

Tranzmobile

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1 TRANZIN

Jack has got some friends visiting from out of town, and since it is Friday, he would like to show them a good time. DJ Deep is supposed to play at Vega, and French house may hit the spot, with danceable funky rhythms. After a few Gin and Tonics, they decide to take a cab to Vega, only to discover that all the tickets are sold out.

They start discussing alternatives, but when nobody can come up with anything good. Jack decides to check out Tranzistor's calendar service on his WAP phone. It turns out that there is another French DJ in town, playing at Rust, but one of the Tranzistor 'raters' reports a half an hour long line outside, and Jack's friends are getting impatient. Jack checks out some of the other reviewed venues, and finds out that there is a small club, Lab, just around the corner, that has gotten great reviews and seems to be populated with 'their kind' of people.

They decide to give it a try, and while they do the walking Jack sends an SMS to two of his friends (Julia and Jim), telling them to get on the Tranzistor chat. After a few minutes all three of them are on the chat. Julia is inside Vega but agrees to move on to Lab when the DJ at Vega has finished. Jim, sitting at home with a few of his buddies, is chatting with Jack and Julia via the Tranzistor web site. He checks up on the more elaborate versions of the reviews of the DJ but decides to listen to a few of the DJ's contributions to the Tranzistor web radio before making his decision.

2 INTRODUCTION

WAP¹ is positioned at the convergence of two rapidly evolving network technologies, wireless data and the Internet. It can be used for transfer of data on handheld digital wireless devices such as mobile phones, pagers, two-way radios, smartphones and communicators.

Although the WAP technology is receiving increasingly more focus in the media the services that exist have not been promoted very well. There seems to be missing a WAP site that provides a truly useful or essential wireless service that is able to convince people that a WAP phone is a valuable product worth investing in. Furthermore, it is only recently that the different mobile manufacturers have delivered their products to the Danish market, therefore there is still only a small number of people that own a WAP phone.

At present WAP is still a very young technology, and thus it is not surprising that WAP services are yet to find their niche. It is the project group's conviction that WAP has great potential in the near future. The increase in the availability of WAP phones just these last few months² alone is an indicator of great expectations for the market of WAP and WAP sites³.

Until recently the prices of WAP phones made it a product for a limited target group. Until recently, the only available WAP phone in Denmark was the Nokia 7110 (DKK 2.995). Now it is possible to purchase, for example, a Motorola T2288 for just DKK 769. The increase in both devices and services

¹ Wireless Application Protocol, from now on referred to only as WAP

² In March 2000 the only available WAP phone was Nokia 7110. According to Sonofon there are currently 7 different WAP phones available for the Danish Market.

³ WAP site will in this project be used as the Web site's counter part for WAP phones.

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supports the notion that the spread of WAP will continue. However, most of the present services are made for a "high profile"⁴ target group and it is therefore evident that sites with other target groups are needed now when people with less buying power are able to purchase WAP phones.

In this project we will deal with the issue of creating WAP sites in general as well as the specific development of Tranzmobile. Tranzmobile is an alternative WAP service that will utilize not only the ability to receive data via a wireless device, but also the ability to enter and update data via a mobile phone. Furthermore, the Tranzmobile project will attempt to combine the two media, Web and WAP by basing both sites on the same database and using the same API language. The only difference being the way the sites are generated; the Web site is based on Flash and the WAP site is based on WML.

2.1 Problem Definition

As we are all students of the Design, Communication and Media department, the group members have a great interest in exploring new media. The Tranzmobile project gives us the opportunity to learn about the new wireless media of WAP while developing a real service that has roots in an actual Web site (www.tranzistor.dk). With this project we have three goals in mind;

- To explore the integration of the new media with existing Internet technologies,
- To work with site design in order to gain an understanding of the usability issues of WAP and WAP enabled devices, and finally,
- To create a site that utilizes new technology to successfully expand the services of an existing Web site.

Since most of us are focusing our education on design, communication and media and not on programming, the project is not structured like a traditional computer science project. It is the project group's intention to explore both programming issues and more soft issues of WAP and the Internet, such as the usability and limitations of WAP in this connection. This is reflected in the report where the more technical matters are not separated from the other issues, as it is the group's belief that all should be considered when dealing with a new technology such as WAP.

