Data Portability and Media Migration for the Mobile Internet (MeMiMo) – Final Report

Dr. Marcelo Milrad
marcelo.milrad@vxu.se
Phone: +46 470 708725

Växjö University

Executive Summary

The wide spread of mobile devices with Internet capabilities is contributing to the rapid expansion of the wireless Internet. This latest development brings new opportunities for the implementation of a wide range of new mobile services, as well as new roles when it comes to information providers and information consumers. New patterns of interaction have developed regarding how people use mobile devices and services. The latest have the potential to improve the quality of these services by allowing users to provide valuable feedback to information providers. During the last couple of years, it has become even possible for mobile users to have an important role in the process of generating multimedia content. XML seems to be one of the most powerful technologies to deal with data portability and media migration, two key technical concepts that are raising a major concern among web developers.

The rapid adoption of mobile technologies by end users allows them to produce a variety of digital content (images, sound, and video) on the spot. This latest phenomena has gained wide popularity and clear indications of this latest fact can be found in sites such as www.youtube.com, www.flickr.com, www.nokia.com/lifeblog. Even in educational settings, students can now easily produce mobile multimedia content during their different learning activities. Thus, a main challenge relies upon how these different types of digital content can be used in different contexts. Our main idea of contextualizing digital educational content to be used in a variety of activities is based on the approach to tailor content to a specific location, activity/task and to a specific individual/community of users.

The aim of the MeMiMo project has been to explore and implement a number of collaborative web based and mobile applications related to data portability, media migration and reusability of information in educational contexts. An additional objective of this project was to illustrate innovative ways of integrating mobile devices and reusability of digital content to support students and teachers in different educational activities. This goal was achieved by developing and implementing several applications in order to exemplify the potential benefits of re-using media, visualizing content in context and merging the wireless internet with the wired world in educational contexts. The outcome of this applied research has resulted in a number of working prototypes that have been used in regular curricula in different schools and universities in indoor and outdoor activities.

The project started in January 2007 and it concluded by the last of January 2008. The work and activities conducted in this project were carried out within the framework of our going efforts while developing collaborative web applications and educational mobile services to support learning and teaching in K-12 schools in the Kronoberg region. Upon the completion of the project, our applications have been used by almost 200 students and teachers from K-12 schools and Växjö University that were involved in producing their own mobile multimedia content and would like to share it with others. The system and applications we have developed provided a generic framework for developing innovative services and content deliverable in mobile devices primarily used in learning environments.

We have designed and implement a number of learning scenarios that used mobile and web 2.0 technologies for supporting collaborative learning activities in the field of natural science, in particular biology and environmental science, physical education and history. The target audience for these activities were groups consisting of high school and university students. We used a number of mobile and web application we developed to support the students, thus providing access to different types of content from internet resources in order to support learner' different activities. We have also

developed a number of mobile applications and tools that allowed mobile users' generated content (such as images and sound) created on the spot to be published and shared via the internet. The design of these educational scenarios was implemented using user centred design techniques and it was developed in close collaboration with students and teachers from local schools and Växjö University. The teachers´ involvement was carried out as a series of workshops where we tried to match the educational needs with new ideas of how to provide mobile technology and support.

Participants in the different trials were equipped with Nokia 6630/ N70 smart phones with mobile internet access. The phones were loaded with a number of mobile applications we have developed, running on Symbian mobile OS. During the trials, the students at both schools and campus were interviewed about their experience using the different tools, and their experiences were continuously observed using different techniques, including both participatory and observatory approaches. At the end of each trial, selected focus groups were used to summarise their experiences. All these activities together with a description of the technological and educational aspects are described in details in Appendix 1 that contains all our interim reports delivered to our project officer and project evaluator during the period January 2007- January 2008. Based on the outcomes and results of our activities we assess that the objectives of the project were fulfilled and field tested.

There were several collaborating partners that actively were involved in the project:

Kronoberg and Norregård schools, at Växjo Municipality provided access to initial users in order to develop and test several applications.

A teacher student course at Växjo University (VXU) provided the campus and initial subscriber base to develop and test several applications.

Mapping Växjö, a partnership between a number of orienteering clubs from the Växjö region and the Swedish Orienteering Association.

TeliaSonera AB provided access to the GPRS network covering the trial areas.

Nätverket SIP, is a network of four Swedish national Non Governmental Organization (NGO) for youngsters

In addition to the technical development and implementation efforts undertaken during the lifetime of the project, we put special emphasis on producing scientific publications in connection to our work. During this period two master students in Computer Science at Växjö University have completed their thesis in connection to the work done in this project and one of our PhD students that is about to defend his Licentiate thesis in the summer has used MeMiMo as a part of his field of research. Moreover, we have been actively presenting the results of our work in several events both in Sweden and abroad. A detailed description of these activities is provided in Appendix 2.

The refinements of our applications combined with the involvement from the end users in the design process have provided relevant results for our work, both with regard to the technical infrastructure and the design methods to support different aspects of mobile learning. From a technical point of view, we plan to expand some of the features of our architecture to provide new possibilities for positioning and context awareness support. The design approach we have used to involve teachers and students have created a higher level of engagement for both parties and it has helped us to recognize the actual technological needs in the classrooms and the perception of technology by students and teachers. We plan to continue our efforts in this direction together with colleagues from our university in the field of outdoors Math Education and also with European colleagues as part of our coming efforts in connection to a number of proposals we have submitted to the FP7 ICT program.

APPENDIX 1: Collection of Interim Reports for the period January 2007- January 2008

Växjö University

Internet Infrastructure foundation of Sweden (IIS) funded project 2007

Project Name: *Data Portability and Media Migration for the Mobile Internet*
Documentation Type: Monthly Report, January 2007
Contact person at CeLeKT, Växjö University: marcelo.milrad@msi.vxu.se

1. Introduction

This brief report describes the efforts we have undertaken during the first month of the project named "*Data Portability and Media Migration for the Mobile Internet*". During this period the CeLeKT research team has taken several initiatives. These initiatives have been conducted as part of the feasibility study that was carried out according to the project plan. We have investigated and explored a number of new technologies that we may use in this project. Since one of the expected outcomes of our project should result in the development and implementation of *"A robust web platform to illustrate the potential benefits of re-using media, visualizing content in context and merging "the wired" Internet with the "wireless" world"* we have being exploring which are the most suitable technical solutions for achieving the purpose mentioned above.

2. Technical Aspects:

Based on our investigations and technical analysis regarding the points above, we came to the conclusion that the use of a Service Oriented Architecture based on web services can be suitable for our purposes. This approach would enable the data transaction between different communication platforms, thus supporting the reuse of digital content available on the internet to support users in the field. We chose web services as they can serve as "glue code" between different communication platforms (internet, Bluetooth, GSM etc.) used by a variety of devices. In this way, we will be able to support communication in heterogeneous device environments which it may increase the contextual support for the users. The idea of giving users contextual support will be implemented by trying to adapt existing content stored in a repository available via Internet. The content adaptation will be based on users' location and their activities. In order to explore and implement the communication and technical aspects related to web services, two master students in computer science have joined our team and they will carry out their thesis in conjunction with the MeMiMo project. Their thesis proposal named "*Exploring the Possibilities of Using Cascading Web Services to Bridge Wired and Wireless Data Transactions*" can be downloaded from the following URL:

http://w3.msi.vxu.se/users/mmilrad/Thesis/Miranda_Vato_07.pdf

2.1 Tools and techniques to be used

Regarding the use of new technical platforms to support the development of mobile internet applications, we have identified Apache Racoon which is a research initiative undertaken by Nokia Research (http://research.nokia.com/research/projects/mobile-web-server/). In its core, Apache Raccoon is a platform that makes it possible to run an Apache httpd web server on Symbian S60 supported mobile phones. Traditionally, cellular devices have been restricted to being merely clients, but by being able to run a mobile web server it is possible now to extend the client-server architecture and to decentralize server-logic. Aside from the httpd port, Apache Raccoon offers a set of handy functionalities, such as Instant Messaging (IM) services and remote control

over the built-in camera phone. We are convinced that Apache Raccoon will allow us to reach a high level of flexibility when designing our future mobile applications, especially by building location independent PAN (Personal Area Networks). For investigating the possibilities of designing and implementing customized novel mobile applications we have scheduled a trial that will be conducted with a group of 20 children (ages 14-16) during week 8. The main purpose of this activity will be to support groups of young people participating in a treasure hunt outdoors activity supported by mobile technology. A more detailed description of this activity (in Swedish) is given at the following URL:

http://w3.msi.vxu.se/users/mmilrad/MeMiMo/Skattjakt.pdf

This particular activity will allow us to work very close with users in order to identify their needs and see which features for mobile support can be offered using Apache Racoon in combination with modern web technologies such AJAX, Flash Lite and Google Maps API. Also as part of this feasibility study, we have investigated which technical capabilities are offered by a number of mobile web browsers. We found out that some of them do not support W3C recommendations when it comes to JavaScript and AJAX functionality. The results of our explorations show that the *Opera Mobile* web browser supports these techniques and it can be installed as a normal application in most of the mobile phones.

3. Pedagogical Ideas:

Scenario-based learning, with student-controlled interactive stories based on discovery learning methods (Schank, 1995) will be initially proposed with potential to license and reuse successful, validated content offerings in the future. Options for receiving the scenarios could easily include text messaging, email, audio playback, downloaded audio, voicemail delivery, and combinations of these delivery methods as requested by the learner. A variety of mobile devices will be used for delivery and prized will be awarded for incentives. Instilling a notion of competition will broaden the appeal and stickiness of the scenarios and place them in a game-like structure.

4. Further development and coming efforts:

The trial scheduled for week 8 will serve as the first testing opportunity in order to validate our ideas of how to support mobile users that can access both the wired and mobile internet. We will analyze the outcome of this activity both from a technical and pedagogical perspective. Our particular approach of early involvement of users in the design process is consistent with well known design techniques such as *user centered design* and *contextual design* and they will help us to identify users' needs and expectations. This activity will mark the beginning a new phase of this project described in the proposal as "Defining requirements".

Växjö University

Internet Infrastructure foundation of Sweden (IIS) funded project 2007

Project Name: *Data Portability and Media Migration for the Mobile Internet*
Documentation Type: Monthly Reports for February and March 2007
Contact person at CeLeKT, Växjö University: marcelo.milrad@msi.vxu.se

1. Introduction

This report describes the efforts we have undertaken during February and March within the project named "*Data Portability and Media Migration for the Mobile Internet*". During this period the CeLeKT research team carried out several activities. We have designed, implemented and conducted a trial involving a number of users in order to carry out outdoors activities supported by mobile technologies. In parallel to these efforts, we have investigated a number of possible solutions to bridge data transactions between the wireless and wired internet, as well as we have started to design an educational activity to bridge outdoors and indoors learning activities supported by mobile technologies. All these efforts are described in the coming sections of this report.

2. Technical Aspects:

During the previous month in the scope of the "*Data Portability and Media Migration for the Mobile Internet*" project we explored the potential of using different technological solutions that would be useful for our planed trials. In the last two months, we have explored a possible architecture to bridge data transactions between the wireless and wired internet. The conceptual model of this approach is illustrated in the figure bellow.

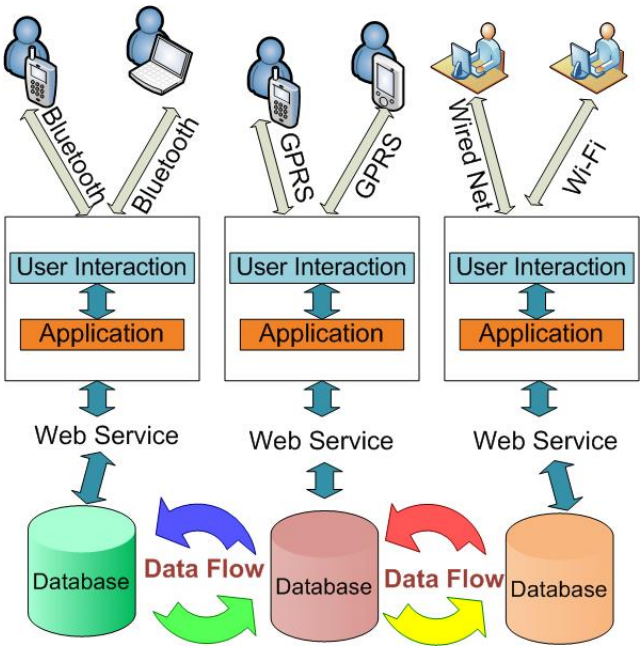

Figure 1 *– Data flow architecture to support bridging data transactions between the "wireless" and "wired" Internet*

The main idea behind this architecture is to make internet data resources available to heterogeneous mobile environments in order to provide support to mobile users that have not direct access to different internet resources. The ideas described in this section are going to be further developed and we expect to implement a couple of prototypes that will be tested in our coming activities.

In the next section we described the technical aspects related to the implementation of the first trial we conducted with a group of teenagers by the end of February. The main purpose of this activity was to provide mobile technology support to groups of young people participating in a treasure hunt activity conducted outdoors.

2.1 Tools and techniques and applications

As already stated, we conducted a "Treasure hunt" activity in cooperation with Nätverket SIP and two local clubs from the city of Växjö. The trial was designed as game based activity and it was run simultaneously by all users. More detailed information regarding this trial can be found at the following link:

http://www.kollegiet.com/templates/StandardPage.aspx?id=5504

2.1.1 Flash Application for the NOKIA 6630 Treasure Hunt

For this particular activity we developed a Flash Lite application running in each phone that communicates with the Activity Control System (ACS) (See figure 1). The ACS is a software application we have developed that controls the flow of the different activities based on a predefined logic and users input.

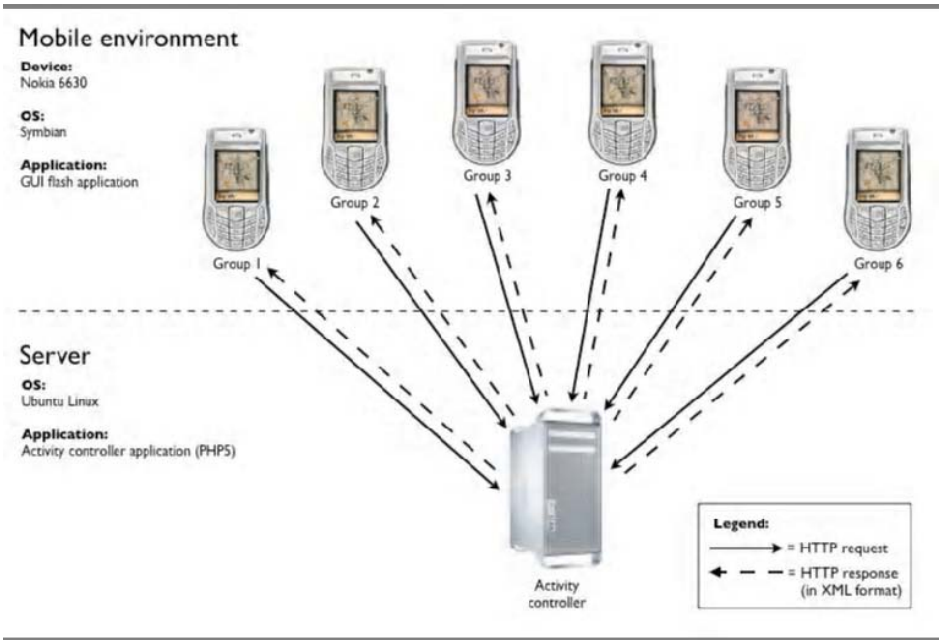

Figure 2 *– An overview of the architecture implemented for the treasure hunt activity.*

The communication between the Flash Lite application and the ACS was implemented by using the Post Variables command from the Adobe Flash Action Script language. When a request is sent by the phone to the ACS, the returned value is a XML string which is parsed in the Flash application running in the phone. The

Flash application was designed in a way that the IMEI number for each phone is included in the ASCII

string sent to the ACS server, as well as the unique ID activity number that can be identified by the ACS that will generate a new activity according to the value of these variables. Figures 3 and 4 illustrate the logic and sequence diagram of this implementation.

