In the Zone: Views through a context-aware mobile portal

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ABSTRACT
Context-awareness can make mobile services more easily available and spontaneous to use. By identifying the user's context, the service can offer information related to that context. It can also make the user more aware of the social surroundings. The paper describes the system and conceptual approach that are used to study context-awareness in the project Kontti (Context-aware service for mobile users.) The developed prototype can act as a very personal guide that provides context-aware services and up-to-date information about the contexts of friends. The system and the concept were evaluated in everyday use in spring 2003. The evaluation yielded a group of service concepts, which will be studied further.

Keywords
Context-awareness, mobile portal, social context, location-based.

1. INTRODUCTION
For many, a mobile device is a constant companion during daily routines. The information and service needs vary according to the user's immediate situation. A context-aware service responds to this by offering contextually relevant information. By identifying the relevant situations and the varying information needs users have in them, mobile services can be made more topical, personal and easily available.

Existing research in the field of context-awareness covers context-aware messaging [1] and service scenarios for instance for event navigation [2] and tourist guidance [3]. Another approach has been to identify relevant contexts and develop a classification, which could in turn be realised as software architecture [4].

In order to study the technology and concept of context-awareness, VTT has developed a context-aware mobile portal. The portal was developed from an earlier media conversion and adaptation proxy for mobile devices [5]. Based on the evaluation results regarding conversion and adaptation, we concluded that a personalised service, with a close match to the user's actual life is the next step to take.

A user requirements study was made to decide on the features the new service would include. The study consisted of 28 interviews of potential users, aged 14 to 72. We analysed how the participants described their everyday routines and contexts. In addition, the participants were shown images of context-sensitive service concepts. The concepts represented communication within a context (leaving either personal or public messages to a location), context sensitive information at an event and tourist information.

The prototype was developed on the basis of the study. It adapts the contents of the service to the user's current context. The system supports location-based, time-based or manually activated contexts. However, we have not ruled out any contexts, whether they are automatically identifiable or not. The system allows users to create their own personal contexts, such as "At home", "At work", "Out partying", "Feeling blue". The users can link personal notes and existing services to the contexts relevant to them. They can also inform others of their current personal context.

1. PERSONAL PORTAL
In order to match the user's personal contexts as closely as possible, we have set out to create a system with a lot of flexibility. The prototype makes several use scenarios possible. For the user, the service appears as a web-based mobile portal. Both WML and XHTML versions of the portal are available.

The contents of the portal are existing mobile services, converted web pages as well as personal notes and files. The service consists of four main items: Messages, Friends, Services and Zones. The top of the front page shows the link to current content as determined by the context.

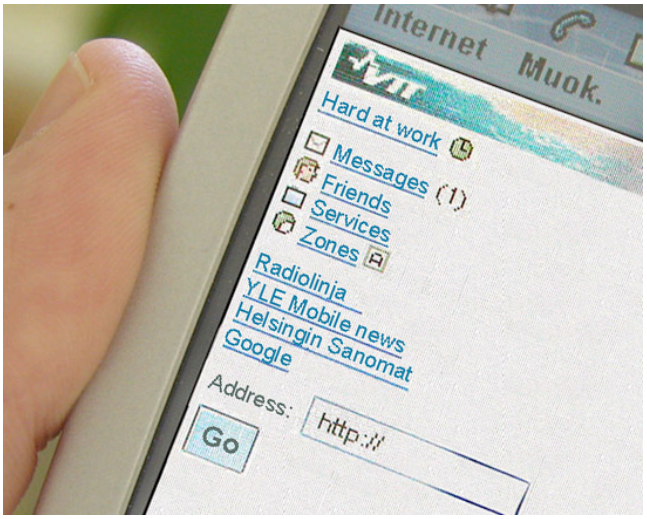

Figure 1 The portal and its features. The user's active context is displayed at the top of the page. The original service is in Finnish.

Figure 1 shows the front page of the portal, the context-sensitive and personalised features are seen with an icon next to the links. Any link, note and message can be given a context in which they are active. In addition, any context-aware messages that are sent will be delivered only once the proper context is active for the recipient.