The above considerations lead us to the following problem definition:

- Is it possible to integrate WAP with existing Internet technologies?
- Can the usability problems be overcome in order to create a valuable WAP service, which fulfill the needs of our target group
- Can WAP be implemented to successfully expand the services of an existing web site?

2.2 Delimitation

Although this project also includes Web site that interacts with the WAP service, the focus is on the WAP part, especially in the issue of usability. It is not our intention to create a fully functional Web and WAP site. Rather we wish to develop a functional prototype with potential (for future development) and thus illustrate how the two media can interact. Due to the time constraints of this project, we have limited our user tests and redesign of the site to two. Further, the user tests and

⁴ By "high profile" we are referring to the group of people who were in possession of the early WAP phones. This was mostly people working in the IT-industry or with a higher income which allowed them to purchase the rather expensive device.

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interviews are used as indicators of what the service should contain and whether or not it is easy to understand and navigate the site. Since the focus is on WAP, the Web site will not be tested or discussed in the interviews.

As seen in the figure below, the implemented parts of the transistor service are the WAP site “read” and “update” pages and to a certain extent the update part of the Web site. The reason for this limitation is the level of importance the four parts have. Since the service is created with the intention of giving people a chance to see ratings on the spot, it is not very useful to have a Web part that displays what is going on at different clubs. Moreover it is essential that the raters be at 'the spot' in order to rate an event; the Web update part is therefore only for the creation of new users, clubs and events.

	WAP	Web
Read	Highly implemented	Not implemented
Update	Highly implemented	Partly implemented

This report is limited to a discussion of WAP issues in Denmark; however, many of the technical considerations are relevant for a broader use.

2.3 About Tranzistor

Tranzistor is an independent net radio broadcasting out of Copenhagen, and has for the last six months established itself as a mixture of Webcast and community. The range of programs and the editorial profile is focused on electronic music, concerning everything from DJs, clubs and the culture that surrounds them. One of Tranzistor's main goals beyond promoting and distributing underground music is to promote music related arrangements and events in Copenhagen. Tranzistor gives producers and DJs the opportunity to present their material to a broad audience, and it gives the listeners access to music that in most cases is difficult to find⁵.

⁵ Most of the music on Tranzistor is only available on vinyl in a limited edition.

3 USER GUIDE?

Usually when creating a computer system or application, a user guide is an essential feature. But when surfing on the Internet (that being WAP or Web), user guides are very rare and the success of a site depends highly on the instant impression and usability of the site. Users do not have the time nor will to find out how to navigate at the site. This should be evident by labeling, icons or structure what the different pages contain. Some sites even presume that the user know the overall purpose of the site. Many sites have 'help' or 'about' pages in case a user has surfed to the site without prior knowledge of what it contains; this is a useful feature and prevents complete confusion when new users enter a site. On WAP this propose a new challenge, firstly because all the usual clues of navigation (compared to the World Wide Web) are not present and secondly because the little display does not leave much room for an extensive explanation of the site. It is therefore our opinion that a WAP site should be so easy to navigate that it is not necessary with a user guide. We have, however, included a menu point called 'About' that links to a short explanation of the Tranzmobile WAP site for the new user who does not know what Tranzmobile is.

To access Tranzmobile by WAP: <http://hug.itu.dk/wap/index.tcl>

To access Tranzmobile rating system by WAP: http://hug.itu.dk/wap/index_rate.tcl

To access the preliminary Tranzmobile Web administration system:

<http://hug.itu.dk/web/index.html>

4 METHOD

4.1 Working process

The WAP service has been developed iteratively⁶. Figure 1 illustrates the working process that has been used to determine content as well as to develop the WAP site. The site's content and navigation structure have been developed simultaneously with the file structure; the data model however, required basic information of precisely which entities the database should contain and was therefore developed right after the first interviews with representatives of the target group.

⁶ The working process has been inspired by Molich (1999:33).