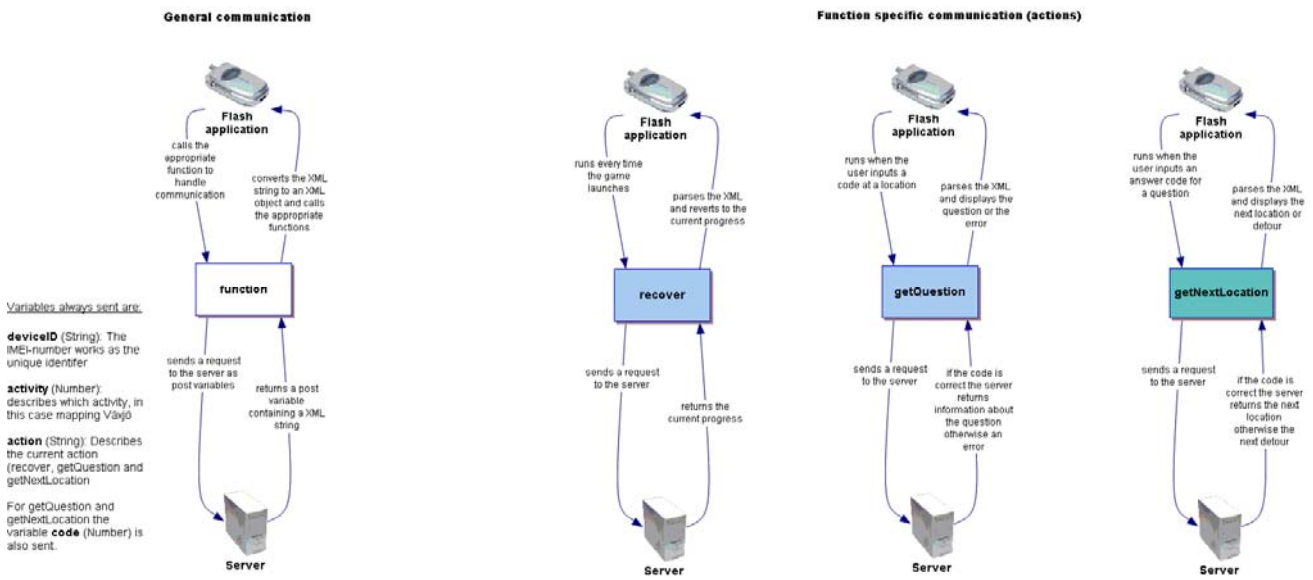

Figure 3 *– An overall view of communication between the mobile flash application and the server.*

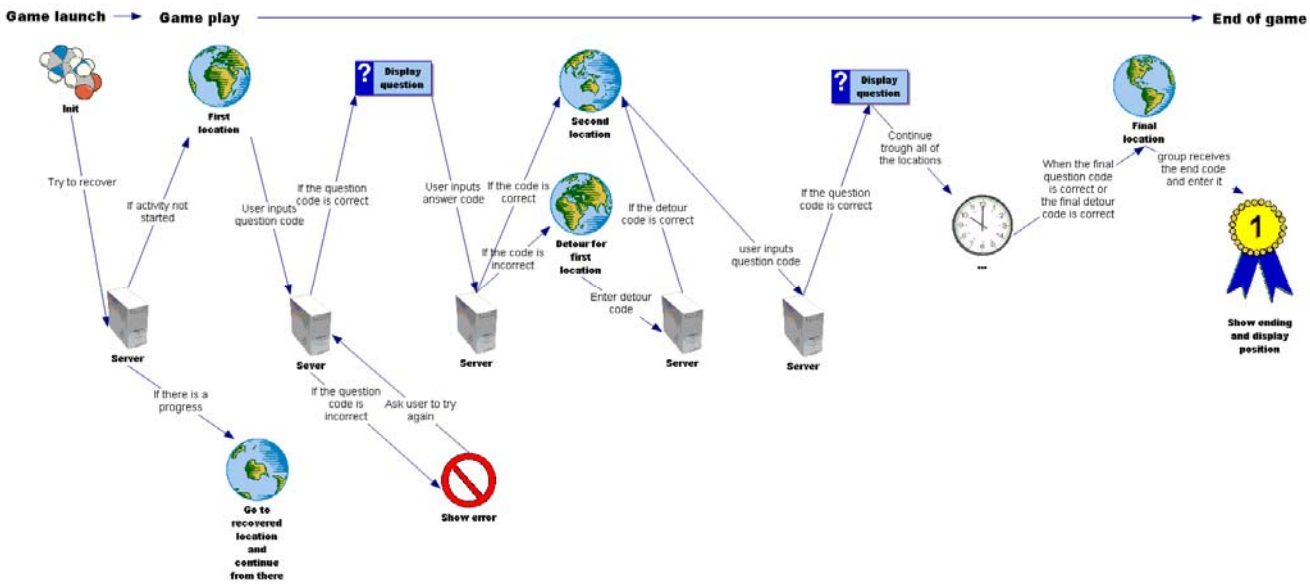

Figure 4 *– A sequence diagram over the treasure hunt application.*

3. Further development and coming efforts:

The treasure hunt trial served as the first testing opportunity in order to validate some of our ideas regarding how to support mobile users that can access both the wired and mobile internet. The implementation of this trial was successful and we

explored the use of a number of mobile techniques while trying to bridge this gap, especially in outdoors environments. Moreover, this activity served us a source for getting input from the users related to the design of mobile applications in connection with our future activities. Based on the outcomes of this activity, we will incorporate those lessons learned in our future implementations.

In our coming efforts in April and May we aim at supporting the notion of situated learning with mobile and positioning technologies to promote new ways of mobile interaction and collaboration based on the users´ learning context and activities. Situated learning is a general theory of knowledge acquisition that is based on the notion that learning (stable, persisting changes in knowledge, skills and behaviour) occurs in the context of activities that typically involve a problem or task, other persons, and an environment or culture.

We will design and implement a learning scenario that would use mobile technologies for supporting situated learning in the field of natural science, in particular biology and environmental science. The target group for these activities will be 18 university students from Växjö University. We plan to use some of the mobile technology solutions (based on what we reported earlier) to support the students, thus providing access to different types of content from internet resources in order to support learner' different activities. Moreover, we are also going to allow mobile users' generated content (such as images and sound) created on the spot to be published and shared via the internet. The design of this scenario will be implemented using user centered design approaches and it will be developed in close collaboration with teachers from Växjö University.

Växjö University

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Project Name: *Data Portability and Media Migration for the Mobile Internet*
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Contact person at CeLeKT, Växjö University: marcelo.milrad@msi.vxu.se

1. Introduction

This report describes the efforts we have undertaken during April and May within the project named "*Data Portability and Media Migration for the Mobile Internet*". During this period the CeLeKT research team carried out several activities. We have designed, implemented and conducted a new trial together with 18 university students that were involved in educational activities supported by mobile technologies. These activities were part of their actual curricula in an undergraduate course in the field of Biology. In parallel to these efforts, we have continued to developed cascade web services software solutions that can be used to bridge data transactions between the wireless and wired internet. By the end of May we conducted also a design workshop with the teacher students that took part in the activities in April, in order to involve the end users in the design process, as well as to get new insights regarding the design of novel educational activities supported by mobile technologies. All these efforts are described in the coming sections of this report.

2. Design of innovative educational activities:

We have designed and implement a learning scenario that used mobile technologies for supporting collaborative learning activities in the field of natural science, in particular biology and environmental science. The target audience for these activities was a group consisting of 18 university students from Växjö University. We used some of the mobile technology solutions (based on what we reported earlier) to support the students, thus providing access to different types of content from internet resources in order to support learner' different activities. Moreover, we have developed a number of mobile applications that allowed mobile users' generated content (such as images and sound) created on the spot to be published and shared via the internet.

The design of this scenario was implemented using user centered design techniques and it was developed in close collaboration with teachers from Växjö University. The teacher involvement has been done in a series of workshops where we tried to match the educational needs with new ideas of how to provide mobile technology support. The trial consisted of four stations in the field around four different families of trees and different features such as leaf morphology, type of tree, environmental aspects, etc. The 18 students where divided into 4 groups and then half the group explored the first two stations in the field while the rest worked around the desktop in the computer lab. After the field group completed the 2 stations they returned to the lab and switched providing an opportunity for all students to experience all the roles.

The trial took place on April 25th and it was part of their regular course activities. The content under exploration was closely connected to the curriculum and it explored aspects related to plant biology, specifically how to learn and explore issues connected to tree morphology. Together with the instructor we designed a learning activity that explored collective collaboration between groups of students inside the classroom and in the field. The activities for the outdoor subgroup in the mobile environment were supported by 2 smart phones used as tools for collaboration,

communication and for creating, receiving content, and controlling the activity. The first smartpone has been used as a semacode[1] reader, for reading the tags and for triggering the events (based on a specific location) and actions to be conducted by the outdoor subgroup. The second smartpone was used as an audio and still image camera to help the students to take pictures of the trees and record their notes. All the mobile media generated by the students in the field was published on the Internet almost in real time. The indoor subgroup was equipped with a desktop computer with Internet access and collaborative tools to work with the outside group (All these aspects are illustrated in figure 1). After the activity, the students discussed their experiences and filled out a survey about their experiences. In the URL below you can find a collection of pictures that illustrate the outcome of this activity.

http://w3.msi.vxu.se/users/akumsi/projects/amulets/album1/

2.1 Tools, techniques and applications

2.1.1 Mobile applications and description of the architecture

As explained in the former section, we developed a couple of mobile applications in the phone (using Python for series 60) in order to support the different activities. A picture taking and a voice recorder application were designed and implemented. These applications were design to allow dynamic metadata generation (including descriptors such as time, group name, activity type and position) for the user generated mobile content that was almost immediately published on the internet. The reason for generating this type of contextual metadata has to do with aspects related to reusability and easy to search parameters for content retrieval. See the URL below for an example of how this mobile content with associated metadata can be used:

http://musis.msi.vxu.se/Debbie/Amulets_biologi/resurser/alpha.php

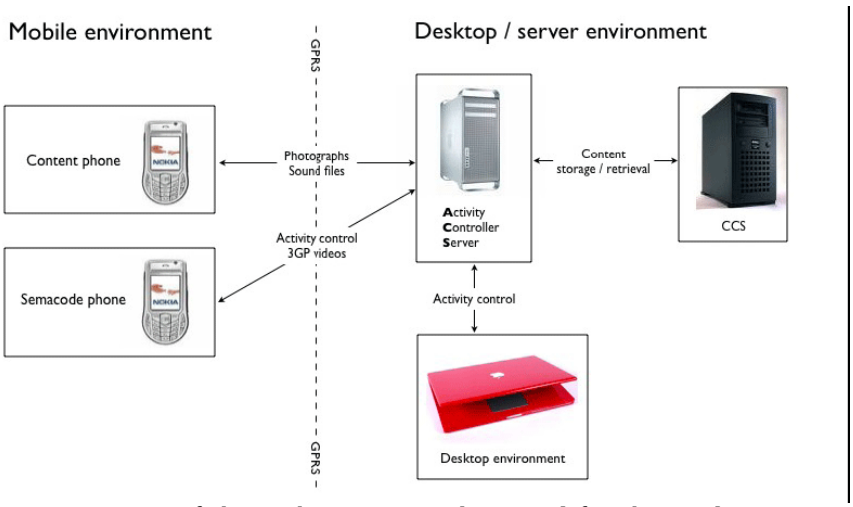

Figure 1 *– An overview of the architecture implemented for the outdoor activity with the teacher students.*

The ACS component described in figure 1 was already explained in the former report. The content repository in figure 1 is called Collect, Convert and Send (CSS) system. CCS is a software application we have developed in one of our on-going research

[1] Is a 2D barcode tag for embedding URLs to a specific location (source: http://www.semacode.org/). Semacode tags can be read by a camera-enabled mobile phone.

projects. It also includes a repository with metadata associated with the content that flows through the system. The CSS system is modular, reusable and easily expandable having the ability to deal with new types of content and technologies. The CCS can get the content from its source based on pre-defined rules, convert it to formats that are supported by the mobile device, and transmit it.

2.1.2 Technical development of cascading web services

In our feasibility study we came to conclusion that the best solution for our system would be a Service Oriented Architecture based on web services. This would enable the data transaction between different communication platforms and innovative interaction patterns with users. Currently we have developed the first segment of an architecture that bridges the Bluetooth segment with the GPRS infrastructure. The bridging is based on web services and it enables the data transaction in form of text and pictures. We regard this as an important development of our project because it enables us to design short-range clustered interactions between users based on the co-location perspective. The limitation posed by this solution is the relative short range availability of Bluetooth networks (up to 10 meters). Small interactions clusters (up to 10 meters radius) can interact with each other using web services across different communication platforms. This is illustrated in the figure 1. This picture illustrates the data transaction flow implemented using web services.

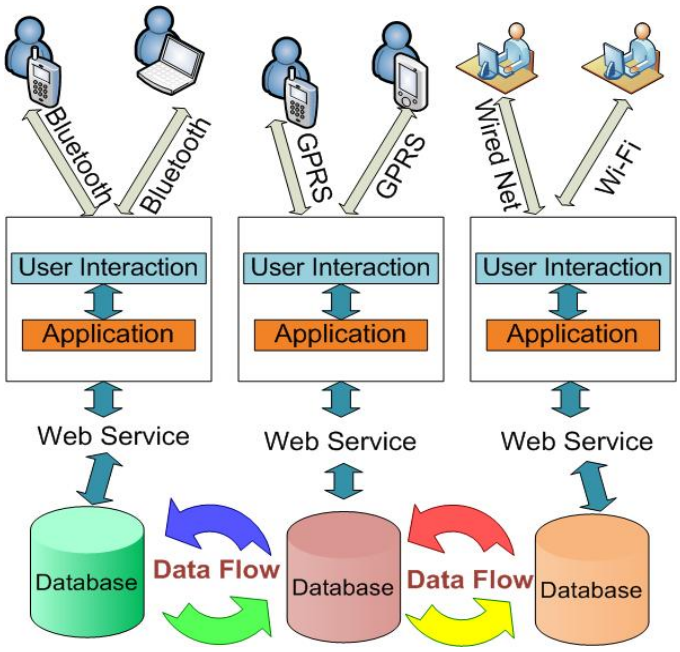

***Figure 2**. Data transaction flow*

2.1.3 The Interaction Process Using Cascading Web Services

The interaction process with the cascading web services solution we are exploring is flexible and provides different interaction opportunities for the users. Figure 3 below illustrates the possible way of user interactions with the system. The first part of the illustration describes the interaction way of User A with the application that establishes contact with the services. User A is equipped with an enable Bluetooth device and he/she needs to access some information in one of the databases that are part of the system. User A sends a request for retrieving information related to “astronomy” that exists in the database. In the second part we illustrated how User B requests to process information related to the field of “biology” where this

information is not available in the local database. In both cases, an automatic process between the web services and the databases respond to the user's request, whether or not relevant data has been found. Interoperability between networks and data transactions is implemented using web services.

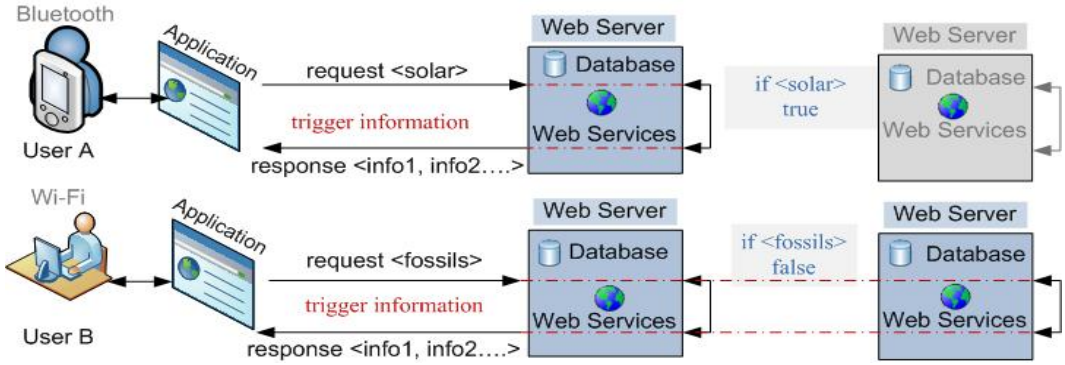

Figure 3. *Interaction using cascading web services*

Each query sent over the system is primarily controlled by web services that communicate with the databases. This implementation segment provides specific functionalities related to cascading web services as a part of the service oriented architecture that we are developing as part of the efforts in this project. This implementation will allow users to reach the content of the database from anywhere and from diverse platforms. By the end of June we plan to have a working prototype demonstrating all these features.

3. Future Learning Workshop with the students and coming efforts:

Following up the activity conducted with the students on April 25th, we wanted to to involve students in the design process of future educational activities. The special focus of this design process activity consisted of the students working through a process without the use of mobile technology in an unplugged fashion in order to give them the ingredients to shift from users to designers. The task they supposed to complete was related to measuring the effects of light, temperature, and moisture on plants over a three-week period. This activity should be conducted outdoors.

The students had to go out to the field and select the plants they want to study during a period of time. In order to accomplish this task they could used the map features available at kartor.eniro.se to record the geographic coordinates. These exercise provided the students with tasks to think about how technology enhanced learning activities could be designed guided by educational content. The key goal of this process was to shift the frame of mind of these future teachers from mobile device users to mobile course designers. This activity was a continuation of the process started on April 27th when the students participated in a technology trial and ended on May 23 with the hands on workshop.

3.1 Workshop goals:

The goal of this activity was to imagine future uses of the mobile technologies experienced on April 25th and to provide a transition from current thinking to future thinking in conjunction with the last tasks described in the section above. One of the goals of CeLEKT is to enhance collaboration between students, teachers, and experts. Collaboration can be explored in face-to-face and between locations or in other modes.

3.1.1 The Task Summary

The task to be accomplished was to monitor different growing patterns of plants over time. Tasks included soil temperature, plant location, plant identification, GPS coordinates, photographs, and notes.

3.1.2 The mission of the workshop

Brainstorm how we can design a technology enhanced learning activity for students based on the task summary and YOUR experiences combined with how you would IMAGINE the technology would work. The task at hand is the current one that you have doing in May with the plants, keeping in mind how the tree morphology tasked worked. Remember to imagine how you would like the technology to work. The pictures in Figure 4 illustrate the students in the different activities of this workshop.

3.2 Summing Up and Coming Efforts

The activity presented in this report served as the second testing opportunity in order to validate some of our ideas regarding how to develop mobile applications and systems that can support learners in the field. The implementation of this trial was successful and we explored the use of a number of mobile techniques while trying to connect people conducting collaborative activities outdoors and indoors. Moreover, input from the users based on the outcome from our future design workshop gave us an important source of inspiration for our future activities. Based on the outcomes of the activities we have conducted until now and our original ideas, we will make an attempt to conceptualize and describe a generic architecture to support data portability between outdoors and indoors environments. .

In our coming efforts to be carried out in June we plan to finalize the implementation of the cascade web services and to connect them to mobile devices. A particular demonstrator will consist of an implementation including a picture taking application running on a pocket PC that will be connected via Bluetooth to a Laptop. This latest machine will be connected to the Internet and using a web service application the picture taken with the pocket PC will be automatically published as a GeoTag image in Flickr (see www.flickr.com).

Figure 4. *Students working on the future workshop activity.*

Växjö University

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Project Name: *Data Portability and Media Migration for the Mobile Internet*
Documentation Type: Monthly Reports for the period June-September 2007
Contact person at CeLeKT, Växjö University: marcelo.milrad@msi.vxu.se

1. Introduction

This report describes the efforts we have undertaken during the period June-September within the project named "*Data Portability and Media Migration for the Mobile Internet*". During this period the CeLeKT research team carried out several activities. We have implemented and conducted a new trial together with 30 children that were involved in informal educational activities supported by mobile technologies. These activities were conducted in the form of a treasure hunt game. In parallel to these efforts, we have finalized with the development of cascade web services software solutions to bridge data transactions between the wireless and wired internet. Since the end of July, and based on the data we collected during the treasure hunt activities with the children, we have developed a couple of applications that use GPS data to provide contextual metadata to digital mobile content generated on the spot. During the last weeks we have been trying to integrate all our past and current efforts in order to design a generic system architecture that represents the scope of our overall work. All these efforts are described in the coming sections of this report.

2. Design of innovative educational activities

We have implement and refined a learning scenario that used mobile technologies for supporting collaborative learning activities in the field of history and orienteering. The target audience for these activities was a group of 30 young girls from the Växjö region. We used some of the mobile technology solutions (based on what we reported earlier) to support the children, thus providing access to different types of content from internet resources in order to support learner' different activities. Moreover, we have refined our existing mobile applications in order to allow mobile users' generated content (such as images and sound) created on the spot to be published to the internet. In the URLs below you can find a detailed description of this activity as well as a collection of pictures that illustrate its outcome .

http://www.celekt.info/max/

http://www.23hq.com/spikol/album/2100584

3. Tools, applications and overall architecture

3.1 Technical development and final implementation of cascading web services

During this phase of the project we took several initiatives in order to implement and investigate whether if the suggested solution based on a Service Oriented Architecture (SOA) would suitable to implement and to use in learning activities taking place outdoors. The SOA we decided to explore was based on the idea of using the so called *cascading web services*. Cascading Web Services (CWS) represent a collection of services offered in a system consisting of multiple devices and multiple interacting and communication platforms. Cascading enables Web Services to exploit access in diverse environments without manual intervention. Our particular interest was to investigate

how mobile web services can interact with other web services by allowing posts and request generated at the mobile client to cascade between different platforms and clients.