The front page has a space for links that can be common to all users. In the trial the fixed links included mobile news, a WAP portal by the Finnish teleoperator Radiolinja and the Google search engine.

1.1 In the zone

The contexts that are created in the system are referred to as “zones”. It was determined that “context” as a term was too abstract to use in the interface. We also wanted to use a relatively open term, so as not to exclude time-based, mood-based or any other contexts. Users can create zones for many purposes: to provide information to other users of their current context, to attach information to a certain context or even to create a set of zones with a theme to send to others. The zones can be time- or location-based or manually activated.

- **Manually activated** zones are not recognised automatically. The advantage of a manually activated zone is that they can be based on contexts that are difficult to identify otherwise - mood-based, for instance. They can also be more accurate than automatically updated zones if maintained regularly. The downside, of course, is the effort that is needed from the user.
- **Location-based** zones are defined by co-ordinates and a radius. These create a circle-shaped area. The co-ordinates can be retrieved with whatever positioning system is available. Once the zone is created, it will be active within the defined area. The benefit from a location-based zone is that the activation is automatic. The sufficient accuracy for the positioning is determined by the purpose and nature of the zone. Cell-based positioning can be used to distinguish between cities and city areas. More accurate positioning should be used within city centres or buildings.
- A **time-based** zone can be defined either as a single or a weekly occurring event. Time-based zones are automatic, accurate and ideal for re-occurring routines.

The system also supports Boolean operators (AND, OR, NOT) to create a combination of zones. When creating the zone, the user can also define how public it is; i.e. can others see whether the zone is active. Once a zone is active, it has four effects on the content:

1) Any messages dropped to that particular zone will be delivered to the user.
1) The active zones are shown at the top of the front page. The link can be used to access the content that is linked to the zone.
1) Links that are connected to an inactive zone are blocked from view. Links that are not connected with any zone are visible all the time.
1) Others will be able to view the current status of the user as determined by the active zone. Only users with the permission for viewing will be able to see the status. The feature is described more fully in the chapter below.

1.1 Social surroundings

One motivation for creating and maintaining zones is to convey information of your own context to others; e.g. whether you are available for contact or what your plans for the evening are. The feature can also act as a mood indicator, telling others if you’re tired, anxious to go out etc.

The idea for viewing your social surroundings came directly from user interviews at the start of the project. As well as event and tourist guidance, the most apparent information need was for social context. They liked to know where their friends were or if they could be contacted.

It was clear from the beginning that the users who shared their status had to be given full control over what was public to avoid any Big Brother-type scenarios. We took a very soft approach to how others could be observed. The service allows the user to choose which zones are visible to others, who they are visible to and what kind of description is shown. The actual location or context itself does not need to be revealed. The information that is published for others to see is a public name for the zone and a longer, public description of it.

In Figure 2, the list of friends is shown along with the public name of their current context(s). You can see in one glance who is available, who is not. Friends can be contextual as well;

Figure 2 List of friends and their status. A closer view brings up more information, such as a longer description of the zone and the user’s telephone number.

your football team can be in view only on practice day, for instance.

1.1 Dropping a line

The system allows users to send context-aware messages to each other. The message is dropped to a target zone. The message will be delivered when the chosen zone is active, i.e. when the recipient enters work, home, or other context.

Targeting the message allows, for instance, a work-related message to be dropped to the workplace. The message will be delivered once the recipient enters the location. The service uses WAP push to inform users of the delivered message. If no target context is chosen, the message is delivered instantly.

With e-mail or SMS, you can assume that once the message is sent it will also be delivered unless complications occur.

However, when sending context-aware messages, the gap between sending and delivery can be intentionally quite wide. It is important to let the sender know if the message has been delivered or "left hanging" if the user did not, for instance, arrive at the specified location. In the system, the message that was sent will contain the time when the recipient read it.

A context-aware message system needs a method of handling undelivered mail. Technically, the message is not copied for the user before it is saved. Only rights to view it are modified. This way messages that are not delivered will not clutter up the system.