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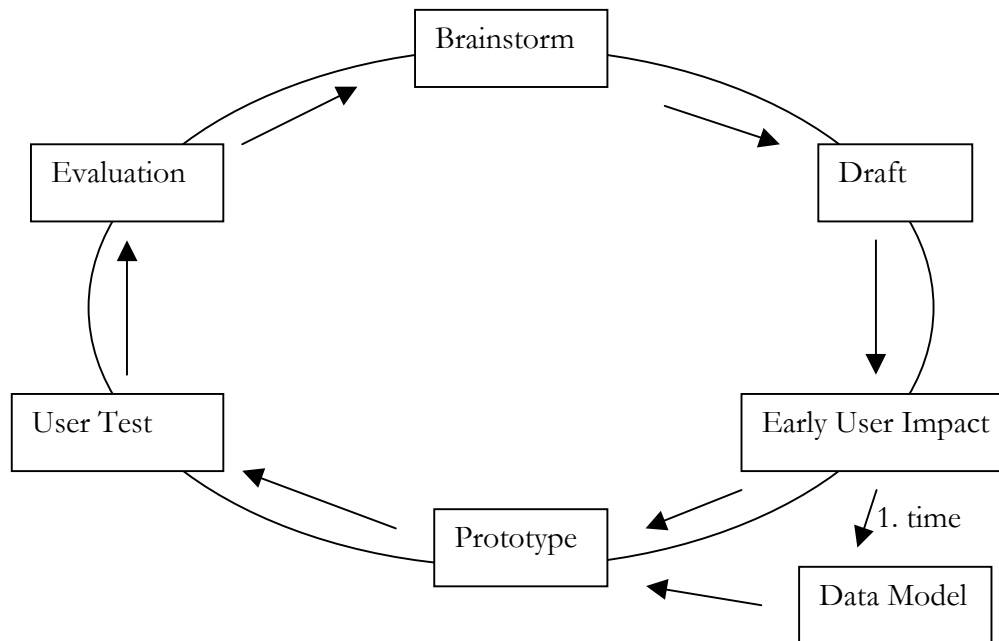


Figure 1: The Iterative method used for the development of the WAP site

4.2 A qualitative approach

We have chosen to conduct qualitative⁷ interviews and tests with representatives of our target group. We find that this method is the best way for us to determine what kind of content would be useful for the service as well as to gather a comprehensive understanding of the way our target group experiences the WAP service. By using this method we wish to reach a level of reflection which will prove useful in improving our service rather than drawing scientific results of the testing.

The tests are interpreted as indications of the tendencies that exist within our target group and the means of interpretation are discussed in the chapter on User Evaluation.

Methodological concerns of the interviews

We have made three different types of interviews. In the first week of the project period, we met with three respondents to get an insight in their needs in relation to the content of our service. This interview was divided in two sections one covering the qualitative insight of their habits and the other consisting of a questionnaire where the interviewees were asked to rate their preference of content⁸.

The six tests consisted of use case⁹ scenarios that were presented to the interviewees in order to test the prototype. By doing so we hoped to obtain an understanding of how the actual user situation would take place and which problems could occur while using the WAP service in the same environment that the service is developed for. For each meeting we had created a list of use cases¹⁰

⁷ When talking about qualitative interviews we are primarily drawing on 'Det Kvalitative interview' by Steinar Kvale (Enderud red., 1984) combined with 'Design af brugergrænseflader' by Søren Lauesen (Lauesen, 1999).

⁸ Question guide 1., Appendix 2.

⁹ Inspired by Lauesen (1999).

¹⁰ Question guide 2. and 3. In appendix 3 and 4.

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that we thought would characterize actual user scenarios, which the respondents performed on the site.

After having performed the second testing we conducted qualitative interviews with the three respondents. The interviews were semi-structured, as they were neither free conversations nor highly structured questionnaires. We had a list of topics that were to be covered in the interview. In addition, it was our intention to make room for spontaneity and a broader perspective on the subject. By making a more structured interview we would have eliminated the opportunity to be informed of different aspects than those predicted by us. Thus the interviews were a combination of interviews and a broader dialog between interviewees and interviewers.

As the interviews were performed on locations where the actual user situation will take place (clubs, discos and bars where loud music is played), it was impossible to tape the interviews which would have been the optimal way of recording the dialog. Hence all information is made in noteform and will be in our appendix 2.

4.3 Choice of technology

During the Tranzmobile project we have been in possession of two different WAP phones: Nokia 7110 and the Ericsson R320s. As these two WAP phones were rated best¹¹ in a review in Politiken¹², we choose these as our test phones.