These services using the cascading web services concepts were demonstrated as a technical design solution, in a number of trials within the field of educational technologies. Communication among devices is preceded using request-response commands by cascading these commands between different Web Services that are self-contained and independent on their context or state. The system represents a typical Service Oriented Architecture based on the use of distributed system. Cascading Web Services involve multiple transport networks including Bluetooth Technology, GPRS, Wi-Fi, and Wired Networks. All these concepts are illustrated in the figure bellow.

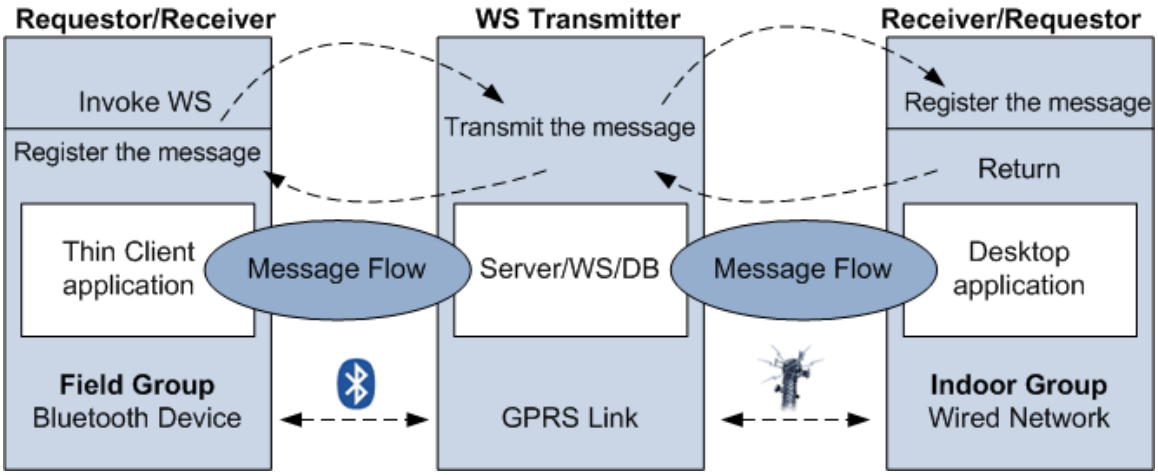

Figure 1. *Web Services transmitting message between two applications.*

Whereas the protocol of this communication is to bridge wired and wireless networks for data transactions, specifically from a Bluetooth location-based network. A number of particular cases were designed and implemented in the context of "outdoors activities" to demonstrate how the system solution works in real settings. Web services performance can be considered very beneficial, especially having into consideration, their flexibility and their interoperability in diverse networks. In the next section we describe in details a couple of cases that illustrate how cascade web services have been used in the project.

3.1.1 Scenario Description

In this scenario we describe some events of a task to be performed by a group of learners conducting an outdoor activity using mobile devices. While this group is located in the field, another group of students are indoors in a laboratory. The domain in which activities are taking place is related to the field of "*environmental studies*" and "*tree taxonomy*". Part of the activity for the outdoors group consists of documenting the surrounding environment (images, sounds, text) in order to share this information with their peers inside. The digital content (images and text) is generated by the members of the outdoors groups. This content needs to be transferred from a particular location to a final destination using wide ranges networks. In this particular case we want to primarily illustrate the approach of using cascading web services that allow us to use some of the online services from http://ww.flickr.com, even if the user is not connected to the internet and has a limited range connection. To clarify such a transaction we will give a step-by-step explanation of this activity. Initially, we present some general requirements related to the use of flickr and its API services.

Identifier: R2	**Name:** Cascading Web Services to Bridge Wired and Wireless Networks.
	Description: Diverse Technologies interconnected.
	Requirement details
R2:1	The software system should be implemented in multiple transport networks. Web Services should interconnect these networks and should allow groups of users to exchange content from one network to the other, without noticing the difference between networks.
R2:2	Bluetooth connection should be connected with the first server in the range of at most 10 meters far.
R2:3	Groups of users connected with Bluetooth devices should be supported by a server that is available in the same area. This server is used as an intermediate communication device, which purpose is to serve for cascading Web services to search for different content in a different server, or to publish the generated content on internet.
R2:4	The user should be able to generate content and publish it immediately on a flickr service.
R2:5	The content should be published from a Bluetooth network, cascading to a GPRS, Wi-Fi or a wired network until it reaches an internet connection.
R2:6	The user should be able to retrieve the published content from a Bluetooth device by cascading over multiple services.

Table 1: Requirements for CWS to bridge Wireless and Wired Networks

We start by publishing the content from a location-based network. Our built-in Web services cascade from the point where the content starts to move, until it is published on the internet, in this case on Flickr. To see this activity from the perspective of the generic architecture, we present the blocks used within this activity.

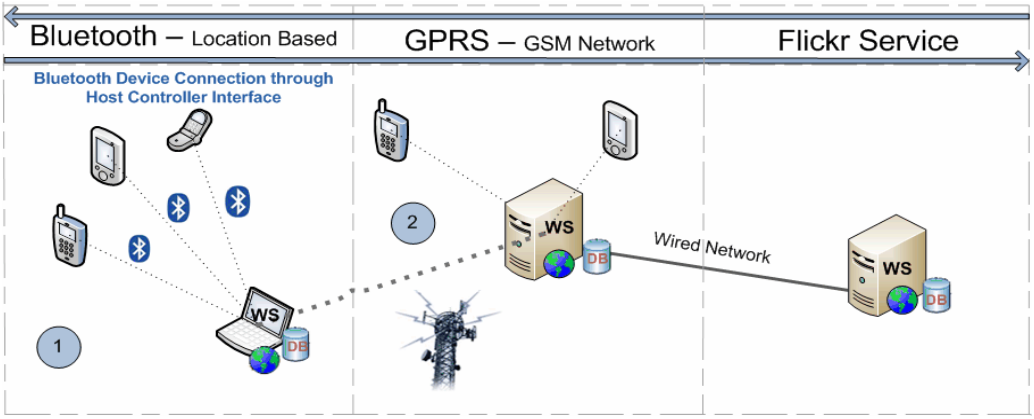

Figure 2. *Publishing mobile content to Flickr.*

3.1.2 Flow of Events

1. *A picture is taken with a mobile device at a specific place. The picture is taken with embedded EXIF tags[i].*
2. *The geographical position of the picture is already known and placed to the database.*
3. *A user wants to publish this picture on flickr.*
4. *The Web Service is requested to send the picture with all automatic generated EXIF data to flickr.*
5. *Flickr gets the message and responds to the user that the message is uploaded.*
6. *The picture is placed on the fly with the exact given location in the map.*

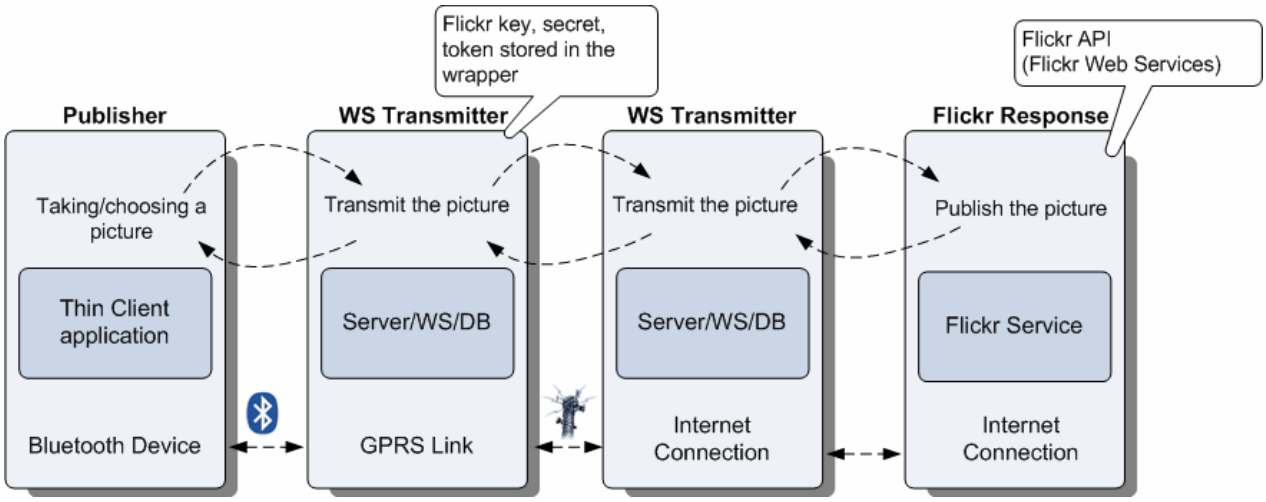

Figure 3. *Calling the Flickr service for publishing a picture.*

3.1.3 Sequence Diagram for Retrieving the Published Picture from flickr

In the former section we showed how a picture can be published from a Bluetooth-location based network using a mobile device to flickr. In this case, the sequence diagram below shows how the published picture can be retrieved from flickr to a mobile device that uses the Bluetooth-location based network.

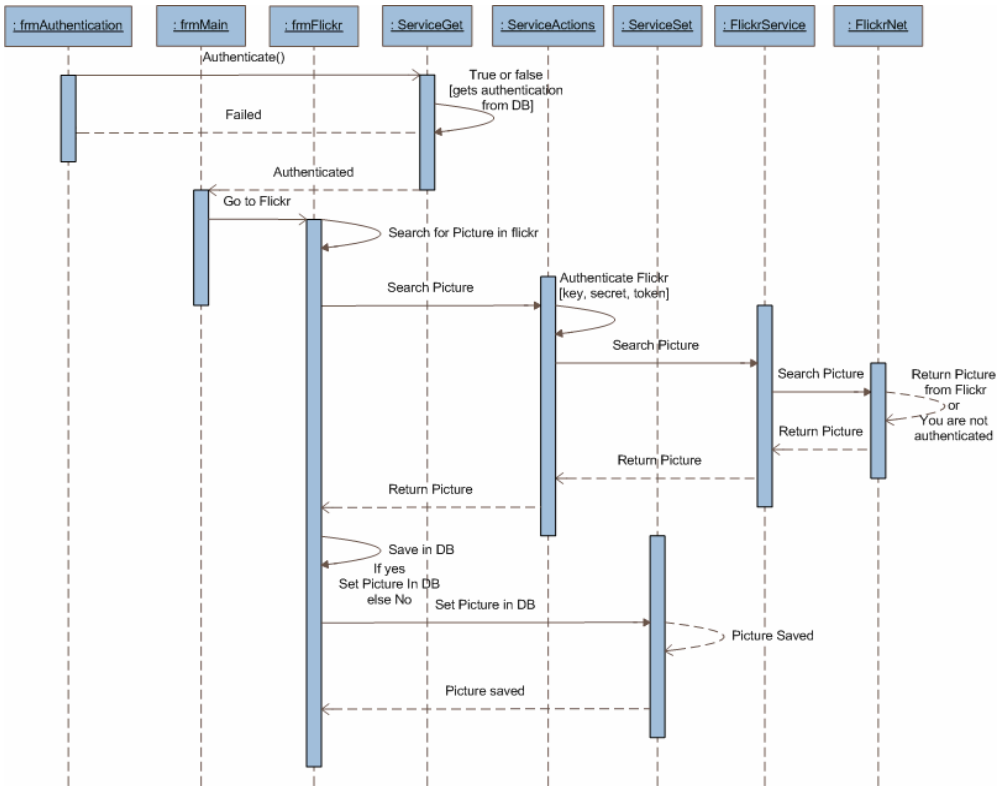

Figure 4. *Sequence - Retrieving a picture from flickr to Bluetooth device.*

3.1.4 Image on map – automatic geo-tagging

Another application we developed for mobile devices running windows mobile is a image-taking (see figure 5) client that can publish the image taken with the camera phone on a map. For achieving this functionality, we have used Flickr services and Flickr map.

Figure 5. *Taking an image and publisjing it on flickr from a Bluetooth device.*

Figure 6 below shows an image taken with a Bluetooth enable mobile device. This image has been published at Flickr while at the same time it is automatically geo-tagged[ii] and placed on the map. The figure below illustrates the map of the place where the image is published from a Bluetooth mobile device via CWS.

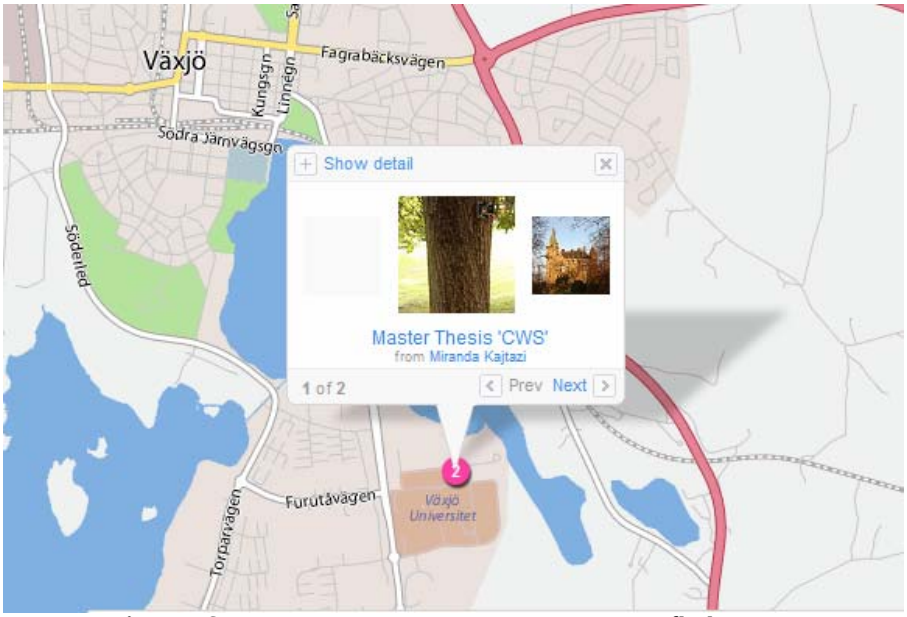

Figure 6. *Automatic Image geo-tagging on a flickr map.*

Moreover we developed a web based application for desktop environments that allow the group in the indoors environment to access the content generated by the outdoors group. The main goal of this application is to demonstrate how two or more groups of users can interact with each other by means of connecting different networks using cascading web services.

Figure 7. Web based application for group collaboration

3.1.4 Summing Up

We have developed new series of applications that are capable to allow multiple users to interact using a system architecture consisting of diverse networks. The proposed technological approach represents a flexible solution for the user, strongly based on cascading Web services that are the key feature for bridging these multiple networks

to support data transactions and interoperability. As for the different applications, we were able to program and implement a couple of Web services that can operate in different networks. The primary network from where CWS have been moving is the Bluetooth – location based network. A more detailed explanation with access to diagrams, code and further implementation aspects can be found at:

Kajtazi, M. & Vogel, B. (2007). Cascading Web Services in Mobile Environments: Bridging Wireless and Wired Networks for Data Transactions. *Master of Science*, School of Mathematics and System Engineering, Växjö University, Sweden. It can be downloaded from:

http://www.diva-portal.org/diva/getDocument?urn_nbn_se_vxu_diva-1389-2__fulltext.pdf

4. Karamel: A repository and logging system for appending geo-metadata to mobile content

The aim of this application is to automatically geo-tag user generated mobile content create by users using a mobile device. The normal scenario is that a location aware device, such as a mobile phone with a GPS connection, records a piece of information (image, audio) and submits this to the application server[2] together with the associated GPS data. At the server side, the application can analyze the submitted content, and then if applicable, embed metadata[3] and abstract the content to one of several data models (See figure 8) we have implemented. The model is then stored in the database and the content data is saved to a file repository. When a particular client wishes to view this content, it can be requested by using a URL that defines what method the server should use to render the content, what format should be rendered and possibly parameters that must be passed to the method. For example, the method for extracting entries created after 2007-01-01 at 12:00:00, belonging to the topic with id 123 and rendering the results in the particular KML format (a XML-based format used by Google Maps to place data type in a certain location) could be constructed as: http://{server location}/render/slice/123.kml?from=20070101120000

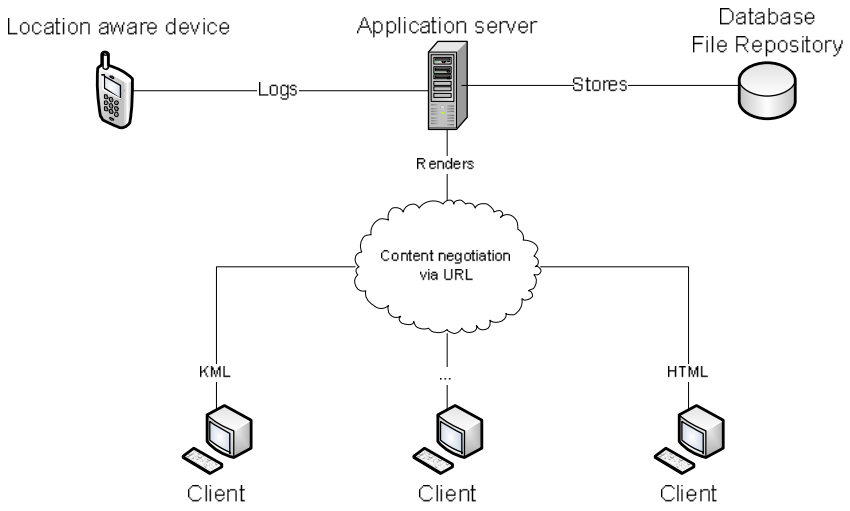

Figure 8. *An overview of the Karamel architecture.*

[2] Running on Django. See http://www.djangoproject.com
[3] Generally using ExifTool. See http://www.sno.phy.queensu.ca/~phil/exiftool/

4.1 Karamel model structure

As a topic relates to itself it is possible to create a tree of topics and thereby structuring the entries (see figure 9). Each entry has a content object attached which references to some sort of data (image, audio) belonging to the entry. Tags can be attached to entries, as can geodata.

