Thinking Global Acting Local: A Human-Centric Pattern to Designing Information-Intensive Services for Global Crisis Management

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ABSTRACT

Information-intensive services for global crisis situations management can no longer be based on local information only. A global picture is required to be able to make informed and reliable local decisions. It takes also to know how the local decisions one country may take will affect the others. Indeed, each country, city or community needs the whole picture and the key facts in managing the situation in their local area. Therefore, we should provide a proven solution to identify, analyze and mix the relevant information to support informed local decision based on both global and local information. In this paper, we introduce a novel design pattern to face this challenge of making informed local decisions. We also provide two real life examples illustrating the needs of the design pattern.

Keywords

Global crisis management, design patterns, information-intensive service design, human-centered design.

INTRODUCTION

Intensive-information services for global crisis situations management are services that help in identifying, assessing, and handling a crisis situation by orchestrating the communication between all parties/stakeholders involved in handling the crisis, by allocating and managing multiple types of information coming from multi-institutions sources, and by providing support to relevant and authorized local users for taking informed local decisions. As a matter of example, we may consider the case of a distributed information system used by a world-wide financial institution. All branches can be connected and synchronized together to support the local services provided to customers in a specific region or country. The local services are based on the fact that information is no longer stored in one specific place or in one country. Each service is aware about the location of the information. When tracking the solvability of customer, a local branch may aggregate several distributed information and build on the fly an informed profile of the customer required for decision, for example to approve a credit line.

Information-intensive services for global crisis management are extremely a broad topic with numerous related concepts. The emerging discipline of Global Information Technology is also referred to within the Information Systems (IS) discipline as “Global Information Technology Management”, as “International Information Systems”, and as “Global Management Information Systems”. Global information-intensive services is also difficult to tease out of the matrix of interrelated business forces such as levels of capitalization, variations in market characteristics and product preferences, and differing accounting systems and practices..

Literature studies have shown the great complexities surrounding the design of this kind of systems and similar ones (Kyng, Nielsen and Kristensen, 2006). To facilitate the rapid development of this kind of applications, one may look for design solution that has been already implemented and proved in other environments. Unfortunately, although there are some general designs principles available (Turoff, Chumer, Van de Walle and Yao, 2004) that designers can consider when starting a new project, it is difficult and costly to apply them since they are too general and there is no obvious way to translate them into concrete solutions. Besides, not knowing how others previously solved a problem or why they did things in a certain way makes it complex to reuse design knowledge.

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Design patterns are a mechanism for capturing and sharing design knowledge. Designers can use them to identify and propose solutions to recurring problems (Gamma, Johnson and Vlissides, 1995). Design pattern has demonstrated it potential to be a solution to overcome the design problems highlighted here. We propose the TGAL ("Think Global Act Local") pattern, which aims at detailing a mechanism of collecting and sharing global information/data and data required for taking local decisions..

MOTIVATING SCENARIOS

To motivate our investigations, we briefly details two scenarios illustrating the needs for the TGAL design pattern. These scenarios are based on true real-life experiences.

Bird flu (Influenza A H5N1) is a type of influenza that attacks almost all types of birds, including birds migrating in large geographical area. Over the past few years this disease was spread over some countries such as China, Vietnam and Indonesia. We may consider in this context a factory that produces chicken products in a country neighboring one of these three countries. Based on the evidence that there are no cases of bird flu infecting humans or birds in that country, the factory continues its manufacturing normally. The problem is that the sources of information that the factory used for environmental tracking are local. These sources do not take into account the bird flu spread, its origin, evolution, as well as strategies to stop it in the neighboring countries. From a global perspective, it is a fact that viruses travel by wind or air. People traveling by routes, airs and seas are also another factor that increases the spread of the disease around the globe.

Homeland security concerns and terrorist attacks is another possible area of application for the proposed patterns. Almost all countries around the world have their agencies responsible for the control and the assurance of public safety. Ensuring the public safety includes activities such as making sure that people living or coming or traveling through the country are not considered dangerous and will not perform any harmful acts that affect the lives and security of the country's residents. Let us consider the case of Howard who wants to travel to country A from country B. All the information on Howard is collected form country Z sources, and also an interview was done with him, finally a decision was made to grant him the visa. What is wrong with this process? What if Howard lived in several counties beside the one from which he applied for the visa. How such information will affect the decision process? Note that in some cases extended investigation is conducted on selected people but this cannot be considered for every single person because it is simply too expensive and in some cases not doable for political reasons.

THE TGAL PATTERN – AN OVERVIEW

"Think global act local" pattern aims at solving a global crisis at local level. It provides a way for identifying relevant sources of information from which relevant information are collected. The sources include external or global sources as well as internal and local servers. Sources includes databases, information's systems, Website, agencies, NGOs, researchers and in some case citizens etc. TGAL can be seen as a protocol for analyzing the selected information while trying to understand how the global or external information affect and impact on the local decision. The TGAL pattern provides a human-centric iterative approach, based on *personas*, for problem solving that distinguishes five key steps (successively): *define* the problem, *determine* external and global sources, *collect* required information, *analyze* collected data and facts and finally *make an informed decision*.