The server scripting language we have chosen is TCL, which runs on an AOL server, and the database is an Oracle 8.1. The generated output for the WAP phone is WML, which is used to display the content. The Web site is based on Flash movies that request variables from the server via TCL. We will argue for the choices in the chapter of "Technical factors of the WAP site".

5 TARGET GROUP CONSIDERATIONS

As the use of WAP has been limited to a small number of people in Denmark the number of services are still quite small. However, as the availability of WAP devices is increasing so is the demand for WAP content and services.

Until recently the only WAP phones available were very expensive and hard to get and so the demand for content was developed for the small group of people in possession of WAP phones. Thus the typical content was stock prices, news, weather reports and other services with relevance to the target group.

5.1 Primary target group

As the prices of WAP phones are decreasing the target group is no longer as limited as before. Hence, there is a need for a broader range of services, which the market is already responding to¹³.

The "tech-generation"¹⁴ probably serves the greatest potential as WAP users. As they are accustomed to new technologies they are normally early adopters of new media. Therefore, we find it a great

¹¹ The Nokia 7110 was rated four stars out of five and the Ericsson was rated three stars out of five.

¹² Politiken Internet section May 11, 2000

¹³ An example of this is the WAP service wap.ibiffen.com, which won the price for Best Mobile Solution at Reboot 2000.

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challenge to develop a service that is of interest to that group. Our product however, given the media and content might not appeal to all members of this group. We have therefore decided to limit our target group to include only those that own and use mobile phones on a regular basis. Further, we have decided to limit our group to those that frequently go out and that enjoy listening to music.

Hence, our target group consist of:

- 18-30 year olds.
- Techies.
- Mobile phone owners and users.
- Goes clubbing averagely once a week.

5.2 Secondary Target group

As our service will be a part of www.tranzistor.dk, we have a secondary target group consisting of all users/ listeners of the net radio. In general, this group can be divided into two groups: content providers and listeners. The content providers, which counts approximately 40 DJs, promoters and radio journalists, can be considered a subculture by it self¹⁵, with it's own sets of rules cultural values. It is far more difficult to target and profile the listeners, but we think it is safe to say that the returning visitor has an interest in electronic music, and are a frequent user of Internet¹⁶.

Tranzistor has an average¹⁷ of 3000 users a month.

6 IMPLEMENTATION ON THE WORLD WIDE WEB

The web construction of Tranzmobile can be divided into two parts, the integration of the WAP service into the existing site, and the construction of an administration page where updaters, raters, modifiers and super-users have access to and can modify the database. In this chapter we will take a closer look at some of the problems concerning this construction, and present examples of how they may be solved.

6.1 The role of the Web part

The question concerning whether the Web site should reflect the WAP service or just share the service data, is primarily a discussion of whether Tranzmobile is just another service for the Web site or a service solely developed for wireless media. If one takes the wireless position, it would be obvious to present Tranzmobile independently of the web radio section (www.tranzistor.dk). This way the service would be separated from the existing site, and it would underscore the effect of the service. On the other hand, one might argue that the focus should be on the service and not which media it is developed for.

¹⁴ Tech-generation: Youngsters between 18-30 that are raised with computers, mobile phones and other technical devices as an integrated part of their everyday life.

¹⁵ Heuseler and Staun interviews and gives a portrait of one of these DJ's in "Den samlede generation" p 22.

¹⁶ The use of Internet as a multimedia channel, is still limited.

¹⁷ According to Mikkas Skulstad, www.Tranzistor.dk.

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When interchanging different media with each other there is the danger of wasting the media's potential and strengths (for example, theater on TV, desktop design on Web, or radio on Web). It would be more natural to integrate the service into the existing site, and make the implementation as transparent as possible.

If one chooses to look at it as a separate service, a solution could be to launch a pop-up window with a WAP emulator, made in the same design style as the Tranzistor radio. This would work well graphically with the radio graphic as a metaphor, and it would be possible to emulate a WAP telephone down to the smallest details. Speaking of usability an emulation might not be a good idea, but it would give the service a 'gizmo flare', and emphasize that the service was built for portable units.

On the other hand, it would be reasonably easy to integrate the service into the existing site. By using, and possibly extending, some of the WAP features it could, for example, fit perfectly under the 'CPH Live' section as a calendar just like the calendar on the WAP telephone. An implementation like this would be as good as transparent, and the user would probably just see the new service as an extension of the 'CPH Live' section, more than a new WAP service. Furthermore, it would be possible to change the start to 'Right Now', whenever a new rating arrives from the raters out on the clubs.