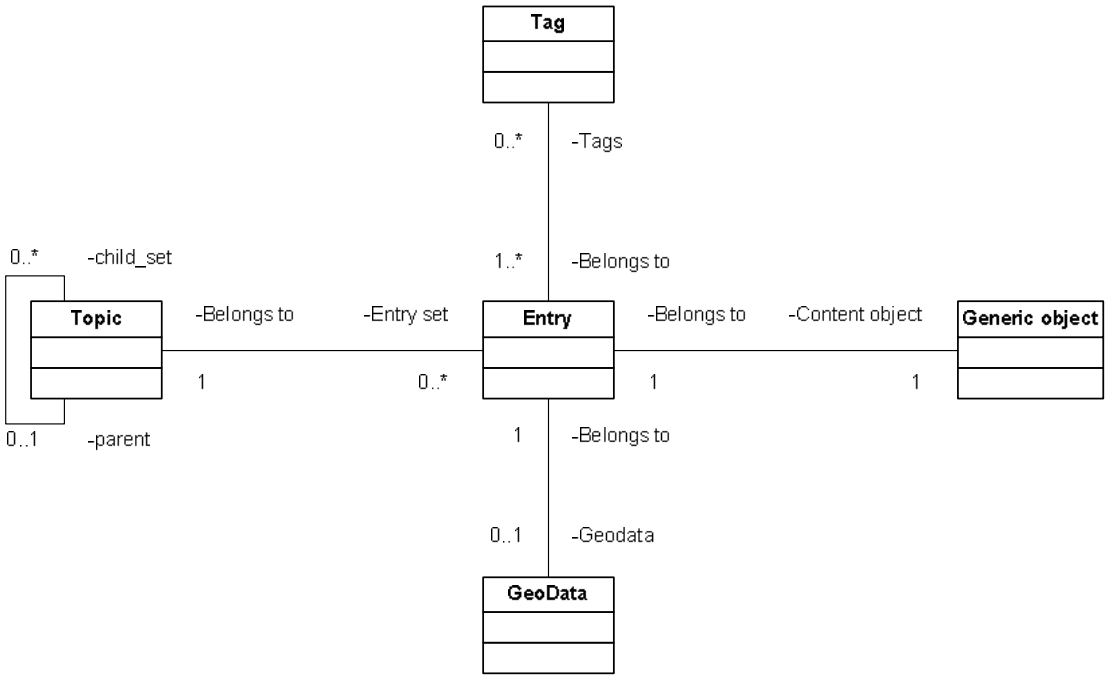

Figure 9. *Karamel model structre.*

4.2 Karamel rendering capabilities

The application server uses Django's default templating engine to render content. A template is constructed by abstracting the document that should be rendered, replacing dynamic elements with Django template notation.

Example fragment of a KML Template:

```
<Placemark>
    <name>{{entry{{</name>
    <description>
       <![CDATA[<img src="{{entry.content_object.get_image_url}}" />]]>
    </description>
    <Point>
      <coordinates>{{entry.content_object.longitude}},{{entry.content_object
      .latitude}},0</coordinates>
    </Point>
</Placemark>
```

When the above fragment is rendered the content between {{...}} is evaluated by the Django´s engine and inserted in the final document.

4.3 Karamel Client

The mobile client used for interfacing with Karamel is built using a port of Python for S60 smartphones, PyS60. Using built-in device capabilities, the mobile application we developed enables the user to record audio or to take pictures, and then submit it to the Karamel application server. The content is sent together with geodata, if available, and a unique identifier (IMEI) which is used on the server for tagging.

5. Elaboration and description of the overall architecture

During the last months we have tried, tested and evaluated different technologies that helped us to design and developed a number of mobile applications, as well as server side solutions. These applications have been tested with end users and feedback was collected in order to improve and refine them. Our aim now is to go a step further while trying to formalize a generic architecture for supporting *Data Portability and Media Migration for the Mobile Internet,* in particular for learning situations involving outdoors and indoors activities. In the technical architecture presented in figure 10, we illustrate the three main components of the technical system. The central component is the *Learning Activity System* (LAS) that is comprised of three main functional blocks, the Activity Generator, the Collaboration Tools, and the Presentation Engine. The Activity Generator contains the Activity Control System (ACS) that enables collaboration between users and devices while retrieving and storing the content and it controls the flow of the learning activities. The Collect, Convert, and Send (CCS) is the content repository and it is used to collect content generated by the different groups and to deliver content to the mobile devices and computers upon request. The educational content delivered to the mobile phones and computers is also stored in this repository. The LAS manages the automatic generation of metadata storing the tags and the content in the CCS that the two other components, namely the Collaboration Tools and the Presentation Engine create and utilize.

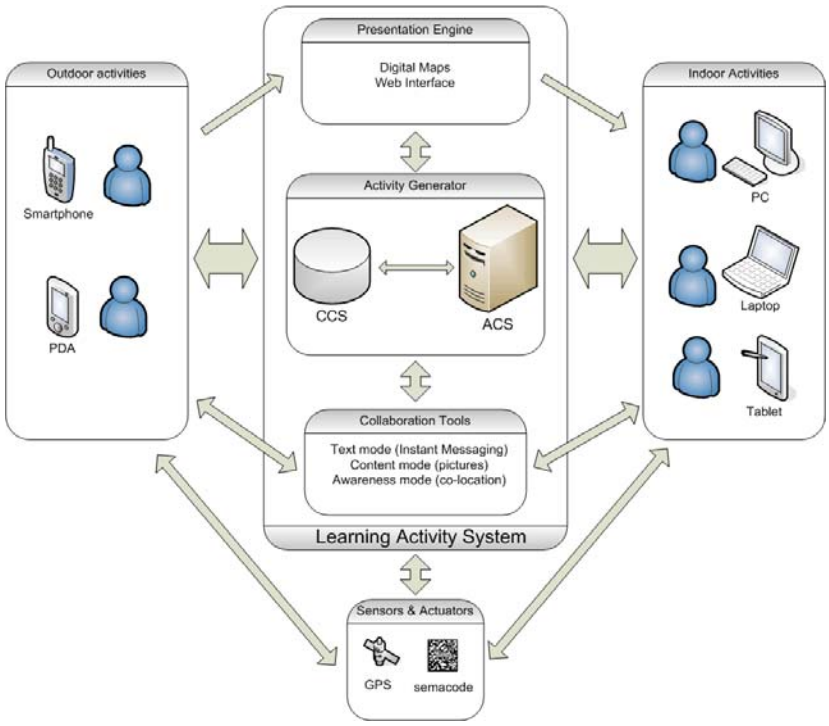

Figure 10. The technical architecture of the MeMiMo system

The *Collaboration Tools* provide the literal bridge between groups outside and inside through instant messaging, images, and audio. For the outdoor activities we have used smartphones and PDAs with GPS capabilities to interact, create, collect, and communicate throughout the learning activities. These devices exchange data with the LAS components retrieving and sending content and information, as well as they interact with the sensors. The *Collaboration Tools* enable the technology-mediated support for remote groups to work together by providing text, content, and awareness modes. For the text mode collaboration, support was provided by a Mobile Instant Messaging application we developed using instances of the Nokia Raccoon software (already discussed in earlier reports). Nokia Raccoon has a built-in python script for enabling mobile text communication via instant messages. In addition, we used these features to send photographs, video, and audio files from the mobile phones to the LAS, thus linking the content delivered and created by the group. All the content generated by the learners contained contextual information such as group number, activity type and additional information that was stored in the CCS. The user-generated data was handled by a python application that ran on the smartphones that automatically sent the meta-tagged data to the CSS. Depending on the different learning situations, this content and its associated metadata was available for immediate access to the indoors group via the presentation engine.

The Presentation Engine provides the visualization tools to support the collaboration during the activities and for reflection in the post activities through the use of metadata and rich media content generated during the group activities. See figure 11 for an example of how the presentation engine can render out the data from specific tasks and actors in the learning scenarios. For example, the indoor activities students can interact through a web interface linked to the presentation engine, thus providing contextual content and connection to activities performed by the outdoor group. The fourth block of this architecture consists of the sensors and actuators that support the Outdoor Activities with location and visual tags (semacodes) to trigger or record events that are related to a particular location.

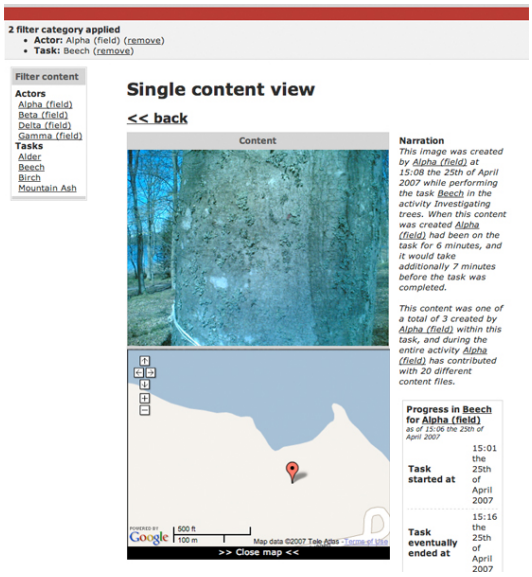

Figure 11. Mapping digital content with associated metadata in one of our trials.

6. Summary and Coming Efforts

In our coming efforts to be carried out during the rest of the fall, we plan to finalize some technical details regarding the integration of the different applications we

developed in accordance with the ideas of the overall architecture described in the former section. We will also explore how to have a simple interface that allows mapping the content stored in the repository with digital maps of the type offered by Google Maps or Google Earth. These different solutions will be tried once more, together with one class from one of our local schools. Based on the outcome, we will continue to validate some of our ideas, as well as we will use the feedback from the students in order to refine our solutions and the functionality they offer.

In the coming months, we will continue to disseminate the results of our efforts at events such as Internetdagarna 2007 and the EDEN 2007 conferences, both taking place in Stockholm. We have also submitted a contribution for a book chapter that has been accepted and it will be published next year by the Idea Group Publishing Company in the US. Moreover, we are preparing a paper to be submitted to *IEEE WMUTE 2008* to be held in China next year.

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[i] EXIF stands for Exchangeable Image File Format. This is a format that stores generated information of the image file such as: Camera Type, Date Taken, Longitude, and Latitude (Kurti et al., 2006).

[ii] Geographical identification metadata – including latitude and longitude coordinates.

Växjö University

Internet Infrastructure foundation of Sweden (IIS) funded project 2007

Project Name: *Data Portability and Media Migration for the Mobile Internet*
Documentation Type: Monthly Report for the period October 2007
Contact person at CeLeKT, Växjö University: marcelo.milrad@msi.vxu.se

1. Introduction

This short report describes the efforts we have undertaken during October within the project named "*Data Portability and Media Migration for the Mobile Internet*". During this period the CeLeKT research team has been working mostly on processing and analyzing the data we collected during the trials we conducted with University students in April-May and in June with young people. The results of these efforts have been formalized in the final version of a book chapter and in a long paper submitted to the IEEE WMUTE 2008 Conference. Moreover, we have also been invited to give a talk at *Internetdagarna 2007,* so we have been preparing materials for this presentation. Below we give a description of these publications together with a short abstract. It should be noticed that two of the authors of these papers are doctoral students that will be using these publications for their final dissertations. From a technical perspective, we have been reflecting and discussing about possible improvements to the applications we have developed, so that we can test them again in the last trial to be conducted with young people by Mid December.

Publications and Knowledge Dissemination Activities

1. Spikol, D., Kurti, A. & Milrad, M. (2008). Collaboration in Context as a Framework for Designing Innovative Mobile Learning Activities. In Ryu & Parsons (Eds) *Innovative Mobile Learning: Techniques and Technologies,* SAGE Publishers.

Abstract:

In this chapter we describe our continuing efforts related to the design, implementation and evaluation of innovative educational activities supported by ubiquitous computing in the AMULETS (Advanced Mobile and Ubiquitous Learning Environments for Teachers and Students) project. We argue that the design of innovative mobile learning activities should be guided by collaborative learning scenarios in context supported by mobile and ubiquitous technologies in authentic settings. To support this claim, we propose a conceptual framework of collaboration in context that can be used when designing novel mobile learning scenarios. This framework provides the designer with opportunities to tackle the challenges of designing for innovative mobile learning activities. To illustrate our ideas, we present the results of three trials we have conducted with children and adult students since the spring 2006. These mobile learning activities have been designed and implemented using our proposed framework. Working together with the teachers and students gave us the opportunity to design learning activities at authentic locations using meaningful content that has relevance for the school curriculum. The outcome of our efforts suggests that outdoors learning experiences supported by ubiquitous technologies should be combined with learning activities in the classroom to provide learners with meaningful activities.

Keywords: Mobile Technologies, Emerging Technologies, Technology-Enhanced Learning, Electronic Learning (E-Learning), Computer Supported Collaborative Learning, Empirical Research, Field Study, Action Learning Interactive Problem Solving, Socio-Technical Systems, Technological Innovations.

2. Spikol, D. & Milrad, M. Combining Physical Activities and Mobile Games to Promote Novel Ways of Learning. Submitted to the *IEEE WMUTE 2008* to be held in China, March, 23-24th.

Abstract:

Mobile outdoor games can be seen as fertile ground for conducting novel learning activities that involve children in different tasks including physical motion, problem solving, inquiry and collaboration; all those are activities that support different cognitive and social aspects of learning. Co-design and human centric design practices have been the focus of current research efforts in the field of educational technologies but not as prevalent in mobile games to support learning. In our current research we are exploring which design methods are appropriate for developing innovative ways of learning supported by mobile games. This paper presents all those aspects related to the design and implementation of a mobile game called Skattjakt (Treasure Hunt in Swedish). The outcome of our activities has provided us with valuable results that can help us to bridge the gap between learning in informal and formal settings. Moreover, we believe that involving children in the design process of mobile games may give us new insights regarding the nature of their learning practices while learning with games.

3. Milrad, M. (2007). Innovativa mobila applikationer för att stödja samarbete och lärande. Invited talk at *InternetDagarna 2007*.

http://oldweb.iis.se/internetdagarna/2007/45-tjanster-2/index.html

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Contact person at CeLeKT, Växjö University: marcelo.milrad@msi.vxu.se

1. Introduction

This report describes the efforts we have undertaken during the period November-December within the project named "*Data Portability and Media Migration for the Mobile Internet*". During this period the CeLeKT research team has been working on different directions including activities with young people regarding the design of a new mobile game, as well as intensive efforts concerning knowledge dissemination activities both in Sweden and abroad. Below we give a detailed description of these activities. From a technical perspective, we have further developed the Karamel application (described in an early report) that includes now new functionalities we have implemented. These new features will be tested in the last trial of this project. Note that during November and the first ten days of December we have worked hard and put extra efforts in order to be able to accomplish all our goals before the Christmas break. Thus, this report covers the working period November-December.

2. Educational activities:

Currently, in cooperation with the local project Mapping Växjö (supported by the Swedish Orienteering Association) we are running an elective course on game design at Norregaardskolan, a local middle school. The class has been meeting one day a week for an hour for the fall semester. Eleven students are participating in the course. The aim of the course is to co-design a new game with the students and teachers to be based on the Skattjakt engine (described in an early report). The students played the original Skattjakt by the beginning of the course. Then we spent several classes dissecting the game and looking at how games work. Several classes have been about game design with hands on workshops with graphics programs and Adobe Flash. By being involved in brainstorming and play testing activities, the group of children has developed a new game story with new game features. Currently, together with the children we have play-tested the game concept on paper. The new features include mobile-based photographic tasks that combine GPS with the Karamel application. The game will be tested and played by other local schools by mid January 2008 (there is a slight delay from the original plan due to changes in the schedule of other activities at the school). The story of the game, which has been developed by the children, is about environmental issues in which the players need to solve specific tasks where they need to identify and solve problems related to how to reduce the level of pollution in the city of Växjö. Figure 1 below illustrates the different activities conducted by the children in this course.

Figure 1. *The children playing the Skattjakt game, discussing and designing a new game.*

3. Current status of the Karamel application

In our current efforts we have continued to develop those ideas related to the visualization of mobile users' activities using digital maps. In one of our previous reports we introduced an application called Karamel that could be used to visualize the mobile users' activities. In this report we show the progress made in developing this tool.

3.1 Conceptual design

The conceptual ideas behind the Karamel application are based on our view of the context in which an activity is taking place. Thus, context is comprised of three major attributes: location/environment, activity/task and personal interpersonal. A more detailed description of the context model that guides our work can be found in the following publications (Kurti et al., 2008 and Spikol et al., 2008). The visualization of the activities is based on the layered visualization of the context attributes defined above. The conceptual design of this approach was based on layering contextual information. The bottom layer is the location information layer (in our case the Google maps), on this layer we tailored content (in our case pictures) that could represent the users´ activity where the third layer deals with filtering of the visualization (activities at specific location) based on the person shooting the pictures (in our case based on IMEI number of the mobile device). The conceptual design is presented in figure 2.

Personal profile information (Filtering based on IEME number)
Activity information (Pictures)
Location information (Google Maps)

Figure 2. *Conceptual design for visualization of the activities for the mobile users*

3.2 Architecture and technical implementation

The architecture of the Karamel application (see fig. 3) is built upon three interconnected blocks. Those three blocks are:

- *the mobile client*
- *the Karamel server and*
- *the web interface.*

The mobile client block consists of the user equipped with a camera phone and a Bluetooth enable GPS device that communicates with the phone. The Karamel block consists of a server with static file storage connected to a database that contains topics (i.e activities) with links to the content belonging to the specific topics. Moreover, we are using Django (http://www.djangoproject.com/) as the tool for content management at the server side.