In addition, the message has an expiration date after which it is no longer valid and can be automatically deleted. The user can set the expiration date. Eventually the user will be able to define what happens to the message once the message expires; it could be delivered to the recipient in any case, deleted or returned to the sender.

Social context. The message system takes into account the social context the user is in. Once a target zone for a group of recipients is chosen, the sender can choose a delivery method for the message: One by one; All after one; All after all.

- The "**One by one**" –method is the most conventional. Once each recipient enters the target zone, the message is delivered.
- Choosing the "**All after one**" method means that once a *single* recipient enters the target zone, it will be delivered to *all* the users. An example of using this method was given by a user: *"It is sort of like 'We'll have dinner once I'm at home"*.
- "**All after all**" is the most rigorous condition that can be set for the message. The message is delivered only *all* recipients once *all* of them are present at a certain zone. An example of this would be *"We'll have the meeting once all of us are at work."*

To avoid complexity with the several options that are available, the sending of the message is carried out with a wizard-type interface. It allows users to easily pass the extra options or use them at will.

Attachments. All content that is within the service can be sent as attachments to other users; links, notes, even contexts themselves can be sent. This allows the creation and dissemination of context-aware services. A coach, for example, can create a training schedule along with instructions and send it to the trainees. The schedule is active at pre-defined times in pre-defined places.

In addition to schedules, the feature makes it possible to create and send personal, location based material. A couple's personal history can be attached to a certain area, along with photographs, to be viewed whenever one of them is in the neighbourhood.

1.1 Services

The portal provides access to a personalised set of links. By adding notes and files to the set, the portal can be turned into a personal media bank as well as a gateway to existing services. The system allows operations on files remotely, without having to download them to the client device.

When the links are connected to a certain context, they only appear when that particular context is active. This has two benefits: contextual links can be shown only in the context they are used in and filtered out in others. The other benefit is that the active content can be displayed more prominently in the proper context. Active zones are shown at the top of the front page to allow easy access to the zone-specific contents.

Any content can be linked to the contexts the user has created or in other manner deposited in the service. If the content is not linked to any context, it will be visible all the time.

1. EVALUATION

A series of evaluations will be carried out with the service. A pilot evaluation of the system took place in the spring of 2003. Conceptually, the evaluations approach the subject from three different angles, namely, everyday contexts, context-aware services and social surroundings. The main focus of the pilot evaluation was on everyday use. In further trials, a total of over 70 users will be involved as the prototype is tested in the field.

Each angle means differences in how accurately the contexts need to be identified, how much tailoring is needed from the user, and what the social connection to other users is. This has consequences related to how users wish to send messages or how they wish inform others of their current status.

1.1 Set-up

The first trial took place in spring 2003. The trial considered context-awareness in everyday use.

There were 13 users, who used the portal for 6 weeks. The test users were all members of smaller groups; three teenaged girls; three friends in their twenties; three men with work-related interests and a family with four members.

The users were instructed to get to know each feature and think of their relevance to them. As the prototype consists of quite a few features, we did not expect the users to be active with all of them. We wanted the users to concentrate on what *they* felt was useful and/or fun. The users were quite adept in describing why one feature would work for them and not the other.

Use in everyday life requires a mobile device that is available all the time and not limited to a certain area. Consequently, the devices that were chosen for the trial were WAP-enabled mobile phones. The users were provided with multimedia phones, either Nokia 7650, 3650 or Sony Ericsson P800. Cell-based positioning was used for identification of location during the trial.

1.1 Preliminary findings

Since daily life was in the main role in this first evaluation, the goal was a natural integration of the service with what the users actually do. As "context" itself is a highly personal concept, so do context-aware services need to be flexible enough to fit the varied situations in the users' lives.

For the trial, we did not choose a single use scenario, such as shopping or messaging. We wanted users to create zones that were relevant to them and use them for a purpose they felt was meaningful. By default, the personal zones for each user need to be created and maintained by the user. The challenge is in achieving this high personal conformance without requiring too much effort from the users.

The **user interface** appeared to work quite well. The users found it easy enough to create zones, but keeping them current manually was tasking. Accurate and automatic identification

of location, for example, increases the usefulness considerably.