6.2 Web vs. WAP

Even though Web and WAP are two different types of media, and have two different formats, we believe that it is important to maintain a certain degree of consistence in the navigation. Especially in this case where two media work together in providing a service, consistency in terminology, labeling and content is essential. The WAP unit may use a few more screens to reach a certain type of information¹⁸, but the order in the flow should be as light as possible. This makes it easy for the user to operate on both platforms, and a switch will just make the navigation feel more intuitive, as the user is already accustomed to the flow.

Web administration

Although it is possible to insert new events and clubs via handheld units, it will be more efficient to update the database from a web interface. This page does not need too many graphical details, since its main purpose is to make the actual database insertion as simple and efficient as possible.

On the start page you can either request a login by a form, or if you already have been granted access, you can login to the pages that you have permission to update/ insert.

Raters (clear. level 3) and updaters (clear. level 4) will be able to insert an event and change the events they have inserted; modifiers (clear. level 2) will be able to update and insert all the events and the ratings, while the super user (administrators, clear. level 1) will be able to modify all tables in the database.

¹⁸ Cache limitations and display size forces the cards to be small (physical size as well as file size)

7 THE WIRELESS APPLICATION PROTOCOL¹⁹

The Wireless Application Protocol (WAP) is developed to make it possible to access the Internet from remote places through mobile phones and other handheld devices. There are numerous technical limitations of the devices and the forms of data transmission. We have to take these limitations seriously and make the best of this limited technology. In this chapter we relate the technical limitations to the issue of usability of WAP phones.

7.1 General facts about WAP and WML

WAP is a communication protocol and an application environment, initiated by Ericsson in 1995. By protocol means that it provides a method to communicate across wireless networks quickly, securely and efficiently. The fact that it contains the markup languages HDML and WML. In 1997 wapforum.org²⁰ released the first version of WAP, currently available in a version 1.1, with a coming version 1.2 the fall 2000.

Client/gateway/server

Instead of reinventing the wheel, the WAP standard is constructed in more or less the same fashion as the HTTP universe, with a set of communication layers, scripts and protocols. The layers can be divided top - down into the following list.

- Wireless Application Environment (WAE), consists of WML and WMLscript.
- Wireless Session Protocol (WSP) does the same job as HTTP together with Wireless Transaction Protocol (WTP).
- Wireless Transport Layer Security (WTLS).
- Wireless Datagram Protocol (WDP) is the replacement of TCP.
- Basic mobile network.

A WAP phone functions via a WAP gateway, which acts as a translator between the WAP and HTTP protocol. When the WAP phone (the client) requests a page from Tranzmobile, the request is sent to the gateway which translates the request from WAP to HTTP, and passes it on to the net. The request finds it's way to the server in (what can soon be described as) the traditional fashion. The AOL server calls the TCL scripts, which trigger the server to request data from the oracle server. The Oracle server returns the request to its client, the AOL server, which passes it on to the TCL script, which then uses the data to produce a WML document. The AOL server sends the WML document back to the gateway via HTTP, where the gateway, in reverse fashion, formats the document into WAP and returns it to the client.

7.2 Flash/Server

The Flash client requests data from the server in a slightly different matter. The request can be triggered from a browser where the Flash film is embedded in an HTML document, or from a stand-

¹⁹ This chapter is based on the following articles: Wireless Developer Network: "Introduction to the Wireless Application Protocol" and Gilmore, W.J.: "Introduction to Wireless Access Protocol".

²⁰ An organization put together by the industry, not unlike w3c: www.wapforum.org.

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alone application. The Flash film requests a TCL file from the server, and uses a Get command if a variable is to be passed along with it. When the TCL file gets the data from the database, it converts the results into variables that the Flash film can read. Flash uses the variable syntax `&var=value`, where `var` is the variable, and `value` is the value the variable holds. When Flash gets the variables, it treats them in a fashion not unlike the variable system WML uses. The values can be used as a string literal or expression, which makes it possible to name a text field, and treat the input as variable value.

