

# 2<sup>nd</sup> International UBI Challenge 2013

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## ABSTRACT

This paper summarizes the 2<sup>nd</sup> UBI Challenge that invited the global R&D community to design, implement, deploy and evaluate novel applications and services in real world setting atop the open urban computing testbed in Oulu, Finland. The paper first recaps the 1<sup>st</sup> UBI Challenge and then provides a procedural description of the 2<sup>nd</sup> UBI Challenge. The paper concludes with a discussion on issues related to participation in the UBI Challenge.

## Categories and Subject Descriptors

K.0 Computing Milieux.

## General Terms

Experimentation.

## Keywords

Ubiquitous computing, urban computing, urban informatics, testbed, in the wild.

## 1. INTRODUCTION

This paper summarizes the 2<sup>nd</sup> UBI Challenge 2013 (Challenge from now on) [14]. The 1<sup>st</sup> UBI Challenge 2011 was at the same time inspired and enabled by the Open UBI Oulu testbed deployed at downtown Oulu, Finland [9]. The testbed enables research on ubiquitous computing systems in authentic urban setting with real users and with sufficient scale and time span. Such studies are important because real world systems are culturally situated, and cannot be reliably assessed with lab studies detached from the real world context. By deploying a system for a sufficiently long time we can establish the technical and cultural readiness and the critical mass of real users needed for determining whether the system can be deemed ‘(un)successful’ [3].

The first objective of the Challenge was exactly this – to provide the ubicomp community with an opportunity to transfer their ideas from labs into a real-world urban environment. This is very much in line with the increasing community support for the “in the wild” studies conducted for substantial amounts of time with large numbers of real users in real-world settings [12][13]. The second

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MUM '13, December 02 - 05 2013, Luleå, Sweden

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<http://dx.doi.org/10.1145/2541831.2543881>

objective was to employ our testbed and the Challenge as a vehicle to stimulate global research collaboration on urban informatics in a very concrete manner. While many other disciplines have collaboratively invested in common testbeds bringing the community together, for example networking in computer science, there is no such activity among the ubicomp community. A successful Challenge would demonstrate the benefits of our open testbed to the broader ubicomp community.

The paper is organized so that Section 2 first recaps the 1<sup>st</sup> Challenge 2011. Section 3 then provides a procedural description of the 2<sup>nd</sup> Challenge. Section 4 concludes the paper with a discussion on the feasibility of the Challenge as a vehicle for promoting longitudinal real world studies atop our testbed.

## 2. RECAP OF 1<sup>st</sup> UBI CHALLENGE 2011

### 2.1 Preparation

The Challenge was designed in collaboration with a number of leading international researchers on ubicomp and urban informatics, many of whom have later served in the jury of the Challenge. The design phase yielded a particularly valuable by-product in form of the annual international UBI Summer Schools that have been held in Oulu since 2010 [15]. The week-long summer schools have comprised of parallel hands on workshops where junior researchers have studied various topics on ubicomp and urban informatics under the tutelage of senior experts.

### 2.2 Execution

The call for proposals was released in October 2010 with submission deadline on November 31, 2010. Participation was stimulated by advertising that up to five proposals would be invited as finalists to implement and deploy their applications in Oulu, each receiving up to 10000 EUR grant for covering expenses and a chance to report their study in a full paper in the upcoming MUM 2011 conference. The call “challenged the global R&D community to design, implement, deploy and evaluate novel applications and services in real world setting at downtown Oulu, Finland.” While the scope of a proposed application was left open, it had to comply with few general requirements emphasizing real-world urban computing:

- The application was expected to provide a service to the general public or a reasonable subset of the general public.
- The service could be provided directly by the application, or the application could allow the municipality, a NGO or some other third party to provide a service to the general public.
- The service was expected to be available for use continuously or for a substantial amount of time, thus one-time installations did not qualify.

Proposals had to use a given template that covered a range of topics from system architecture and user interface to business model. 11 valid proposals were received, three from Finland, six from Europe and two outside Europe. Although the application

scope was open, nine of the 11 proposals involved the UBI-hotspots, a network of dozen large interactive public displays installed at pivotal indoor and outdoor locations around Oulu [8].