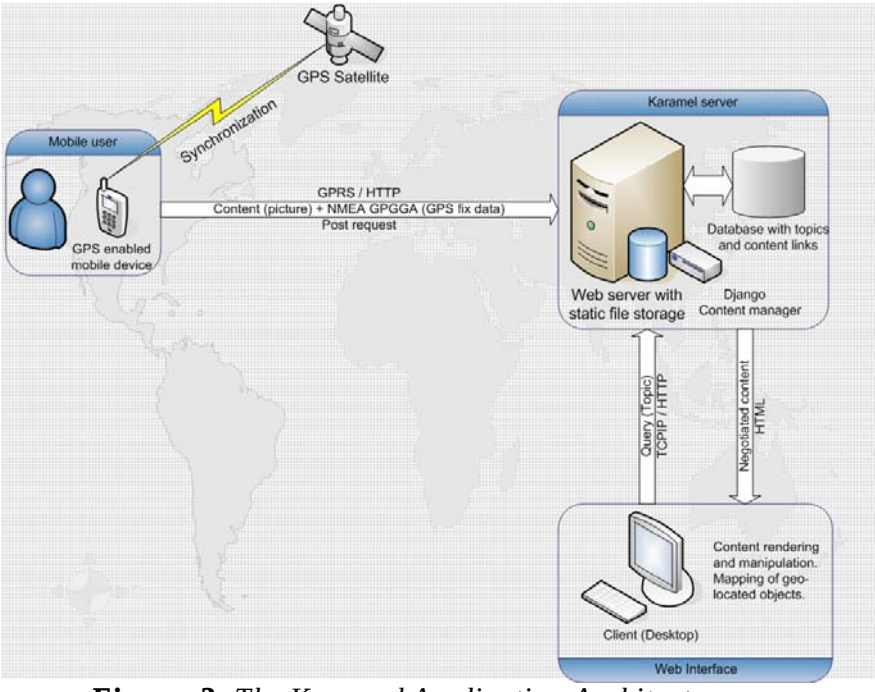

Figure 3. *The Karamel Application Architecture*

The Smartphone runs the Karamel client we have programmed using *Python for S60* smartphones, PyS60. Using built-in device capabilities (camera and GPS transceiver), the mobile client application we developed enables the user to take pictures that are automatically (using a background Paython process) submitted to a selected topic to the Karamel server. The content (in our case images) is sent together with GPS fix data (if the GPS transceiver is available) and a unique identifier (IMEI), which is used on the server for tagging and filtering. The karamel server stores the

content (pictures) in the static file storage while the database is updated with the topic information and the links to the contents belonging to the choosen topic. The Django content manager renders the content based on the queries sent by the web interface. Through the web interface users can submit their queries by selecting their topics of interest. The results they get are all the (content) pictures tailored in the Google maps using the geolocation data, as described in figure 4. In this way the user can see his/her activity placed in the location it took place. A functional demo of the karamel application that illustrates many of the pictures we took during our recent trip to Berlin can be found at: http://karamel.dev1.vm.celekt.info/render/5/

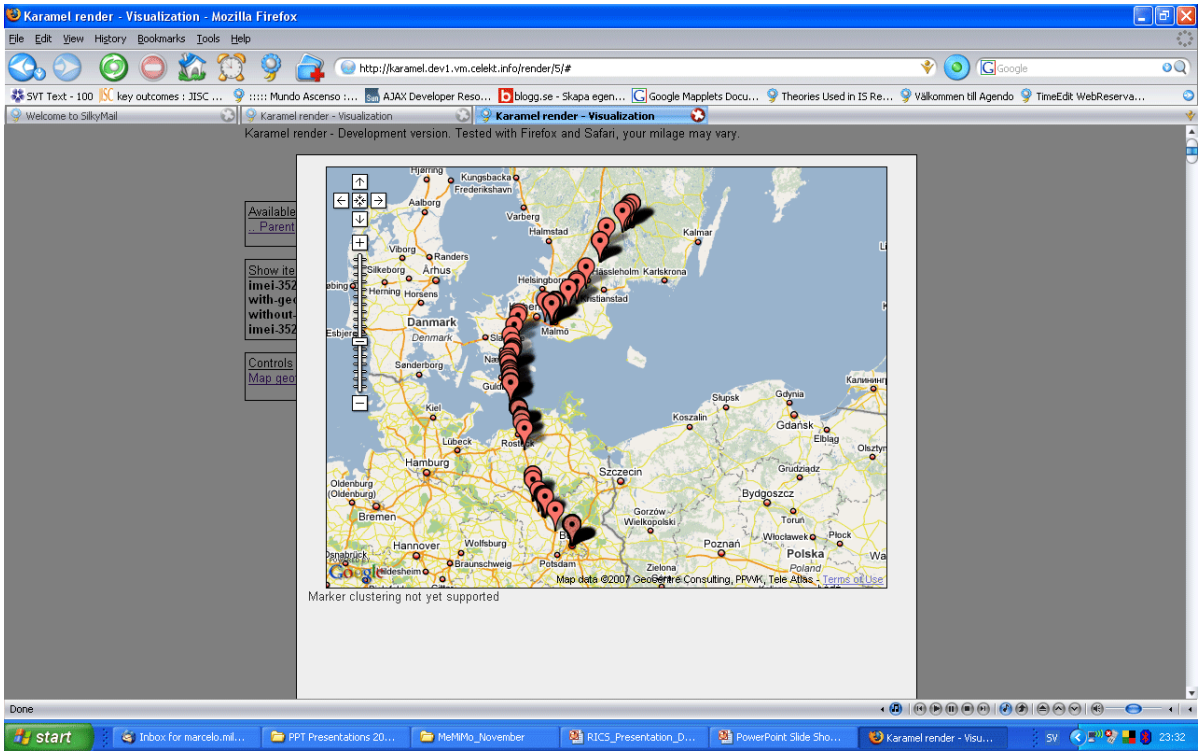

Figure 4. *The web interafce representing the GeoTemporal location of the pictures taken by the mobile users.*

3.3 Karamel Further development

Karamel represents a powerful tool that can be used to connect the content generated by mobile users to the wired Internet. It is a domain independent application that can be used in education, tourism, sports, journalism etc. As already stated beforew, we will run a test trial during January 2008 where the Karamel application will be used as a documentation tool for the filed activities. From a technical perspective, we plan to enhance the features of the Karamel application in order to support other types of media such as sound and video. Also we plan to provide a MMS gateway to our web interface, that will allow new ways to promote communication between users connected to the wired internet and mobile users.

4. Knowledge Dissemination

During this period we have presented the results of our activities at the following events:

1. An invited lecture given at InternetDagarna 2007.

http://oldweb.iis.se/internetdagarna/2007/45-tjanster-2/index.html

2. A seminar and an interactive demo given at the Kaleidoscope European Network of Excellence Symposium in Berlin:

http://www.noe-kaleidoscope.org/group/symposium/programme/

During the interactive demo session more than 50 visitors from the whole Europe could try and test our applications, as well as we discussed different aspects related to our presentation. Two posters have been developed for this event, which can be downloaded from the following URLs:

http://w3.msi.vxu.se/users/mmilrad/MeMiMo/poster1.pdf

http://w3.msi.vxu.se/users/mmilrad/MeMiMo/poster2.pdf

3. Daniel Spikol, PhD student at CeLeKT, will be presenting a paper describing some of the activities we have conducted during the fall at the International Workshop *Research Methods in Informal and Mobile Learning: How to get the data we really want*

Spikol, D. (2007). Designing Mobile Games that Explore Novel Learning Practices with Co-Design. International Workshop, *Research Methods in Informal and Mobile Learning: How to get the data we really want*. To be held in December, 14th, 2007 WLE Centre, Institute of Education, London, UK.
http://www.milrm.wle.org.uk/programme.htm

5. References

Kurti, A., Spikol, D., & Milrad, M. (2008). Bridging Outdoors and Indoors Educational Activities in Schools with the Support of Mobile and Positioning Technologies. *International Journal of Mobile Learning and Organization*, Volume 2 (2).

Spikol, D., Kurti, A. & Milrad.M. (2008). Collaboration in Context as a Framework for Designing Innovative Mobile Learning Activities. Book chapter to appear *in Innovative Mobile Learning: Techniques and Technologies* edited by Hokyoung Ryu & David Parsons, IDEA GROUP INC.

Växjö University

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Contact person at CeLeKT, Växjö University: marcelo.milrad@msi.vxu.se

1. Introduction

This report describes the efforts we have undertaken during January 2008 within the project named "Data Portability and Media Migration for the Mobile Internet". During this period the CeLeKT research team carried out several activities that have linked together efforts of the last year. We have designed, implemented, and conducted a couple of trials with local schools that supported outdoor activities with mobile technologies. These technologies used robust prototype solutions that bridged data transactions between wireless and the wired Internet. In addition, we have been working together with local schools involving the students and the teachers into the design process. This approach has given them input into to the use of the different applications. All these efforts are described in the coming sections of this report.

2. Design Aspects

Through out the fall semester of 2007 we worked with 2 local middle schools where a co-design approach was used to involve the students and teachers in the design process while introducing them to the technology. For the first task, we had 6 teams of students that played the Treasure Hunt mobile activity with one team using a prototype of the Karamel GPS photography application and several teams using off the shelf GPS devices to record their game play. The second school acted as the test bed for the original game and then later for new co-created game.

The co-design process consisted of a weekly class with 11 students where hands-on workshops were used to explore game design and digital competence building. The outcome of these workshops resulted on a new game story and new technology concepts. Together with the students a new story for the Treasure Hunt was developed. The main idea of the story explored issues related to the environment and to the effects of green house gases. In addition to this new story the CeLeKT team developed a new technical feature for the Treasure Hunt game engine that enabled teams to send out bombs to other teams and to have shields from these attacks based on power-ups that became available during the game. More detailed information about the design process can be found in our recent publications (Spikol and Milrad 2008, and Spikol 2008)

On January 17, 2008 the new Treasure Hunt game was played by the second school with the playing field consisting of central parts of the city of Växjö. Fourteen students divided in 5 groups participated in the game. Each group was also equipped with a mobile phone for the treasure hunt and one with Karamel application running for self-documentation.

3. Educational Activities

On January 17, Treasure Hunt 2.0 was played by 14 students from Kronobergskolan, while 8 students from Norregaardskolan observed, photographed, and video taped the game. In addition Smålandsposten and Skogssport reported on the event and Vetenskaplandet is making a segment for SVT on the game. Besides the media coverage, several researchers from IT-Pedagogy, Cognitive Science, and Math Didactics observed and documented the activities. Post game surveys were collected and interviews with players were recorded for research purposes. The following week

we had a meeting with students from Kronobergskolan in order to review the photographs and talk more about the game. Figure 1 illustrates the outcome of the different activities involved while playing the game.

Figure 1. Detailing the mapping feature and photograph from the Karamel Application

For research purposes observations, surveys, video, log files, and interviews were collected and will be analyzed to evaluate the design methods, the usability, and how activities like this can be applied to more learning based activities. We are working on developing longer term relationships with local schools providing greater opportunities for research and larger scale projects that support curriculum with authentic tasks that take advantage of mobile technologies that bridge the wired and the wireless.

4. Technical Aspects

As detailed in our previous reports concerning the Treasure Hunt and the Karamel applications provided the technical infrastructure. During this period refinements from first prototypes to applications were achieved. For the Treasure Hunt the game play of the application was extended by the introduction of the power-ups. This new feature was primarily implemented as a server sided feature that enabled teams to send all other teams on a detour or to get a shield from being sent on a detour.

As noted in previous reports communication between the Flash Lite application and the ACS was implemented by using the Post Variables command from the Adobe Flash Action Script language. When a team was first to a marker/location in the playing field and answered the question correctly, the players had the power-up option. When the phone sends this new request to the ACS, the returned value is a XML string that is parsed in the Flash application running in the phone that either sends the other teams to detours or ignores the detour. This was accomplished in a way that the IMEI number for each phone is included in the ASCII string sent to the ACS server, as well as the unique ID activity number that can be identified by the ACS that will generate a new activity according to the value of these variables.

For the Treasure Hunt activity we used an improved version of the Karamel client that has been developed using Python for S60 smartphones, PyS60. Using built-in device capabilities (camera and GPS transceiver), the mobile client application we

developed enables the user to take pictures that are automatically (using a background Python process) submitted to a selected topic to the Karamel server. Each of the six groups used Karamel with a selected topic and sub topic for the group. The activity included photographic tasks that each team had to complete and then the teams gathered to review the images and to de-brief on the game. Figure 2 illustrates the web interface developed to display the photographs.

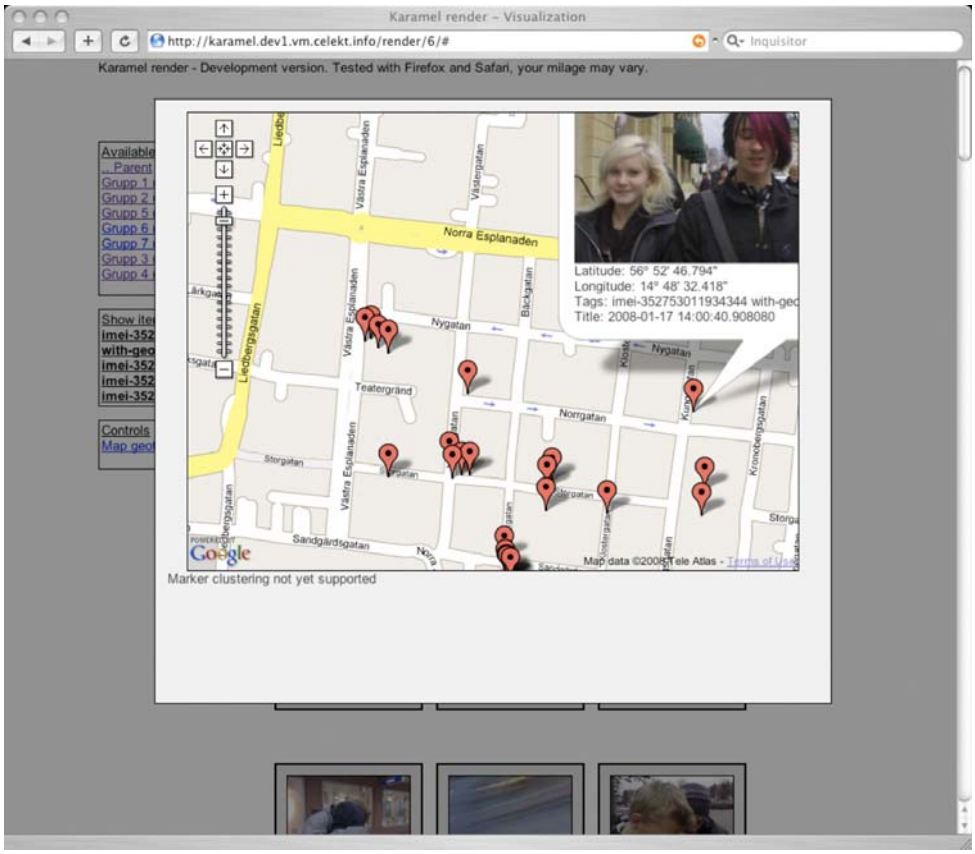

Figure 2. Detailing the mapping feature and photograph from the Karamel Application

5. Further Developments

The refinements of both applications combined with the co-design process have provided relevant results for our work, both in the technical infrastructure and the design methods to support different aspects of mobile learning. From a technical point of view, we could expand the game features of the Treasure Hunt enabling better game play and possibilities of adding in the future a more explorative feature to the activity. For Karamel, the mapping feature of the photographs provided a real-time tool for monitoring the game that shows promise for the future of designing and managing mobile activities in the field. The design process in which we involving teachers and students have created a higher level of engagement for both parties and helps us to recognize the actual technological needs in the classrooms and the perception of technology by students and teachers.

References

Spikol, D. (2008 forthcoming). 'Designing Mobile Games that Explore Novel Learning Practices with Co-Design' at Research methods in informal and mobile

learning: How to get the data we really want. WLE Centre, Institute of Education, London, UK to be held December 14th. Conference proceedings will be published either in the WLE Occasional Papers Series (ISSN: 1753-3385) or as special issue of the Centre's online journal Reflecting Education (ISSN 1746-9082)

Spikol D. & Milrad M (2008 Forthcoming) "Combining Physical Activities and Mobile Games for Designing Novel Ways of Learning" at *IEEE WMUTE 2008* to be held in Beijing, China, March 23-26. 2008

Knowledge Dissemination

Smålandsposten "Teknik skall få ungdomarna fysiskt aktiva"
http://www.smp.se/nyheter/vaxjo/teknik-skall-fa-ungdomarna-fysiskt-aktiva(434900).gm

Article published at the Magazine Skogssport, issue number 1, 2008 (see attached file in Appendix 2).

APPENDIX 2: Scientific Publications and Knowledge Dissemination Activities

Scientific Publications:

Kajtazi, M. & Vogel, B. (2007). Cascading Web Services in Mobile Environments: Bridging Wireless and Wired Networks for Data Transactions. *Master of Science in Computer Science*, School of Mathematics and System Engineering, Växjö University, Sweden. It can be downloaded from:

http://www.diva-portal.org/diva/getDocument?urn_nbn_se_vxu_diva-1389-2__fulltext.pdf

Spikol Daniel. (2007). Designing Mobile Games that Explore Novel Learning Practices with Co-Design. Proceedings of the international workshop *"Research Methods in Informal and Mobile Learning 2007"*, pp, 41-47, Institute of Education, University of London, London. WLE Occasional Papers Series, ISSN: 1753-3385.

Spikol D. & Milrad M. (2008). Combining Physical Activities and Mobile Games for Designing Novel Ways of Learning. Proceedings of *5th IEEE International Conference WMUTE 2008* held in Beijing, China, March 23-26. 2008

Knowledge dissemination activities:

1. Milrad, M. (2007). Innovativa mobila applikationer för att stödja samarbete och lärande. Invited talk at InternetDagarna 2007, Stockholm.

http://oldweb.iis.se/internetdagarna/2007/45-tjanster-2/index.html

2. A seminar and an interactive demo given at the Kaleidoscope European Network of Excellence Symposium in Berlin, Germany.

http://www.noe-kaleidoscope.org/group/symposium/programme/

During the interactive demo session more than 50 visitors from the whole Europe could try and test our applications, as well as we discussed different aspects related to our presentation. Two posters have been developed for this event, which can be downloaded from the following URLs:

http://w3.msi.vxu.se/users/mmilrad/MeMiMo/poster1.pdf

http://w3.msi.vxu.se/users/mmilrad/MeMiMo/poster2.pdf

3. An article published at the local newspaper *Smålandsposten* "Teknik skall få ungdomarna fysiskt aktiva"
http://www.smp.se/nyheter/vaxjo/teknik-skall-fa-ungdomarna-fysiskt-aktiva(434900).gm

4. An article published at the Magazine Skogssport, issue number 1, 2008 (see attached file at the end of this appendix).

Combining Physical Activities and Mobile Games to Promote Novel Learning Practices

Daniel Spikol & Marcelo Milrad
Center for Learning and Knowledge Technologies (CeLeKT)
School of Mathematics and Systems Engineering, Växjö University, Sweden
{daniel.spikol, marcelo.milrad}@msi.vxu.se

Abstract

Mobile outdoor games can be seen as fertile ground for conducting novel learning activities that involve children in different tasks including physical motion, problem solving, inquiry and collaboration; all those are activities that support different cognitive and social aspects of learning. Co-design and human centric design practices have been the focus of current research efforts in the field of educational technologies but not as prevalent in mobile games to support learning. In our current research we are exploring which design methods are appropriate for developing innovative ways of learning supported by mobile games. This paper presents all those aspects related to the design and implementation of a mobile game called Skattjakt (Treasure Hunt in Swedish). The outcome of our activities has provided us with valuable results that can help us to bridge the gap between learning in informal and formal settings. Moreover, we believe that involving children in the design process of mobile games may give us new insights regarding the nature of their learning practices while learning with games.