As the user requirements revealed, the **social surroundings** are an important aspect of the personal context. In our study, the users created their own context mainly to inform others of their current situation. Almost all users felt this was both fun and useful. One user was away abroad for a week during the test period. She felt comforted to see what her friends back home were doing. The friends at home, on the other hand, felt they were with her on the trip because she kept them up to date through the service.

The usefulness arose from the fact that users could see when to contact the other person and when not. Seeing the other person “lying around at home” could spark a phone call and an invitation to meet somewhere. The usefulness of the feature can vary according to how large a group is in question and how tight a unit they make. If a tight circle of friends knows what the others are doing anyway, the feature will be used differently than within a loose work team.

In the pilot, **context-aware messages** were used scarcely. Users felt that among friends who see each other constantly, instant messaging was more practical. Messages that were left hanging were not the most useful. As one user noted: *“They can’t be very important messages, because if I have, let’s say a “Resting here” zone, then my friend can drop a message there saying “It’s nice to take it easy once in a while”. And then I’ll find it there some day and it doesn’t really matter. So, planning appointments - and some such that you’re used to - you handle with text messages or short calls ‘cause you’re used to that.”*

Instead, context-awareness was seen useful in filtering messages in work-related messages. One user felt that sending a work-related message on a weekend would be questionable. In contrast, by dropping the message directly to work, instead of instant delivery, it will not bother the recipient on the weekend. Moreover, the message will reach him/her at a situation, when there is something that can be done about the matter.

Using WAP push to inform of personal messages was regarded as very beneficial. An alert of some kind is certainly a necessity, so that the user can keep his/her attention on the task at hand and focus on the system only when there is new information to turn to.

In our study with tailored, everyday contexts, **existing web or mobile services** did not seem context-specific enough for spontaneous use. Users did not see a reason why the existing content could not be available all the time. Using such services also lacked spontaneity; the user had to predict the need for specific material in a certain context and link the service to that context beforehand.

It would seem that the context-aware content would need to be tightly linked to the context *and* not of much use elsewhere. Case in point; one user added the mobile service of the local chain of cinemas to her “Out on the town” -context. With the mobile service, she could find up-to-date movie schedules. She quickly realised, however, that the link seemed to lack the urgency that would be needed to make the context-awareness work.

The results confirm earlier findings about the highly topical nature of location-aware services [6]. Once the user is out on the town, a truly context-aware service would not have the general movie schedule to browse through. The proper approach would be to show immediately the movies that will be showing at a nearby cinema within the next hour and whether there are still seats. The same applies to bus schedules: give the user the next buses that will be leaving from the nearby station (Figure 3), not the complete timetables.

Figure 3 A display for arriving buses. Current mobile services lack the context-awareness that is on offer in displays such as above.

Current mobile services do not yet offer such material or do not offer it contextually. Other kind of displays, on the other hand, have made use of contextual information for a long time: arriving/departing transportation at bus stations or seating status for a movie are being shown around lobbies in most towns. Some information, such as event schedules, is just waiting to be converted into context-aware services.

2. FURTHER RESEARCH

Based on the findings of the first trial, the project will explore further cases in context-awareness. We will delve especially into the concept of ready-made context-aware services. This kind of service may not adapt to the user’s everyday life but can provide content with little need for further personalisation.

In the autumn of 2003, the evaluation will focus on a context-aware guide at an event. The event will be a weeklong Tampere Theatre Festival in August. Users will be able to receive context-aware information as the festival progresses.

A trial on a WLAN platform will complement the evaluation both conceptually and technologically. The case is carried out within a WLAN test site at the centre of the city of Tampere. The target of the evaluation will be a context-aware guide to the architectural history in the city of Tampere.

3. ACKNOWLEDGMENTS

The development and studies are being done under the project Kontti (Context-aware services for mobile users). The two-year project began in 2002 and will run through 2003. The project is funded in part by Tekes and its NETS programme, as well as our co-operation partners in the project: Nokia, Radiolinja and Teamware. In addition, the Finnish Broadcasting Company (YLE) provides content in the trials. We are very grateful for the contributions of each co-operation partner.

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