As the first step, all 11 proposals passed the assessment of technical feasibility by the organizers to determine that the proposed applications could be implemented with available resources. Then each jury member individually ranked the proposals according to their innovativeness, user value, feasibility and sustainability. The rankings were combined into an aggregate ranking and top four proposals, all European university research teams, were invited as finalists to implement and deploy their applications in Oulu. As all four proposals involved the UBI-hotspots, we provided the finalists with remote access to virtual UBI-hotspots so that they could start implementing their services on the actual UBI-hotspot software platform remotely at their home universities. It should be noted that three of the four finalists adapted their existing research prototypes into an entry to the Challenge, i.e. they were not invented for the Challenge.

The finalists' teams spent two to three months in Oulu in summer 2011 to complete the implementation and deployment of their services and to collect research data. Interaction was fostered by seating the teams were seated together in a large open office, and by arranging joint social events with the hosts. Each finalist was appointed a local liaison researcher to serve as a technical contact point. Also, the finalists had at their disposal a translator and a Finnish M.Sc. student for localizing their applications, and for conducting user studies and interviews in Finnish. The services were deployed on the UBI-hotspots for use by the general public on July 7, 2011, after which the finalists collected research data with various methods till August 31, 2011. Serving as assistants in user studies, the finalists also had access to the so-called UBI Guides that the City of Oulu had hired to guide the general public in using the UBI-hotspots. The UBI-hotspots are multipurpose displays where a large number of services compete for the attention of the user. To minimize noise by other services, each finalist was provided with the opportunity to have one outdoor and one indoor UBI-hotspot allocated exclusively to their service for two days. Quantitative data such as the log of all launches of a particular service on the UBI-hotspot were automatically collected by the testbed. The services were required to remain operational till December 31, 2011, yielding six months' worth of log data.



**Figure 1. Award recipients of the 1<sup>st</sup> UBI Challenge (from left):**  
**1. FunSquare: N. Memarovic and I. Elhart;**  
**2. CLIO: E. Christopoulou and D. Ringas; 3. Digifieds: F. Alt;**  
**4. RunWithUs: F. Gil-Castineira; T. Ojala (chair of jury).**

The members of the jury individually ranked the finalists based on a documentation comprising of a video recording of a finalist's presentation to local jury members, a full paper published in MUM 2011 and the organizers' technical report. The aggregate final ranking of 1. FunSquare [5], 2. CLIO [11], 3. Digifieds [1] and 4. RunWithUs [2] was very even among the top three. The finalists presented their work and received their awards in a special session dedicated to the UBI Challenge in the MUM 2011 conference held in Beijing, China, in December 2011 (Figure 1).

## 2.3 Aftermath

The finalists provided feedback on the Challenge in two occasions, first in their jury presentations and then in comprehensive retrospective reports on the whole Challenge process seven months after the award ceremony, as a preparatory step for the 2<sup>nd</sup> Challenge. Selected quotes from the feedback are highlighted in the following discussion in italic.

The finalists' motivation to participate is characterized by the following remarks: *"New research opportunities and the possibility to contact with researchers in this field"*, *"Opportunity to do research "in the wild"!"*; *"Grant was important for covering expenses and for encouraging long term stay in Oulu"*; *"MUM special track was also motivating as it spurred discussion among us and with the greater research community"*.

The Challenge achieved its first objective of providing the four finalists with an opportunity to transfer their ideas from labs into the real world. None of them had prior history of exposing a research prototype to the general public in that extent. *"Our experience was very fruitful: we could deploy research in large scale and collect feedback from real people"*; *"Releasing an application in a real environment is totally different than any experiment in a lab"*; *"Deployments: hard and time consuming!"*; *"New technologies require going into the field! There are many things you cannot learn from the lab."*

Overall, the finalists concluded that the Challenge had been a valuable endeavor: *"UBI Challenge provided a unique testbed and a great environment!"*; *"The UBI Challenge is an invaluable tool for researchers"*; *"Great to see apps "in the wild"!"*; *"UBI Challenge is valuable both to us and the whole research community, participants will publish important outcomes from their research and evaluations"*. Indeed, in addition to their MUM 2011 papers, the finalists have utilized the research data collected during the Challenge in further papers, e.g. [6][10].

The Challenge also fulfilled its second objective of bringing together the hosts and the four finalists in a very concrete manner. *"The exchange and collaboration between the hosts and the other teams is what makes the competition unforgettable"*; *"UBI Challenge is a great opportunity to share information and ideas between international teams"*; *"What started as a competition was actually experienced as collaboration - the finalists' teams worked side-by-side exchanging ideas"*. This get-together has later yielded further collaborative fruits such as joint publications and funding applications for new research projects.