1. Background

New forms of mobile communication and collaboration are rapidly being adopted and integrated into young people's everyday lives on a global scale. Multimedia capable mobile phones, MP3 music players, digital cameras, and GPS devices are merging into single powerful units that rival the computational power of laptops at the fraction of the cost. One of the main assumptions we consider as a point of departure for the ideas that guide our work is the fact that in the coming 5 years, whether educators would like it or not, more and more students will bring these devices into the classroom. Clear indications of this can find in such sites as www.youtube.com, www.flickr.com, www.blogger.com, and www.facebook.com. Lankshear and Knoble claim that school ignores some of these trends and argue that mobile and wireless technologies and new media might be integrated into current school educational activities since they are transforming and defining new literacies in teaching and learning [9].

One possible way to explore these new literacies is through the use of digital games. Until recently, the use of computer-based games has struggled to be taken seriously within the formal educational community. The recent proliferation of mobile games makes them a fertile ground for the development of new resources to support learning [2]. Mobile games can promote children getting involved in different tasks such as exploration, content generation, collaboration, problem solving and navigation in space; all these activities can be seen as important components that support a wide variety of cognitive and social skills.

It is our belief that the active involvement of young people in co-design and human centric design practices regarding the development of mobile learning offer new dimensions and opportunities to promote novel ways of learning. User and learner centered design practices have been the focus of much research in educational technologies in recent years. However, far less efforts and discussions are available on the process of designing innovative educational activities using mobile games. As mobile technologies are already an integral part of young people, homes and social places, we face new problems and issues that pertain to the optimal use of these technologies to support learning. Therefore, the focus of our current research can be formulated as follows:

Which design methods are appropriate for developing novel learning activities using mobile games?

This paper presents those aspects related to the design and implementation of a mobile game called Skattjakt (Treasure Hunt in Swedish). We also discuss the results of the activities we have conducted with 38 young people that played this game in informal learning settings during 2007. Skattjakt has been conceived and developed to encourage young people to

0-7695-3108-3/08 $25.00 © 2008 IEEE
DOI 10.1109/WMUTE.2008.37

get physically active by solving a mystery surrounding a castle located on the university's campus. The game is inspired by the ideas behind treasure hunts activities and the sport of orienteering, a traditional Scandinavian running sport involving navigation with a map and a compass.

The paper is organized as follows; in section two we present the theoretical ideas that guide our design while in section three we illustrate the details of the game including also a brief survey of similar mobile games. In section four we describe the technology behind Skattjakt. Section five describes the results of our two trials based on the analysis of data we gathered from surveys, interviews, observations, and post game workshops with the players. Sections six and seven conclude this paper by providing some conclusions and directions of future work.

2. Theoretical Considerations

Social constructivism, an extension of the constructivist approach, argues that in addition to most knowledge being an interpretation of personal experience, knowledge is also social in nature and is jointly constructed in interaction with others. Recent social constructivist perspectives [14] regard learning as enculturation, the process by which learners become collaborative meaning-makers among a group defined by common practices, language, use of tools, values, beliefs, and so on. Social constructivism asserts that a particularly effective way for knowledge-building communities to form and grow is through collaborative activities that involve the design and construction of meaningful artifacts as well as the exchange of information.

An implication of this view on learning with regard to the design of novel educational activities supported by mobile technologies is that effective and meaningful learning may not take place if these technologies are only used in traditional ways. Thus, a challenge is designing and implementing learning activities that support innovative educational practices.

Co-design can be defined as highly facilitated, team-based process in which teachers, researchers, and developers work together in defined roles to design an educational innovation, realize the design in one or more prototypes and evaluated each prototype's significance for addressing an educational need [10]. The co-design process relies on teachers' ongoing involvement with the design of educational innovations, which typically employ technology as a critical support for practice. What can be lacking form this approach is the absence of the actual learners / students in the design process and this is where approaches such as a Cooperative Inquiry and Learning by Design can be used to explore how to iterative cycles work with adults and kids to create innovative technology for children [3][7].

Based on approaches such as co-design and learner centred design, it can be observed that design is central in efforts to foster learning, create relevant knowledge, and advance theories of learning and teaching in complex settings. These concepts are also consistent with the ideas behind design-based research, an approach that combines the intentional design of interactive learning environments with the empirical exploration of our understanding of how these environments and how they interact with individuals while keeping innovation in focus [4].

By taking this explorative approach as a point of departure, we can investigate through design how to develop different learning opportunities for children not only to learn through experiences, but also to learn by becoming designers. This myriad approach can provide us with ways to gather insight on the design requirements of challenging and novel activities. One of our aims is to explore how learning innovations that take place outside the formal educational system can be brought to schools and how children can gain new and different insights on the nature of their learning practices as they become designers.

3 Game Description

Skattjakt is a game that has been conceived and implemented to promote physical activity and collaborative problem solving by the unique combination of orienteering and mobile technology. The game explores informal skills and learning about local history, reading maps and requires different degrees of collaboration between team members to solve the mystery. Up to six teams can simultaneously compete using mobile phones, as they progress through the playing field with detours for wrong answers. A strong narrative drives the players to help a ghost solve a mystery about her lost husband who built the castle on campus. The playing field is spread out over the university campus with six locations and a final goal at the original farmstead. The mobile game application we have developed provides an interactive map with the different locations marked in a way that the players can zoom and pan to see the entire playing area. Figure 1 illustrates the full map of the playing field with the detours. Children playing the game can communicate with the game server that provides the logic and scoring for the game.

Figure 1. The game map with markers and detours

The players need to find the markers and receive text and audio based clues via the game phone by navigating with the mobile-based map. Figure 2 illustrates the different game modes on the mobile phone, with (a) in map mode, (b) audio clue from the ghost, and (c) a question screen. Once they find the location they need to collaboratively solve different tasks like puzzles, decode numbers, and find orienteering flags and other landmarks.

Figure 2. Illustrates the game screens, map mode, ghost mode, and question mode

The game starts with a video introduction describing a particular mystery surrounding the castle. The ghost of Anna Koskull, former lady of the manor, has contacted the *Center for Electronic Voice Phenomena* (fictional research group at our university) with a series of videos asking for help to solve the mystery surrounding her husband's obsession with numbers and untimely death. She needs to find answers to these mysteries and has only one day every century to find the answers to escape limbo and the day of the game is that day. Figure 3 illustrates the game play process with: image (a) illustrating collaboration between team members, image (b) the physical activity, and image (c) showing the interaction with the mobile handset. In the second trial we conducted during the summer 2007, each group had an additional mobile phone with a camera for self-documentation of what happened in the different positions of the game.

Figure 3. Game play, team collaboration, physical activity, and mobile interaction

3.1 Design Practices

The first trial was conducted during the winter 2007. It took its starting point from co-design, where researchers, developers, stakeholders, and university students from a mobile games course worked together in a series of workshops defining and refining the game concept. The technical platform for the implementation of the game was kept to a minimum, as the developing team decided against GPS due to the time limit of developing a custom solution for integration with Adobe Flash Lite. Semacode and other 2D visual bar code systems were also ruled out due to nighttime light conditions (Semacodes and other visual barcodes can be used by camera phones to trigger events when the image is decoded by software in the phone under good light conditions, for more info see, www.semacode.org). The design challenge was to create a concept that did not require a score collection mechanism but to have instead penalties for wrong answers that involved the campus as the playing field. Working as a team we refined the story using historical figures that lived on the campus and physically play tested different schemes for penalties before arriving at current scheme, as described in figure 1 for the map and detours. The playing field also provided different starting points for the six teams. The pilot game was tested with 12 after school children age 12-15 on February 23, 2007. The main objective for this pilot was to try our *proof concept* regarding both, the activity and the technology. Moreover, we wanted to explore how we could combine an informal learning together with physical activities and history subject matter.

From the success of the pilot game, the project progressed to be part of a weeklong summer school program for technology and design offered for girls age 12-15 in the municipality of Växjö (June 2007). Our intention for this trial was to expand the research approach by using design strategies to explore how to shift the informal learning goals to more of a formal approach. Secondly we wanted to look at different ways to evaluate results from the game and workshops. Twenty-six of the summer students played the game. For the second day workshop we recruited ten of the

older students from 13-15 years old. In addition to the usability survey from the pilot, we provided an extra camera phone for each time to self-document; we used observation forms, and some sample interviews with students. Since the game was part of the summer school program it offered the opportunity to for us to see how co-design and human centric design could be applied when directly involving the students.

For the workshop, we divided the students into four parts, the first part being an introduction to game design where we dissected Skattjakt. The second part we detailed the game parts and rules and the students were broken into two groups. Each group brainstormed different game concepts and then presented to each other to get feedback and to refine the concepts. After lunch the girls recruited some of the other students for a small play test for each of game ideas. Figure 4 documents the workshops during the presentation of the game concepts before play testing. Image (a) is one of the groups presenting and image (b) is a close up of the game flow concept created by the students.

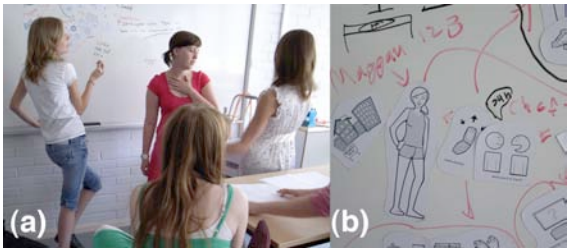

Figure 4. The workshop presentation and results

3.2 Similar Mobile Games

An increasing amount of scientific publications indicates a wide research interest in exploring how mobile games can be designed and used to support a wide range of intellectual activities. Researchers and educators are looking at how to incorporate some of these new literacies into education. Promising results have been reported although the majority of them are more driven by technology and have not always incorporated the actual learners or teachers into the design process. There are some exceptions and in this section we will present a brief overview of some of these games. In Capture the Flag (CTF), standard mobile technology and traditional game play are used to provide a physical experience outdoors. The game provides collaboration between field and stationary players in a mixed reality environment by combing mobile game play with PC based visualizations and mobile electronic flags that are displayed and tracked with the players that enhance game play [1].

In SupraFly, a community-based soap opera, players create characters and interact through them. Players score points by making and maintaining relationships. Interaction occurs via the mobile phones using SMS and through a companion website where the players can track and further develop their characters [5]. Frequency 1550 is a historical based game in which groups of students are competing as pilgrims in old Amsterdam to find a holy relic. Each team has members located at headquarters and in the present day streets of the city. They communicate via videophones and use a GPS equipped mobile phones for the game and position tracking while at headquarters track all the teams and can direct their own team in the street [11]

The COLLAGE (Collaborative Learning Platform Using Game-like Enhancements) project brings to secondary school students and their teachers a mobile learning platform for context-dependent games. Fun, interdisciplinary, collaboration, and challenge beyond the four walls of the classroom that create new learning opportunities. The COLLAGE platform supports the authoring and playing of a board-like game on a site of educational interest. The game is played with the aid of mobile learning technology (mainly mobile phones and PDA's, and GPS technology) with direct communication with players situated on site or in the classroom [12].

The examples described in the section above show promising results regarding the use of mobile games in informal educational settings. From a design point of view, some of these efforts have used design practices that bring in the players into design. The rapid prototyping approach we have used for Skattjakt offered us some advantages over these games by providing us insight on strategies for design and evaluation of future mobile games for learning. The combination of the learning activity together with the creation of the game, offers new possibilities for exploring the potential impact of mobile games in formal education. What the Skattjakt design process has aimed for is the direct involvement of not only teachers but also players/learners into the design process from the start, thus hopefully providing a broader range of ways to adopt innovation already in early stages. By working with the players and involving them in the creation of new game concepts based on Skattjakt, our aim is to gather insights on the design process required to create tools for mobile learning that can engage the students in while providing insights to the design challenges for mobile game based learning.

4 Technical Aspects of the Game

Unlike our previous work regarding the design and implementation of mobile and ubiquitous learning [8], we opted this time to keep the technology in low fidelity mode, giving us a more rapid prototype approach that allowed a more thorough exploration of the design process. For Skattjakt, we developed an Adobe Flash Lite application running on each phone that communicates with the Activity Control System (ACS) (See figure 5 below). The ACS is a software application we have developed that controls the flow of the different activities based on a predefined logic and users input. The ACS is part of larger system the Learning Activity System (LAS) that we have developed that also includes Collect, Convert and Send (CCS) repository for the data handling. The communication between the Flash Lite application and the ACS was implemented by using the Post Variables programming features of the Adobe Flash Action Script language. When the phone sends a request to the ACS, the returned value is a XML string that is parsed in the Flash application running in the phone. The Flash application was designed in a way that the International Mobile Equipment Identity or IMEI number for each phone is included in the ASCII string sent to the ACS server, as well as the unique ID activity number that can be identified by the ACS that will generate a new activity according to the value of these variables.

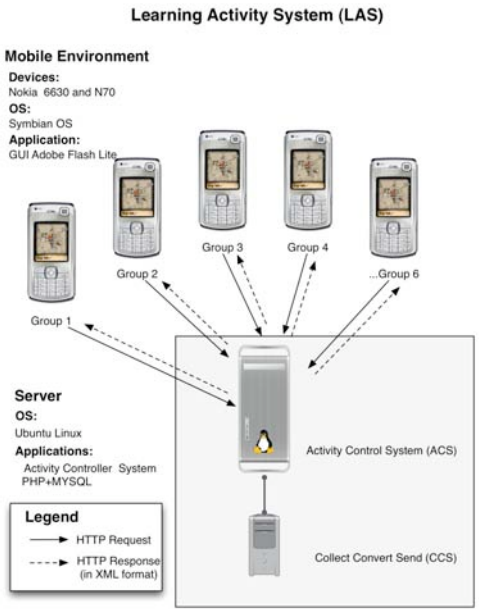

Figure 5. The mobile and server communications of the LAS

5. Elaboration of Results

We have used a more ethnographic and phenomenological approach that combined playing the mobile game with more formal experiences of the co-creation of new games in workshop settings. We have written field notes, made interviews, have been "hanging around," collected documents used in the different learning situations, and in addition have had deep interviews with teachers and learners. The aim of using ethnographical methods has been to "come closer" to learning in real settings, find out "how learning is taking place" – how artifacts are used, how the content of learning is established, what the interaction between the participants looks like, and so on. According to Vavoula [17], mobile learning should be evaluated according to the following 3 levels namely: a *Micro level*: assessing user's experience of the technology including usability aspects and utility of functions, a *Meso level:* looking at the user's learning/educational experience and a *Macro level:* in which the evaluator tries to understand the impact on learning/teaching practice as well as the appropriation of the new technology and new practices. All these different levels can help understand some of the on-going learning processes as well as they can also assist us to identify problems and further requirements.

The results presented in this section look at the experience of the game and workshop, and the knowledge motivation and domains. Using this approach enabled us to use various methods for data collection about the different activities with a loose framework for evaluation. In the first pilot trial we used surveys only and for the second trial along with surveys we used, the photographic self-documentation with additional mobile phones, the use of simple observation conducted by researchers, and a daylong workshop for the some of the players, which resulted in new game concepts. By looking at the results, we begin to see some patterns across the surveys, interviews, and the photographs the students made during the experiment.

The data from the interviews was a random selection of six girls from the second trial where four of them also participated in the workshop activity. The interviews where conducted during the workshop the day after the game. We also used observation and procedures sheets developed in one of our other projects that help observers to look at aspects such as attitudes, engagement, collaboration, understanding of the task, the game experience, roles of players, and cultural issues. The six observers were a mixed group of researchers, university students, and members of the local orienteering club.

5.1 The Game Experience

In order to evaluate the game experience we coupled together data collected from the interviews, observers, and the surveys. Overall, the game was a viewed as a good and fun experience by the players and the group observed this. The girls responded in the interviews that the activity was fun and all of them would like to try the game again in different subject matters and not only in the filed of history. They felt that the questions were challenging and this created curiosity and suspense as they worked they way towards the final goal. As described by one the players below:

> "You didn't get bored, would love to do something again"

From the observations sheets where attitudes towards mobile technologies and usability were observed, little problems were reported with the technologies. Some reported problems were related to using the game interface and two instances of shutting off the phone by accident. In both trials the surveys showed that the response was very positive regarding the game experiences and for ease of use of the mobile application. In the first trial conducted on an early evening of a cold winter night 58% responded that the game was very exciting and 42% only exciting from a total of 12 students that played the game.

The second trial conducted during daytime in the early summer showed 73% of the players finding the game very exciting while the remaining 27% as exciting from a total of 26 students. See figure 6, graph (a) for a visual comparison. Ease of use for the technology breakdown is as follows; for the first trial 50% expressed that the technology was very ease to use, 42% easy, and 8% not so easy from a total of 12 players. For the second trial 23% reported the game was very easy, while 73% easy, and 4% not so easy reported from a total of 26 players. Figure 6 (b) illustrates these results.

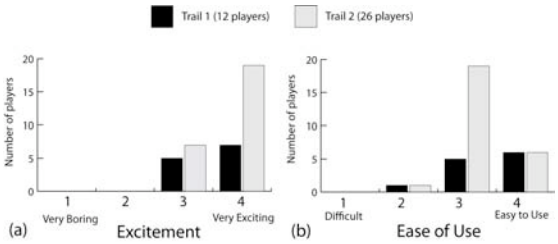

Figure 6. Diagrams of the two trials in terms of excitement and ease of us

5.2 Motivation and Collaboration Issues

The elaboration of the motivation issues and the domain of the game presented some interesting results. The players felt very engaged to learn by playing the game with the phones. But when asked about what they learnt they felt they learnt only a moderate amount about of knowledge regarding local history. During the interviews the girls reported that when they got engaged in the game, they wanted to know more about the history subject inherent in the game as they went along. As one of the students described:

> "There is a different feeling running when you have an added reason to do it"

From the analysis of the observations collected by the team, the actual fact of playing the game and not the narrative motivated the players. The story had little relevance for them; the observers reported that the players responded to the main character, the ghost of Anna Koskull.

The data from the surveys illustrate that the excitement of using the mobile devices was rated high along with collaboration between team members. For the first trial 75% felt motivated to know more about local history by playing the game while 17% thought it was a very good way, and 8% felt neutral about using mobile devices in this context. At the second trial 58% responded it was a very good way and 42% felt it was good. Figure 7 (a) presents the motivation to learn more about history by playing the game. The players in both trials reported that they worked together almost all the time when playing the game. In the second trial the groups consisted only of girls and they collaborated all the time at 92% of the cases, while in first trial of mixed groups all the time was 58% and most of the time 42%. Figure 7 (b) shows how the players perceived their collaboration during the game. Collaboration between the players in both trials was highly rated.