Define the problem

During this step, we deeply examine the problem or situation from all the stakeholders' perspective. The understanding a given problem or a situation needs first to identify all the stakeholders and then to understand the causes of the problems and its consequences from the perspective of each stakeholder. The TGAL pattern suggests using the concept of persona as tool to identifying the stakeholders and to quantifying their perception of the problem. For each persona, we use scenarios to capture and document the problem from the point of view of stakeholders.

Persona encapsulates the whole knowledge (goals, tasks, competencies, etc.) about the potential stakeholder. A Persona is a narrative description of a class of people that may be involved in the crisis and that we have to make decision (Cooper, 2003). Scenarios describe the problems from the perspective of a specific persona. Scenarios specify how a specific stakeholder contributes to the problem and what kind of solution he or she may have in solving the problem. They will become a basic design of the desired service and help define user requests. Scenarios can then be developed based around activities of the persona.

Figure 1 portrays the persona and scenarios template we developed document the problems from the stakeholder perspective.

In the bird flu example, the problem would be the trouble that the factory has to decide on continuing its production based on the fact that there is a pandemic of bird flu occurring in neighboring countries. The causes of this problem would be the lack of knowledge regarding how diseases spread and how successful the neighboring countries are in containing the disease. Finally, the lack of knowledge about the possible flu spreading from one country to another. Possible stakeholders that have to be considered include local government, city agencies, factories, farmers as well as customs at the borders. Researchers' expert in Wild bird migrations in the region as well as park rangers has to be consulted as well.

In our second example, the problem would be in deciding which internal activities inside the country are considered warning and could affect the public security. The causes of this problem arise from the large number of factors to be considered when making such a decision and also the distribution of the information needed. Because of the large number of stakeholders here, we may distinguish between two type stakeholders and persona: primary versus secondary. Primary stakeholders include government investigation agencies, police and customs.

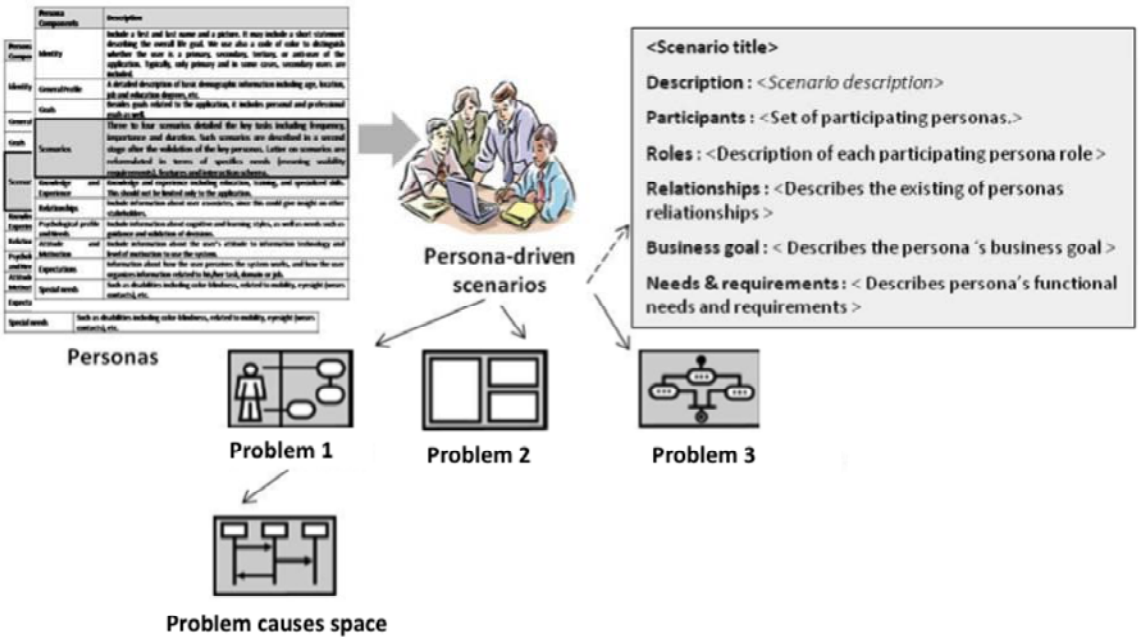

Figure 1. The role of persona and the related scenarios in TGAL

Analyze related sources of information

After defining the problem and its related causes, this stage aims at identifying and collecting information and facts from different sources. This information is added to the previous description of the problem. In order to find the related sources of information, a very detailed study and research must be conducted. Here again, we may consider two other user-centered design techniques: field observation and ethnographic interviews.