The finalists' services were retained in the UBI-hotspots till December 2012 for a total duration of 18 months. The services did attract a constant but modest amount of launches throughout the 18-month period. However, without any marketing efforts the services failed to generate any widespread and active use among the general public. *"Services need to be strongly promoted to reach a critical amount of users"*.

### 3. 2<sup>nd</sup> UBI CHALLENGE 2013

#### 3.1 Preparation

The design of the 2<sup>nd</sup> Challenge commenced with a discussion by the jury on the fundamental question whether there is "market demand" for a new Challenge. The members of the jury voiced their unanimous support for organizing the 2<sup>nd</sup> Challenge, stressing the importance of providing researchers with the opportunity to get access to the infrastructure of the Open UBI Oulu testbed and to conduct "in the wild" studies in authentic real-world setting.

The organizers solicited the jury members for suggestions on modifying the setup of the Challenge. This discussion resulted in the most important change in the setup so that the finalists were no longer required to stay up to three months on site in Oulu to deploy and evaluate their applications in person. Some jury members felt that this requirement limited the people that could participate. So, instead, remote participation was allowed so that the finalists could submit their working applications for deployment and data collection by the organizers.

However, the finalists were still encouraged to come to Oulu to participate in the field trial in June-Aug 2013. Each finalist would get 2000 EUR grant from the UBI RIR (Researcher in Residence) program for covering expenses such as travel to Oulu. The greatly reduced financial support for the finalists was another major change in the setup. The weakened economic situation in the Oulu region deterred the organizers from raising the same level of sponsorship that facilitated the 10000 EUR grants in the 1<sup>st</sup> Challenge.

The generic requirements of a longitudinal real world deployment of a functional service to the general public were maintained. The proposal template was slightly modified to accommodate for the remote participation with a detailed specification of the resources and support expected from the organizers. The jury did discuss the possibility of soliciting also shorter studies, possibly as a separate competition category of a limited scope and a lightweight submission format, but the organizers elected to limit the Challenge to longitudinal studies.

#### 3.2 Infrastructure and resources

The computing infrastructure available in the 2<sup>nd</sup> Challenge was much more versatile than in the 1<sup>st</sup> Challenge. Few additional UBI-hotspots had been deployed in the meantime. The panOULU BT network was now available also in form of portable BT access points equipped with touchscreens. The completely new infrastructure included a very large interactive UBI-wall and an interactive UBI-table to be placed in the entrance hall of the largest movie theatre in Oulu with ~1000 daily visitors, together with access to movie theatre related content, should any finalist provide an application to the movie theatre. Further, a new 3D virtual model of downtown Oulu was available, likewise access to the data of the traffic loop sensors installed at every traffic light junction around Oulu. Server resources included virtual machines for executing application processes and a telco-grade SMSC/MMSC for sending SMS/MMS messages to mobile devices. Categorized directories of services and events in Oulu were available as web services, likewise the statistics and traces collected by the testbed.

The finalists were supported with various resources. First, as mentioned before, they got a 2000 EUR grant for covering travel

and accommodation expenses, and for purchasing rewards such as movie tickets to test users. Further, each finalist was assigned a local doctoral candidate as a dedicated liaison researcher that supported the finalists in the design, implementation, deployment and evaluation of the application, and coordinated the activities and the use of resources in Oulu. The finalists themselves were responsible for the implementation of their applications. The liaison researcher also contributed to the reporting of the finalist's study as a co-author of the MUM 2013 manuscript. Each finalist was also assigned a local M.Sc. student in anthropology as a dedicated research assistant that contributed to the evaluation of the application by collecting qualitative research data (e.g. conducted interviews and observations) according to the instructions of the finalists and their liaison researchers.

#### 3.3 Execution

The execution of the 2<sup>nd</sup> Challenge was similar to that of the 1<sup>st</sup> Challenge but with faster tempo. Again, the Challenge invited the global R&D community to design, implement, deploy and evaluate novel applications and services in real-world setting at downtown Oulu, Finland. The call for proposals was distributed in February 2013 with submission deadline on April 8, 2013. Only four proposals were submitted, three from European universities and one from a local researcher at the University of Oulu. One of the four proposals was deemed infeasible by the organizers. The remaining three proposals were invited to the final, all three again involving the UBI-hotspots. Each finalist was provided feedback from the jury and a detailed assessment of the original proposal by the assigned liaison researcher with respect to technical, content related, cultural and other issues. The objective was to inform the finalists about any potential problems they might face with their original proposal. This early examination proved to be a very useful, contributing to a number of fixes and changes in the final design of the services.