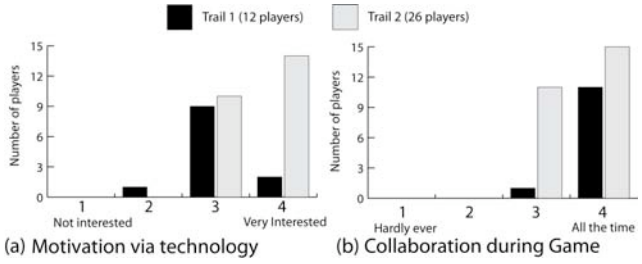

Figure 7. Diagrams of the two trials for motivation an collaboration

5.4 Workshop Activities

The self-documentation and the workshop of the second trial provided additional means to look at the nature of the players learning practices while playing and designing games. The camera phones supplied in the second trial enabled the players to self-document as they played the game. Figure 8 shows a montage taken by the players. The 280 images taken by the 11 groups does a good job of illustrating the game from a more personal perspective of collaboration, physical activity, and how they used the mobile technology.

Figure 8. Self-documentation images

Based on the interviews, the time the players got for the workshops went by too fast for the girls when involved in designing the game. They would have liked to have more time to add other features in the design. They suggested that with added time on the design part, they could have integrated a film in the game for instance. The combination of making up a story and creating assignments for the players is something that the girls say could be used in integrating different school subjects, such as physical education and social and science studies. As described by one of the participants:

> "It would be interesting to challenge different schools to do this. In my sports class I get so sick and tired of always doing the same things, like playing different ball games."

5.5 Results Summary

Exploring the different design practices has provided new perspectives beyond the data we collected from the surveys and interviews. By working with the students in the post game activities and through the design practices we could see how the players become more engaged in the activities by connecting the skills of making games to playing games. The preliminary indications of our results offer insights for exploring how informal mobile games could be integrated into traditional educational settings. This can provide ways to look at the learning practices of the students and provide authentic experiences in digital competence.

6. Discussion

Using the co-design approach together with mobile games for exploring new learning practices show some promises in dealing with the challenges of creating authentic and engaging activities that combine physical motion and gaming. Informal learning coupled with games can provide a foundation for innovation when applied to more formal learning situations. This approach of combining mobile games as part of a bigger learning experience has provided us with a more authentic grounded experience that conventional learning activities conducted in classroom settings using traditional material such as textbooks or demonstrations of experiments. Jonassen and colleagues [6] point out that meaningful learning will take place when learners are engaged in authentic activities that allow for experimentation, conversation, collaboration and reflection.

The co-design process combined with methods like cooperative inquiry and learning by design, among the rich offerings of existing human centric design approaches, offers an arena for innovation to the learning process and the opportunity to actively involve children in the learning process with mobile technology. Additional it can provide new insights to the design process by exploiting learners´ new literacies in more formal contexts that can help them build critical awareness of game design and the other domains that the game is based on. Skattjakt has also illustrated the need for different evaluation practices for mobile-based games with informal learning that can accommodate different levels of collaboration across different learning contexts. Some of the benefits of mobile technologies, especially in the realm of contextual computing can help to provide tools to collect and organize data in new ways that may help us to understand, design, and evaluate these experiments from a wide variety of perspectives. The Skattjakt trials have also raised important questions regarding how to assess learning that takes place informally and across locations. Traditional methods for evaluation do not take into account these new learning situations [17].

As we mentioned in early sections of this paper, mobile technologies offer the potential for a new phase in the evolution of technology-enhanced learning, marked by a continuity of the learning experience across different learning contexts. Chan, Milrad and colleagues [15] use the term *"seamless learning"* to describe these new situations. Seamless learning implies that students can learn whenever they are curious in a variety of scenarios and that they can switch from one scenario to another easily and quickly using their personal mobile device as a mediator. These scenarios include learning individually, with another

student, a small group, or a large online community, with possible involvement of teachers, relatives, experts and members of other supportive communities, face-to-face or in different modes of interaction and at a distance in places such as classroom, outdoors, parks and museums. In the different cases that we illustrated in the trials described in this paper we developed several examples to implement the concept of seamless learning spaces by *augmenting physical spaces with information exchanges* as well as using *geospatial mappings* between the mobile device and the real-world that facilitate navigation and context-aware applications. According to Pea and Maldonado [16] these two latest features play an important role in designing mobile application with an emphasis on inquiry processes, social constructivist theories, and distributed cognition designs.

7. Future Efforts

During the fall of 2007 and spring 2008 we will continue working with the co-design process in Skattjakt. Right now we are working in a local junior high school with an elective class in physical education. The students have played the game and are currently developing new game concepts to implement and to be played with their classmates at the end of this year. From a technical perspective, we have developed a mobile application that provides automatic meta-tagging for the content created by each team. In the coming trials it will be possible to automatically add GPS coordinates to photographs, video, audio, and text created while playing the game. This latest feature allows for an automated cultural probe/self documentation tool where the rich media content created on the spot during the different activities can be stored in a repository for a later view together with other players. The Skattjakt game is also being redeveloped to support additional features like GPS navigation and we are working now on the development of a simple authoring environment based on the XML data that the game uses.

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Designing Mobile Games that Explore Novel Learning Practices with Co-Design

Daniel Spikol,
Center for Learning and Knowledge Technologies,
School of Mathematics and System Engineering,
Växjö University, Sweden
daniel.spikol@msi.vxu.se

Abstract

Co-design practices have been the focus of current research efforts in the field of educational technologies but not as prevalent in mobile games to support learning. Setting the focus on the entire experience of game based learning activities can provide richer opportunities for data collection and evaluation. The flow of mobile activities can be "caught" by using techniques like automatic and collaborative tagging technology that combine users' active contributions, reflections with the exchange of data between devices and systems. This chapter presents how co-design offered insights to the design and evaluation of a mobile game called Skattjakt (Treasure Hunt in Swedish) and the benefits it can have for future learning activities. The outcome of our activities over the last year with two completed trials and a third in progress has provided us with valuable results that can help us to bridge learning in informal and formal settings. Moreover, we believe that involving children in the design process of mobile games may give us new perspectives regarding the nature of their learning practices while learning with these games.

Introduction

New forms of mobile communication and collaboration are rapidly being adopted and integrated into young people's everyday lives on a global scale. Multimedia capable mobile phones, MP3 music players, digital cameras, and GPS devices are merging into single powerful units that rival the computational power of laptops at the fraction of the cost with genuine portability. These devices have provided new opportunities for researchers, educators, and enterprise to explore how mobile activities can be used to support learning practices. Recently mobile games have begun to be taken seriously within the educational arena. The recent proliferation of mobile games makes them a fertile ground for the development of new resources to support learning (Facer et al., 2004). Mobile games can promote children getting involved in different tasks such as exploration, content generation, collaboration, problem solving and navigation; all these activities can be seen as important components that support a wide variety of cognitive and social skills. By adopting a design approach for mobile learning activities that takes in consideration the diversity of mobility and context and focusing on the entire flow of the learning activities where mobile technologies are just part of the activities can provide richer opportunities for data collection and evaluation. The flow of these mobile activities can be "caught" by using techniques like automatic and collaborative tagging technology that combine users' active contributions and reflections with the flow of data between devices and systems. Informal and formal learning and other activities can be designed where students reflect and co-create new mobile content that is used by others in new activities. In my current research I have approached the design through iterative cycles where the mobile applications have become one of the tools in the learning activity. For this chapter the goal is to discuss the value of co-design for the

implementation of new mobile learning activities as one of the ways to analyze and understand the nature of these novel learning practices and outcomes. These efforts may result in new dynamic visualizations that can be part of the toolbox for students, educators, and researchers to explore the emergent properties of the group (Dron, 2007).

This chapter is structured as follows. Section 2 presents a brief background on the theoretical considerations and methods. Section 3 describes the game and the technology and section 4 is the assessment and the design process in relation to evaluation. Section 5 concludes with a discussion about evaluation methods and co-design for mobile games.

Background

The pedagogical design of Skattjakt has been inspired by recent social constructivist perspectives (Jonassen et al., 2002) that regard learning as enculturation, the process by which learners become collaborative meaning-makers among a group defined by common practices e.g. language, use of tools, values, beliefs, etc… Social constructivism asserts that a particularly effective way for knowledge-building communities to form and grow is through collaborative activities that involve the design and construction of meaningful artifacts as well as the exchange of information. An implication of this view on learning with regard to the design of novel educational activities supported by mobile technologies is that effective and meaningful learning may not take place if these technologies are used only in traditional ways. Thus, designing and implementing learning activities that truly support innovative educational practices is a challenge.

One possible way to support innovation is through co-design which can be defined as highly facilitated, team based process in which teachers, researchers, and developers work together in defined roles to design an educational innovation, realize the design in one or more prototypes and evaluated each prototype's significance for addressing an educational need (Penuel et al., 2007). The co-design process relies on teachers' ongoing involvement with the design of educational innovations, which typically employ technology as a critical support for practice. Co-Design can be seen as a collaborative effort that places importance on the designs reflecting the core values of the users. Over the last two decades the roles of the stakeholders, users, and designers of workplace technologies have considered how best to design systems that bring innovation into these environments through various design processes. Penuel and colleagues point out co-design share close affinities to participatory design, user centered, and scenario design. When used in the educational domain co-design shares values with learner-centered-design and design based research. Where co-design differs from exploratory research on learning innovations is that it depends on critically on whether a specific challenged defined at the start is met by the team of people working on the project. Co-Design generally like all the mentioned design processes involve iterative cycles of development where concepts are tested and refined that range from paper prototypes up to the final system.

What can be lacking from this design approach are the learners active evolvement in the design process and this is where approaches such as a Cooperative Inquiry and Learning by Design can be used to explore these iterative cycles working with adults and kids to create innovative technology for children (Guha et al., 2004 & Kolodner et al., 2003). Based on such approaches as co-design and learner-centred-design, it can be observed that design plays a key role in the efforts to foster learning, create relevant knowledge, and advance theories of learning and teaching in complex settings that mobility affords. These concepts are also consistent with the ideas

behind design-based research, an approach that combines the intentional design of interactive learning environments with the empirical exploration of our understanding of how these environments and how they interact with individuals while keeping innovation in focus (Hoadley, 2004).

By taking this iterative approach with the goal as a point of departure, we can investigate through design how to develop different learning opportunities for children not only to learn through experiences, but also to learn by becoming game designers based on the ideas behind Skattjakt combined with the involvement of the teachers. This multimodal approach can provide us with ways to gather insight on the design requirements of challenging and novel activities. One of our aims is to explore how learning innovations that take place outside the formal educational system can be brought to schools and how children can gain new and different insights on the nature of their learning practices as they become part of the design team. Even though the design process is a blended approach I feel it is closer to co-design since the goal of the ongoing trial is to create a game and process inside a formal environment with the different stakeholders where cooperative inquiry and learning by design focus more on the pedagogy.

Game Description

This section presents Skattjakt (Treasure Hunt in Swedish), a game that has been conceived and implemented to promote physical activity and collaborative problem solving. The game is inspired by the ideas behind treasure hunt activities and the sport of orienteering, a traditional Scandinavian running sport involving navigation with a map and a compass. The activities in the game explore informal skills such as learning about local history, the environment, navigation, and physical activities. The game requires different degrees of collaboration between team members to solve the mystery. Up to six teams can simultaneously compete using mobile phones, as they progress through the course with detours for wrong answers.

The playing field is spread out over the university campus for the first version and in the city for the ongoing version, including seven locations and six detours. A strong narrative drives the players to help a ghost or an extraterrestrial solve mysteries. The mobile interface includes an interactive map with the different marked locations where the players can zoom in, out, and pan to see the entire playing area. Figure 1 illustrates the full map of the playing field with the detours and the mobile game interface on the top row of images. Children playing the game can communicate with the game server that provides the logic and scoring for the game. In version 2.0 of the game players used an additional mobile phone for photographic missions that are part of the missions.

The game has evolved over the two trials during 2007. The game has been a central part of informal learning activities and iteratively developed, for the first as a proof of technology and part of co-design effort for a university course on mobile games. For the second trial part of a weeklong summer school class for girls (aged 13-15) where the games acted as a starting point for game design course where the outcome was student created game concepts. Currently the game is being used in an elective class at a local middle school (aged 13-15) where the outcome will be a new co-designed game to run in January 2008 for other students. The game has acted as a catalyst to get the students and teachers involved in the design process providing a bridge to more formal learning activities.

Skattjakt is part of a larger set of work that investigates creating tools for learning activities that combine mobile and computer technologies. This work utilizes our Learning Activity System (LAS) that we are developing. The LAS provides the content and the logic for learning activities that bridge indoor and outdoor locations and tasks (see Spikol, 2008, for a detailed description of the technology). The

technology is straightforward and relies on a mobile phone application that communicates with the LAS over the high-speed cellular network, the general packet radio service (GPRS) commonly known as 3G. The mobile phone application was developed in Adobe's Flash Lite program starts the game by sending a message to the LAS with the phone's identity number and the server returns the first location. When the players get to the location they enter a 4-digit code into the phone that is part of the actual landscape and or connected to an orienteering flag. This code is sent to the server, which returns the next step for the players, being a question, puzzle, or task they must complete. The LAS also keeps track of the teams and each group's progress and controls the locations and the detours. In version 2.0 of Skattjakt the additional photography phone has an application that automatically sends the image and the geo-information to the LAS which then combines meta-data that identifies the device, the team, the photograph and the location and renders it on to a map into the web browser.

< Insert Figure 1>

Assessment

In Skattjakt we are investigating how to promote collaborative tasks that explore physical activities across different subject matters like history and environmental science. Table 1 illustrates the tasks, the skills across the different game versions. Mobile informal learning presents a chance to situate the learners in the physical world where they need to navigate, negotiate, and make decisions together as a team with physical consequences in the game in terms of the detours.

These tasks and skills have raised some key questions about how and what to evaluate during the iterative development of the games. In order to investigate what to assess we have written field notes, made interviews, have been "hanging around", collected documents used in the different learning situations, and in addition have had deep interviews with teachers and learners.

< Insert Table 1 >

The aim of using ethnographical methods has been to "come closer" to learning in real settings, find out "how learning is taking place" – how artifacts are used, how the content of learning is established, what the interaction between the participants looks like, and so on. Over the course of two trials and together with the ongoing class we have used surveys for the players and stakeholders, simple observation forms for researchers, provided additional mobile phones for the players for photographic self-documentation with GPS tagging, and simple data files generated by the game system for collecting data. In the later trials this content was visualized and reviewed to create new content for future games by the team. Through the design process of creating paper based prototypes and the making of traditional board games to test concepts. See figure 1 for images of the workshops and prototyping sessions.

The game with these tasks and skill requirements has provided us with some ways to assess informal learning practices combined with the co-design process has enabled the team to further develop the game features and subject matter. Following Vavoula's (2007) recommendations, mobile learning should be evaluated according to the following 3 levels namely: a *Micro* level: assessing user's experience of the technology including usability aspects and utility of functions, a *Meso* level: looking at the user's learning/educational experience and a *Macro* level: in which the evaluator tries to understand the impact on learning/teaching practice as well as the appropriation of the new technology and new practices. All these different levels can help to understand some of the on-going learning processes as well as they can also assist us to identify problems and further requirements.

Figure 2 presents how different data can be caught and used together with the co-

design process to explore how design and evaluation can be used to “catch” the flow of the learning activity that takes in consideration the additional challenges of mobility and informal learning. This approach enabled us to use various methods for data collection about the different activities with a loose framework for evaluation. In the first pilot trial we used surveys, interviews, and interviews. For the second trial along with surveys we used, the photographic self-documentation with additional mobile phones, the use of simple observation conducted by researchers, and a daylong workshop for 10 of the players, which resulted in new game concepts. With the last iteration of the activity yet to be analysed a new game story and new game features were introduced by middle school students involved in an elective class that ran during the fall of 2007. Another local school played the game and as part of the game play were photographic tasks with an additional mobile phone coupled to a Bluetooth GPS receiver that automatically uploaded geo-tagged images to the LAS and placed them into a Google map. Allowing real-time coverage of the game and more importantly, created a reflective space for post-game activities for the team.

< Insert Figure 2 >

The data from the interviews was a selection of six girls from the second trial where four of them also participated in the workshop activity. The interviews where conducted during the workshop the day after the game. We also used observation and procedures sheets developed in one of our other projects that helped the observers to look at aspects such as attitudes, engagement, collaboration, understanding of the task, the game experience, roles of players, and cultural issues. The six observers were a mixed group of researchers, university students, and members of the local orienteering club. In the current trial 11 students are participating in the class. They have played the game with 10 additional students from another school. Surveys, interviews, observations, along with the game data have been collected during the activities.

Exploring the co-design practices has provided additional information beyond the data we collected from the surveys and interviews. By working with the students in the post game activities we could see how learners want to become engaged in the activities by connecting the skills of playing games to making games and relating this knowledge to other learning domains. The preliminary indications of our results offer promises for understanding how informal mobile games can be used as learning tools in traditional educational settings through the active involvement of students in the design of their own learning activities. This can provide ways to understand the learning practices of the students by utilizing the different assessment techniques. Providing digital competence of game design and production with more authentic experiences for the students and helping the teachers with integrating these practices into the classroom. The game with the surrounding activities has provided us with a way to look at informal learning practices that improve our understanding of the different aspects of the mobile learning and its outcomes with the inclusion of the learners into the design process.

Discussion

Informal learning activities and mobility place different demands on evaluating learning outcomes that requires different theories that need to take in consideration how to design learning differently: linking people in real and virtual worlds, creating learning communities on the move, providing expertise on demand, and supporting lifelong learning (Sharples et al 2008). Different techniques for design and evaluation are being explored like Activity Theory (AT) and critical incidence reporting but these and other theories and methods do not capture all the dynamics of learning and collaborating outside the classroom. Chen and colleagues (2008) have presented a good case for using AT in the design and evaluation in by identifying contradictions

(problems) within the activity system of AT that have identified issues about how the technology worked but they did not explore how the students collaborated yet. Taylor (2006) recommends critical incidence reporting in addition to using various task based focused techniques and has made a strong claim for the relationship between evaluation and design with a strong focus on identifying what is essential.

What the assessment of the different games point to, is the high value of collaboration between players in the teams and in the workshops. During the summer school course the students' expressed to learn more about technology to extend the game features and viewed the running and problem solving as positive. Being able to participate in designing the game in combination with actually playing the game is described from the interviews as an enjoyable creative challenge for the students. The combination of designing new games and creating tasks for the players is something that the girls say could be used in integrating different school subjects, such as physical education, environmental, math, and science studies. In previous work (Kurti et al., 2008) with mobile outdoor learning activities for students and teacher students were they have not been directly involved in the co-design process. Skattjakt has shed light on our research by enabling richer evaluation opportunities that can help the design future mobile learning games and learning activities through this involvement by working with the learners and teachers directly in the creation of new learning materials.