7.3 WML

WML is a markup language specifically created for a WAP network, it is important however, to emphasize that it is not a new language²¹. The code might look quite similar to the traditional HTML code, but is in fact a legal XML document, defined by a standard XML Document Type Definition (DTD²²). WML pages or documents are called decks, and consists of one or more cards, which can hold unique information. This makes it possible to download a set of cards in one step, instead of having to download each page individually. WML can hold variables dynamically, which means that it is possible to hold form variables and data locally on the phone, even from deck to deck.

7.4 Limitation in Data transmission

The present WAP phones in Denmark use GSM, which stands for Global System for Mobile Communications and is a digital cellular radio network. With a normal GSM mobile phone the maximum transmission is 9.6 kbit/s²³ which limits the speed of the transmission a great deal. As a result of this, for usability purposes the data that can be transmitted is limited to text files and small static graphics. As the description of WAP is "Your mobile entrance to the WWW" people expect the content to be as deep and colorful as what they are used to from the Web²⁴.

With the development of GRPS²⁵ (General Packet Radio Service) however, we can expect a whole new type of content, as the data transmission will increase to approximately 200 kb/s. This increased bandwidth will allow WAP to include services such as Web-surfing, video transmission and document attachments²⁶.

Thus many of the current limitations of data transmission will be overcome with the implementation of GRPS. It will then be up to the industry to develop WAP phones that can display the new content type in a satisfactory way.

²¹ Gillmore (2000:1).

²² http://www.wapforum.org/DTD/wml_1.1.xml.

²³ Pedersen, (2000:1).

²⁴ 2 out of 3 of our respondents had these expectations to the WAP and thus felt some disappointment with the layout of our WAP site.

²⁵ GPRS is a GSM service for end-to-end packet switching. Where GSM reserves the whole line for transmission PPRS only occupies the bandwidth needed to transmit the data (like the Internet). The new transmission form will be introduced during 2001. However, the system demands that the mobile network is upgraded and that the users purchases new GPRS phones a breakthrough for the new transmission form is not likely to happened until 2002.

²⁶ Pedersen (2000:1).

8 DESIGN AND USABILITY FOR THE WAP PHONE

Since the underlying technologies of WAP and the World Wide Web²⁷ are the same, these two ways of communicating information is often being compared. It would seem reasonable then to learn from the usability issues of the World Wide Web and transfer this knowledge directly to WAP sites. This can only be done to a small extent, however, due to the limitations of the representation of wireless information on handheld devices. In particular, the following FIVE issues must be taken into account.

- Size of display.
- Download time.
- Memory cache
- WAP phone interpretation of WML tags
- Difference in representation at different WAP phones and gateways.

The usability of WAP sites has even more challenges but these five did show to be the most relevant to our project and they are therefore described in more detail below.

8.1 Size of display

Though the size of a WAP phone's display varies from brand to brand, they are approximately 3.5 x 4cm. The most common WAP phone in Denmark, Nokia's 7110, is 3.5 by 4 cm and displays 96 x 65 pixel. Both Ericsson and Nokia are limited to displaying only 4 lines of "content" text.

The individual cards can contain more text because the phones have a scroll function (either as a scroll wheel or arrow buttons), and though users are accustomed to scrolling, the size of the display does place usability restraints on the presentation of longer texts.

The display size prevents the WAP developer from creating clear and logical navigation bars and icons, as we know them from the Internet and considerably limits the use of graphics²⁸. It is however possible, to program the 'option' menu of some phones to contain a navigation menu, a feature that is utilized in Tranzmobile's WAP site.

Navigation

Because of the lack of a navigation bar, the navigational structure of the site should be very simple. Hypertext in Web applications, meaning fragments of text as links to other places in the application, can lead to confusion because of the potential complexity²⁹. The only way to relate the concept of hypertext to WAP applications is to speak of links in between the levels in the navigation hierarchy (see fig. B and C in the appendix).

In designing for usability on the Web it is recommended to avoid creating too many links between the levels of a site. While designing for WAP one can not easily adopt this restriction. Without the presence of a navigation bar, the 'back' button is the only navigational tool the user is given besides the links within the site. Thus, while designing a structure that allows for navigation throughout the

²⁷ Wireless Developer Network: "Introduction to the Wireless Application Protocol".

²⁸ It is possible to display pictures at a WAP phone but only two-color pictures and they can not be links.