Eventually, two of the three finalists completed the deployment of their applications in Oulu. HotCity had originally been developed for the City of Patras in Greece, and the contributors adapted it for the City of Oulu in the Challenge. One team member from Greece spent a week in Oulu to finalize the implementation, while all other activities were conducted remotely. Martians from Outer Space was being developed independently by a local researcher as a free time hobby, and he then submitted it as a proposal to the Challenge that just happened to conveniently take place.

The collection of the field data commenced on July 1, 2013, and continued till August 31, 2013. The research assistants conducted controlled user evaluations and observations to collect qualitative data, while quantitative data was obtained via logging. The services were retained in the UBI-hotspots after the conclusion of the data collection period to see how much real use they would attract over time. At pre-determined periods the services have also been advertised in the quick launch menu of the UBI-hotspots. This allows for exploring the impact of a menu shortcut on service usage that has been found to be significant in the UBI-hotspots [4].

The finalists reported their studies to the jury in form of a full paper, and a video recording of a presentation structured according to a given presentation template. Right now the members of the jury are scoring the two finalists to determine the winner to be announced at the award ceremony held in the UBI Challenge special session in the MUM 2013 conference in Luleå, Sweden, in December 2013.

## 4. DISCUSSION

Prompted by the disappointing number of only four submissions, I discuss various issues on the feasibility of the Challenge as a vehicle for promoting real world studies atop our testbed.

*The requirement of the lengthy on-site stay by the finalists* for deploying and evaluating their applications was relaxed in the 2<sup>nd</sup> Challenge in favor of remote deployment. However, on its own this relief failed to attract submissions. We still believe that it is beneficial for a researcher to be physically present on site. In our experience, visiting the site makes a big difference in developing the application as well as collecting the data and interpreting the results. Also, as proven by the 1<sup>st</sup> Challenge, the participants' simultaneous stays at the site contribute to collaborative gains.

*The requirement of a longitudinal real world deployment of a functional service at a pre-determined point of time* was retained. This imposes multiple practical demands on a prospective participant from scheduling the Challenge into one's research agenda to allocating substantial research personnel for a significant amount of time and engineering an application that qualifies for a 24/7 deployment to the general public. The busy scheduling of the 2<sup>nd</sup> Challenge of less than two months between the call and the submission deadline and only two months between the selection of the finalists and the deployment in Oulu may have eliminated some participants. The organizers delayed the call in attempt to raise sponsorship to be able to provide larger grants to the finalists, which failed and thus delaying the call was a mistake in hindsight. In terms of resourcing, not that many research organizations have free 'unscheduled' funding to allocate, on a short notice, a team to design and implement a new application required by the Challenge. This is highlighted by the fact that with one exception the finalists of the two Challenges have submitted adaptations of their existing research prototypes, thus participation in the Challenge contributed to an ongoing research agenda and vice versa. Thus, we should seek such a setup that would allow flexible incorporation of the Challenge in research agendas. This may require a more relaxed scheduling of shorter deployments in Oulu.

*The grant money given to the finalists* is apparently of significant importance in enticing participation. The grants have allowed covering expenses for which the participants may have not had any other funding. The much smaller 2000 EUR grant of the 2<sup>nd</sup> Challenge obviously damped interest, but it is impossible to know how many submissions we would have gotten, if we had been able to provide the 10000 EUR grants of the 1<sup>st</sup> Challenge. However, the 10000 EUR grant is not sufficient for covering all labor costs of participating in the Challenge either. Still, we argue that in terms of cost-benefit analysis, the Challenge is expected to provide participants with savings in the overall cost of conducting an experiment of comparable magnitude.

In conclusion, all the finalists of the two Challenges have found the participation to have been a very rewarding experience. The same applies to us organizers. We just have to find the means to run future Challenges with a setup that entices participation.

## 5. ACKNOWLEDGMENTS

The author gratefully acknowledges the support of the Finnish Funding Agency for Technology and Innovation, the Academy of Finland, the City of Oulu, and the UBI consortium support, and the valuable voluntary work of the members of the jury.

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