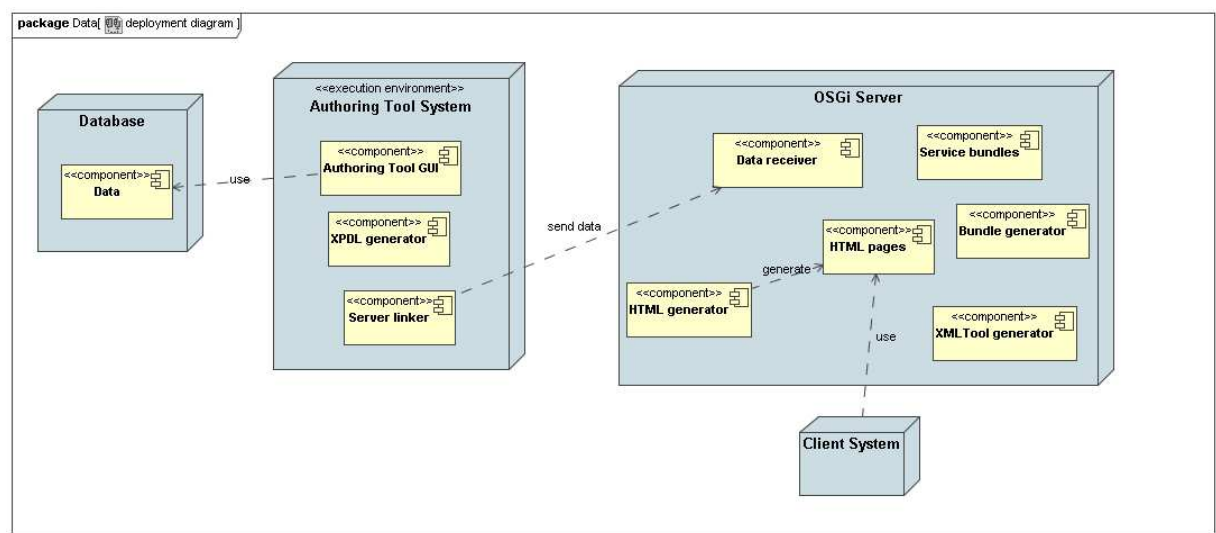


Fig. 5. Components view of the OSAMI platform

5. Future work

Although a panel of around ten persons has tested the developed prototyping tool, it still remains a proof-of-concept tool. Our objective is now to go further in the reasoning. The foreseen next steps will cover the automatic generation of the specifications from the services, the exhaustive identification of relevant and sustainable context services and the automatic generation of realistic functionalities.

Furthermore, there are risks associated with co-design. [21] for example, discussed two types of risks. The first type is related to diminish *control* over the project, because other people, other departments or other organizations are involved as described by [20]. The second type of risks is related to increased *complexity* of the project, because the objectives and interests of diverse people, departments or organizations must be managed and balanced, which can require extra coordination efforts).

6. Conclusion

Its cultural wealth, its central position in Europe favouring transit for travellers, its complex and moving history are a major asset for developing innovative service offerings in the field of tourism for the Grand Duchy of Luxembourg

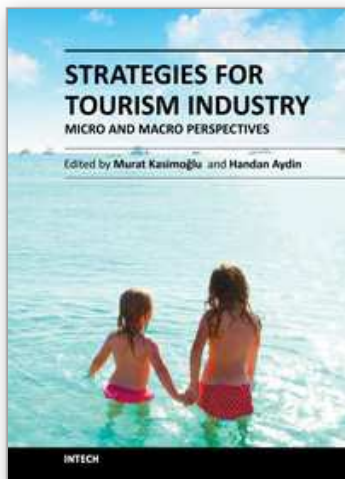
In addition to stay competitive and attractive, new disciplines such as “Service Science” and “Service Innovation” are currently studied and experimented.

However putting around a table the main actors in business and technologies area to ensure the success of a service or product seems currently not enough, but in the same way implicating the end users - the tourists themselves - in a same need of creativity.

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Strategies for Tourism Industry - Micro and Macro Perspectives

Edited by Dr. Murat Kasimoglu

ISBN 978-953-51-0566-4

Hard cover, 392 pages

Publisher InTech

Published online 20, April, 2012

Published in print edition April, 2012

Today, it is considered good business practice for tourism industries to support their micro and macro environment by means of strategic perspectives. This is necessary because we cannot contemplate companies existing without their environment. If companies do not involve themselves in such undertakings, they are in danger of isolating themselves from the shareholder. That, in turn, creates a problem for mobilizing new ideas and receiving feedback from their environment. In this respect, the contributions of academics from international level together with the private sector and business managers are eagerly awaited on topics and sub-topics within Strategies for Tourism Industry - Micro and Macro Perspectives.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Eric Miglioranzo, Damien Nicolas and Pierre Brimont (2012). An Approach of Co-Design in Mobile Services in Luxembourg Tourism Context, Strategies for Tourism Industry - Micro and Macro Perspectives, Dr. Murat Kasimoglu (Ed.), ISBN: 978-953-51-0566-4, InTech, Available from:
<http://www.intechopen.com/books/strategies-for-tourism-industry-micro-and-macro-perspectives/an-approach-of-co-design-in-mobile-services-in-luxembourg-tourism-context->

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