In the bird flu example, field observations may help in identifying and understanding all the places that could contribute to the spread of the flu from one country to another such as bird migration places, locations for trade between neighboring countries, offices for medical tests, agencies and factories for importing or exporting goods, borders checkpoints, etc. Bird migration may indicate that in a neighboring country a certain type of birds has shown some cases of flu infection. This informs the search for some resources that may provide more detailed information on the nature of this type of birds. If we know that this type of birds migrates in the winter following a certain route. If this route crosses the country or the region where the factory is located then we can indicate that there is a possibility of spread infection.

In the homeland security example, we can run a similar field research. However, we should note that it would be on a smaller scale since thousands of people can apply for a visa on daily basis. But given a smaller scale does

not mean that it will not be effective. For example if a person applied for a visa then a quick scan over his biography in all of the countries in which he lived in should be done.

Data Collection

This stage aims to collecting the correct and accurate data from the right sources that were identified in the previous stage. Therefore this process is tightly tied to the previous process, so coordination and communication between the people working on the processes are very important issues. There are numerous data collection methods or techniques including electronic collection, manual collection and human interaction. In both examples, we can use a mix of the three data collection techniques.

Analyze the collected data/ facts, and make a decision

Analysis consists to extract meaningful knowledge that can support objective informed decision. This stage consists of the four following sub-stages that transform the information into a meaningful decision: *Organization*, *Standardization*, *Integration* and *Analysis*. In the bird flu example, we gathered information about the cases of infection in the neighboring countries, about the migration route of the infected birds and the countries located along the route of the infected migrating birds and finally information on the disease itself. If the information showed that the country were the factory is, is located on the route of one of the effected bird types, how would this affect the factories decision whether to continue production or not. If another piece of information stated that the virus causing the infection has a low possibility of infecting humans how this would affect the factory's decision.

Decision making can be regarded as an outcome of a processes leading to the selection of a course of action among several alternatives. Specialists apply their knowledge in a given area to making informed decisions. For example in the case the bird flu, decision making often involves making a diagnosis of the situation and selecting an appropriate action plan (the decision). For the homeland security example, the decision consists whether the applicant can be granted a visa or not, whether the factory can continue its production without fear of selling flu infected chicken or bird products.

THE OVERALL USER-CENTRIC DESIGN FRAMEWORK

TGAL is one specific pattern that we are developing as part of a whole project which aims to defying a human-centric design approach for services and service systems. Within the proposed approach, we use personas as a descriptive model of the user experience, encompassing information such as user characteristics, goals and needs. They are captured in narrative form, and currently, there exists only general guidelines on how they should be represented.

More precisely, our research is tailored towards the definition of a systematic process that derives a pattern-oriented design from persona descriptions, through a set of intermediate steps. We advance that user experiences captured as persona can help in identifying a set of variables that defines behavioral patterns. These patterns are seen as reusable design blocks that are combined to create and validate design concepts and prototypes.

Initially we built an experimental framework to gain experience and as a first step to solve the research problem and test our assumptions on patterns and persona. We conducted a proof-of-concept with an information portal. Our usability evaluations included 39 end-users; 16 at the pre-design stage, and 23 at the post-design stage. Pre-design evaluations consisted of psychometric and heuristic techniques to construct personas and identify usability issues. We then used these personas, as well as accrued usability results, to construct a design approach based on patterns. Based on this approach a new design was prototyped. To test this new design, we carried out a comparative study with the current design and used the following evaluation techniques: Think-aloud protocol, task-based evaluation, structured questionnaires and open-ended interviews. The detail of such methodology goes beyond the scope of this paper. A detailed description of the methodology and its validating case studies are provided in (Javahery, 2007). Although the proposed method share a common user-focused tenet with other similar methods such as scenario-based and persona, it addressed the gap that exists between current user experiences analysis and modeling techniques, and the process of deriving a conceptual design and involving users (Livari, 2009).

DISCUSSION AND CONCLUDING REMARKS

In a previous work (Javahery *et al*., 2007), we applied several patterns as the ones described in (Van *et al*., 1995) to design usable interactive software applications. However, this was not a simple task. First, we had to

check if it was applicable, and then we had to adapt the solution proposed to our specific domain. From this experience, we have adapted several patterns to make them more comprehensible to novice designers.. As a design block, TGAL can be seen as a model that is sufficiently general, adaptable, and worthy of imitation that it can be reused. However, it must obey to three criteria. First, it must be *general* so that it can apply to a meaningfully large set of possible instances or contexts. It must also be *adaptable* because the instances or contexts to which it might apply will differ in details. Finally, it must be *worthy* because the instances or contexts to which it might apply are supposed to benefit by following the pattern rather than being impaired. Therefore, we realize that TGAL is still not mature enough to face all the challenges of the "thinking global, acting local" as a way to manage global crisis situations. However we believe that the most challenging part of the TGAL pattern would be the design and the implementation of the underlying software infrastructure to support the pattern. The infrastructure that we are targeting is not only the software infrastructure. This is only part of the overall infrastructure, which should include other important components such as the people and their behavior.

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