From these nascent results we can see promise in a co-design approach to alleviate some of the challenges faced such as designing activities that take advantage of mobility and context that have value beyond traditional learning and begin to address some of the new literacies afforded by this technology (Lankshear & Knobel, 2006). Skattjakt's game based learning approach integrated with co-design can provide children with powerful opportunities not only to learn through experiences, but also to develop meta-level reflections on strategies for learning by making new games (Facer et al., 2004). At the same time this provides relevant design input by the inclusion of students in the process that provides additional insight for design and evaluation of novel learning processes with mobile technology. In general we can reflect that in terms of innovation Skattjakt has gone from an informal activity involving researchers and after school clubs to a more formal settings of a school based activities involving teachers and students designing and making new games. Recent development with the project include the teacher from the local school together with the class that played the latest version of the game are designing the version 3.0 of the game.

Acknowledgements

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List of Figures and Tables

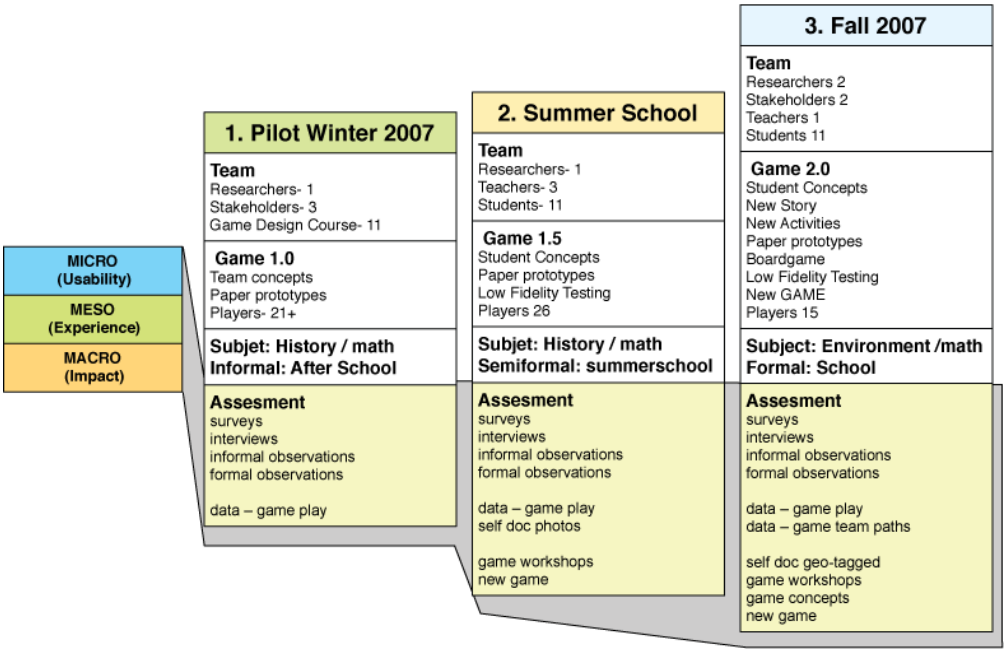
Figure 1 The game map with markers and detours with the mobile game interface below.

Table 1 Collaborative Tasks and skills.

Collaborative Tasks	Skills	Game
Navigation	Map reading	version 1.0- 2.0
Narrative	Comprehension	version 1.0- 2.0
Problem Solving	math and logic	version 1.0- 2.0
Coordination	decision making	version 1.0- 2.0
Strategy	game actions	version 2.0
Creative / expression	photo taking	version 1.5- 2.0
Critical Thinking & Reflective	Game Design	version 1.5- 2.0

across course curriculum (history, physical education, math, & sciences)

Figure 2. How co-design is used across the learning activity.



Advanced Mobile and Ubiquitous Learning Environments for Teachers and Students

The Center for Learning and Knowledge Technologies (CeLeKT)
Växjö University - School of Mathematics and Systems Engineering
Växjö, Sweden

AMULETS

- In this project we are exploring how teachers can develop and implement novel educational scenarios combining outdoors and indoors activities using ubiquitous computing technologies together with stationary computers.
- Since June 2006 we have conducted three trials with 55 children and 16 teacher students. They were equipped with smart-phones, PDAs and GPS devices in order to perform different collaborative activities in the domains of natural science, history and geography.
- Back in the classroom they visualized, discussed and compared their results using interactive digital maps.

Lessons Learned

The outcome of our trials indicate that innovative situated learning ac tivities enhanced by mobile technologies should not be regarded as stand alone activities, as they should be part of a well developed educational flow that also is combined with traditional ways of teaching and learning.

Selected Publications

Kurti, A., Milrad, M., Alserin, F., & Gustafsson, J. (2006). Designing and Implementing Ubiquitous Learning Activities Supported by Mobile and Positioning Technologies. *Proceedings of the IASTED CATE 2006 Conference, Lima, Peru*, October, 4th – 6th, 2006, pp 193-199.

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CeLeKT
Center for Learning and Knowledge Technologies

Växjö universitet

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Skattjakt – Treasure Hunt

The Center for Learning and Knowledge Technologies (CeLeKT)
Växjö University - School of Mathematics and Systems Engineering
Växjö, Sweden

SKATTJAKT

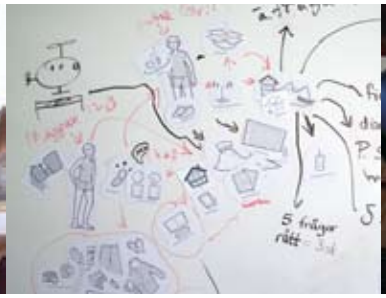
- Skattjakt is a mobile game that has been conceived and implemented to promote physical activity and collaborative problem solving by the unique combination of orienteering, gaming and mobile technology.
- Since Febuary 2007 we have conducted four trials with 79 children. They were equipped with smart-phones and GPS devices in order to play the game that involved collaboration across navigation, history and geography.
- 22 of them have been involved in game designworkshops and classes providing novel ways to connect informal and formal learning activities.

Lessons Learned

Using the co-design approach together with mobile games for exploring new ways of learning show some promises in dealing with the challenges of creating authentic and engaging activities that combine physical motion and gaming. Informal learning coupled with games can provide a foundation for innovation when applied to more formal learning situations.

Dissemination

Spikol, D. (Forthcoming). Designing Mobile Games that Explore Novel Learning Practices with Co-Design. *Research methods in informal and mobile learning: How to get the data we really want.* WLE Centre, Institute of Education, London, UK to be held December 14th. Conference proceedings will be published either in the WLE Occasional Papers Series (ISSN: 1753-3385) or as special issue of the Centre's online journal Reflecting Education (ISSN 1746-9082)



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OFFICIELLT ORGAN FÖR SVENSKA ORIENTERINGSFÖRBUNDET · NR 1 | 2008

skogssport

Fann varandra

Inget problem att accepteras som homo i elitorienteringen

Storebror ser dig i Tiomilanatten

Kartan i mobilen

Tekniken får hela skolan på fötter i Växjö-projekt

VM-testkartan och SM-banan i topp om löparna får bestämma

Expertkunskap

Gueorgiou hjälper svenskar bli bäst i världen

Har du en mobiltelefon som kan ta emot bildfilder kan du också ta emot orienteringskartor. Så här kan det se ut när man med mobiltelefonens hjälp orienterar i centrala Växjö. Foto: Rasmus Westergren

MOBILEN I CENTRUM Så lockas ungdomar i Växjö till orienteringen

TRE NIONDEKLASSARE från Kronobergs skola i Växjö står utanför stadens stationshus och kollar tillsammans inbitet på en högteknologisk mobiltelefon. De zoomar in kartan på skärmen och listar efter en del tankeverksamhet ut att nästa punkt att ta sig till blir till baksidan av den väldiga domkyrkan i Växjö.

I rask takt, nästan joggingtempo, spatserar de under några minuter i riktning mot kyrkan. Väl framme trycker en av dem in lösenordet som de hittat på en papperslapp. Efter några sekunder piper det till i mobiltelefonen.

På skärmen dyker följande fråga upp: "Om jag cyklar en sträcka på 25 km förbränner jag 300 kalorier. 1 liter bensin motsvarar ungefär ett energiinnehåll på 7 500 kalorier. Hur långt skulle jag komma på det energiinnehållet?".

Trion tar fram papper och penna och börjar gnugga geniknölarna. De får fram en siffra som de knappar in i mobiltelefonen. Orienteringskartan över staden dyker åter upp på skärmen och högstadieungdomarna fortsätter färden mot nästa koordinatpunkt.

En timme senare är de tillbaka vid starten vid Smålands museum på Södra Järnvägsgatan. De har funnit alla koordinatpunkter i skattjakten och har fått motion utan att ens reflektera över det.

"Roligare än vanlig orientering"

– Det här var kul, annorlunda och allmänbildande. Roligt med tekniken också, säger Emma Olofsson.

– Mycket roligare än vanlig orientering, fyller Amanda Sjöholm i.

Tomas Hasselquist skulle till och med kunna tänka sig att ge sig ut på en liknande runda med kartan i mobiltelefonen.

– Javisst, fast inte när det är så här kallt som det var i dag, men framåt våren.

Emma, Amanda och Tomas var tre av 15 ungdomar från Kronobergs skola som en dag i mitten av januari deltog i en spännande skattjakt i centrala Växjö. Genom att leta efter ledtrådar i staden skulle de rädda jorden från en hemsk katastrof genom att lösa problem för att komma vidare.

Skattjakten, framtagen av Center for Learning and Knowledge Technologies vid Växjö Universitet, är en del av Mapping Växjös olika delprojekt för att få ungdomar intresserade av att använda kartan och locka dem vidare till orienteringsklubbarnas olika verksamheter.

– Orienteringen behöver ny teknik. Den klassiska orienteringen är inte så spännande för många av dagens ungdomar. De vill ha något som är kul och spännande, säger elitorienteraren Patrik Karlsson, som tillsammans med högstadieläraren Margareta Andersson är projektledare för Mapping Växjö.

Nytt sätt att attrahera ungdomar

I Växjö har orienteringsklubbarna Växjö OK och Värend GN länge satsat rejäla resurser på skolorientering och tog i början av 2000-talet fram mängder med skolgårdskartor.

– Men tyvärr fick vi inte den respons vi ville ha. Ungdomarna kom inte till våra klubbar och vi kände att vi behövde attrahera ungdomar från ett annat håll, berättar Patrik Karlsson.

Det var i den vevan som Mapping

Här är Amanda Sjöholm, Tomas Hasselquist och Emma Olofsson från Kronobergs skola på väg till den femte kontrollen i skattjakten, som är en av Mapping Växjös olika delprojekt för att få ungdomar intresserade av att använda kartan. Foto: Rasmus Westergren

"Det här var kul, annorlunda och allmänbildande. Roligt med tekniken också.

Växjö startade. Det innovativa projektet är en satsning på ungdomar, motion och ny teknik där kartan lyfts fram för att belysa att den hör hemma i alla delar i samhället.

– Som turist i din egen eller i en annan stad är det viktigt att kunna läsa kartan. Dessutom måste du ju också kunna förstå en karta för att kunna använda en GPS-apparat.

Ska testa nya koncept

Ordet mapping kommer från engelskans ord för karta. Kartan ska alltså vara i centrum, eller som projektgruppen själva beskriver betydelsen: "Det är konsten att sätta Växjö kommun på kartan och kartan på Växjö kommun".

– Vår roll som projektledare är att ta fram idéer och testa koncept som kan leva vidare efter projektets slut för att kunna locka ungdomar till orienteringen.

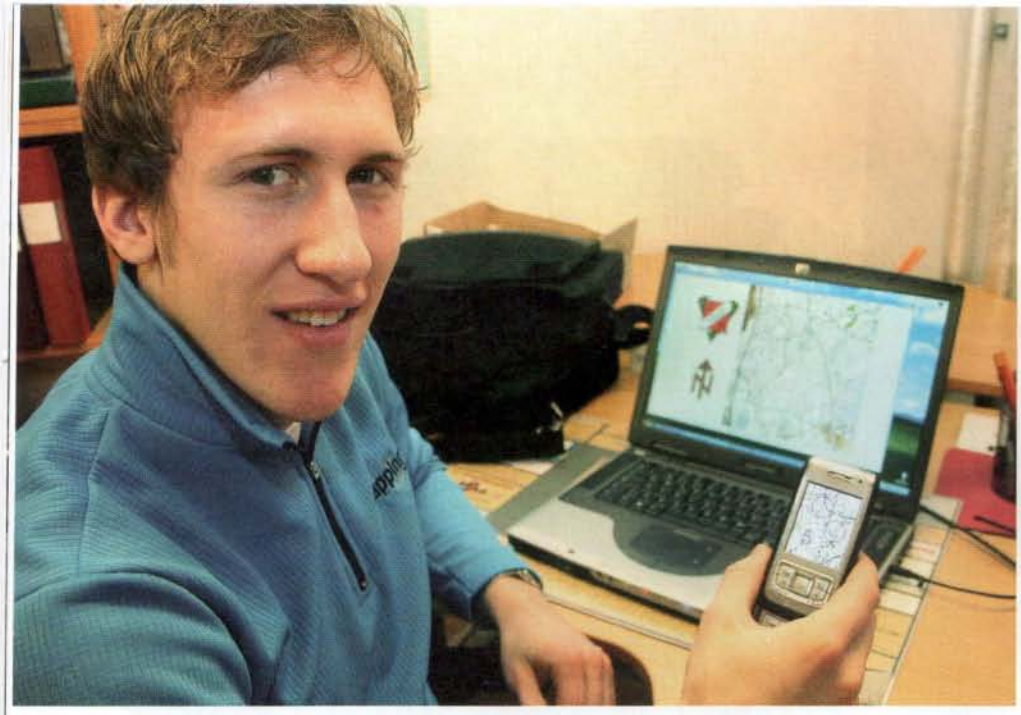
Mapping Växjö har idag tolv delprojekt igång på skolor och fritidsgårdar runtom i Växjö kommun. I Lammhult ska exempelvis ungdomarna på den aktiva fritidsgården där försöka spela orienteringsdataspelet Catching Features där man laddat in en karta över terrängen nära fritidsgården.

– Efter att ungdomarna testat spelet i datorn ska de sedan ut i verkligheten och springa samma bana. Då ska de också ta kort för att jämföra den virtuella världen med verkligheten. Syftet är att visa hur man kan använda den virtuella världen till att lära sig nya saker, att faktiskt kunna se en skog innan man ens varit där. Då är det kanske mycket roligare att därefter springa vanlig skolorientering, säger Karlsson.

Genom att att leta ledtrådar i Växjö skulle eleverna i skattjakten rädda jorden från en katastrof. Vid varje kontroll skulle en fråga besvaras för att få en ny koordinatpunkt. Foto: Rasmus Westergren

Positiva idrottslärare

På skolorna i Växjö kommun pratas det en hel del om Mapping Växjö, och fler delprojekt är redan inplanerade. Bland annat kommer det att bli en fortsättning



Elitorienteraren Patrik Karlsson är en av Mapping Växjös två projektledare. Här tankar han över en av Växjö OK:s kartor till sin mobiltelefon. Foto: Rasmus Westergren

> *Just nu har jag lite svårt att se en elitorienterare springa i ett kärr med en mobiltelefon.*

på skattjakten som eleverna på Kronobergs skola var med och testade.

– Idrottslärarna är väldigt öppna för att lyfta fram orienteringen. De har ju annars haft svårt att lära ut klassisk orientering.

Har projektet redan nu genererat några nya ungdomar till orienteringsklubbarna i Växjö?

– Än så länge har vi inte genomfört så många delprojekt, så svaret är nej. Nu handlar det främst om att förnya klubbarna så att "mappingen" kan leva vidare i framtiden. När en person kommer i kontakt med orientering på en fritidsgård så ska samma person även känna igen sig i orienteringsklubben.

Mål att få 50 nya ungdomar

Patrik Karlsson och Margareta Andersson är halvtidsanställda på Mapping Växjö. Pengar till finansieringen av projektet, som är budgeterat till att överleva fram till slutet av 2008, har främst tillkommit genom Idrottslyftet och Växjö kommun.

Ett av målen är att 50 nya ungdomar regelbundet ska aktivera sig i någon orienteringsklubb och att ytterligare 50 nya ungdomar ska hänga med på aktiviteter då och då. Dessutom står det i projektplanen att projektet ska spridas till minst fem andra orienteringsklubbar i Sverige.

Är användningen av ny teknik framtiden för orientering i skolorna?

– Ja, jag tror att vi kommer att gå ifrån själva skärmletandet och istället öka kunskapen om kartans betydelse och samtidigt använda oss av ny teknik som ju ungdomarna i dag till stor del redan använder. Många lyssnar ju på musik i en mp3-spelare samtidigt som de är ute och springer.

Lätt att få kartan i mobilen

Så värst svårt att få tillgång till en orienteringskarta i mobiltelefonen är det inte. I programmet OCAD kan man exportera valfri karta som en bildfil och föra över bilden till vilken mobil som helst som kan ta emot bilder.

Med en bra mobiltelefon går det att få riktigt hög upplösning på kartorna. Varför man ska springa orientering med en mobil i ena handen kan dock te sig märkligt. Patrik Karlsson förklarar varför.

– Nästan alla har ju i dag en mobiltelefon, så den är ju väldigt lättillgänglig. I dagsläget använder vi dock mobiltelefonerna mest för att locka ungdomar och för att visa att det faktiskt går att se kartan på en skärm.

Är vi på väg bort från klassiskt orienteringslöpande med vanlig karta i handen?

– I tävlingssporten orientering lär det nog ta lite tid innan den försvinner, och just nu har jag lite svårt att se en elitorienterare springa i ett kärr med en mobiltelefon. Men någon gång tror jag faktiskt att vi kommer gå ifrån papperskartan och att vi då istället använder oss av något digitalt, kanske någon slags mobiltelefon.

Patrik Karlsson tog i somras studenten vid orienteringsgymnasiet i Olofström. Efter en framgångsrik tid som junior tar han i år klivet upp bland seniorerna. Första stora målet är att komma med till EM i Lettland och möjligen då göra sällskap med världsmästaren Emil Wingstedt, som ju också kommer från Växjö.

I och med satsningen på Mapping Växjö kan det för staden komma att bli en tradition att fostra skärmletande stjärnor av klass. För inte är det väl helt omöjligt att någon av eleverna på Kronobergs skola, som en dag i mitten av januari 2007 med mobiltelefonens hjälp letade efter ledtrådar vid olika koordinatpunkter, kommer att lockas med till en orienteringsklubb i Växjö och efter några intensiva år av orienteringsträning stå högst upp på prispallen vid ett internationellt mästerskap?

RASMUS WESTERGREN

Daniel Spikol vid Center for Learning and Knowledge Technologies vid Växjö Universitet visar några ungdomar hur mobiltelefonen till skattjakten fungerar. Foto: Rasmus Westergren