²⁹ Rosenfeldt (1998:57).

site without a lot of back tracking, it is difficult to avoid creating a complex navigation structure. The structure should therefore be neither too deep nor broad, and thus the content of WAP site should be limited to the most necessary and be concise throughout the application. How the navigational issue is dealt with in relation to Tranzmobile will be elaborated on in chapter 7, 'Content and Navigation'.

Labeling

Labeling is a concept that is considered a very important issue when designing Web sites and applications³⁰. With a WAP site, labeling becomes even more crucial, because the size of the display limits the length of the links' description. It is necessary to be precise and find words that offer the right associations. Labeling should communicate information efficiently and it should be consistent, meaning the same label should lead to the same card even though the user enters from a different card.

8.2 Download time

A card is the information displayed on the WAP phone that one can scroll through, meaning when clicking a link, one enters a new card. Every card is part of a deck that contains one or more cards. This way the user has to download only one file in order to see several cards. The use of WML decks and cards, reduces the number of necessary connections to the gateway, and thus allows for quicker navigation. When the user jumps from one deck to another, however, the WAP phone has to connect again and download the new deck. This downloading takes a couple of seconds, sometimes more, depending on the connection and the size of the file. It is thus a matter of balancing the size of the deck. A big deck demands more download time, but less connection time, while a small deck will download faster, but require more connection frequent connections.

The fact that GSM is not very fast makes the download time a critical factor for the usability of a WAP site. Experience from the Web shows that users easily loose patience over the download time for a page or file if it is too long.

8.3 Memory Cache

There are two problems with the memory cache of a mobile phone that create serious usability problems. The amount of memory in the cache of WAP phones is very low and varies from phone to phone. As a result of this, the size of a WML file can not exceed 14.4 kbps³¹. When working with dynamically generated cards where file size can change, as is done in the Tranzmobile site, it is very important to consider the maximum possible size of a deck. As elaborated on later in chapter 8, the Tranzmobile site is split into several decks because of this limitation.

In order to save time and to reduce the number of necessary connections, a mobile phone stores the most recently visited sites in its cache. This can be an advantage to both users and designers, but it presents a considerable problem for services, such as Tranzmobile, that offer time-sensitive information. Because the phone may be displaying pages from its cache, the user will not know if the site has been updated since he last visited the site. With WML one can set a limit for the length of time a page will be stored in the cache. Both Nokia and Ericsson seems to recognize this code, but other phones might not. We have dealt with this problem in 'TZ Chat' via the use of TCL and

³⁰ Rosenfeldt (1998:72).

³¹ The Nokia 7110 is the phone with the smallest memory, the Ericsson has 3000 bytes of memory, <http://www.ericsson.se/WAP/products/r320.shtml> [May 28. 2000] and <http://www.nokia.com/phones/7110> [May 28. 2000].

variables and recommend that the same solution be implemented on other areas of the site where the information is time-sensitive.

8.4 WAP phone interpretation of WML tags

Though WML has numerous tags for text type and layout the two phones tested recognize few of these tags. WML allows for such tags as "small", "big", "emphasize" "strong" "underline", and supports layout structure with tags for tables, aligned text and "space" (³²). Nokia recognize none of these tags. Ericsson is considerably better recognizing 4 font tags and the align-text tag as well as the tag. Neither phone, nor the emulator, is capable of displaying tables. A further problem with the layout is that both phones make an automatic line break in association with a link or an input field. Though WML has considerable layout tags, due to the various mobile phones, designers have very little if any control over page layout.

8.5 Difference in representation with different WAP phones and gateways

The lack of compatibility is one of the unfortunate "takeovers" from the Web. Not only is there inconsistency in the way in which different phones display WML, there is also inconsistency in the way different gateways translate WML. Certain sites actually warn the users of difficulties with dissimilarity between gateways³³. If a WAP developer wants to make a site and needs assurance that the site will work on all Danish platforms and phones the site will thus have to be developed for as many platforms that exist (currently 5) and for as many types of phones/browsers that are available. If we take the current situation in Denmark our site should thus be developed in 30 different ways³⁴.

Testing the validity of WML code is easily and quickly done on the emulators that are available on the Internet³⁵. Many of them account for different WAP phones and their inconsistent ways of representing content. When testing on real WAP phones, however, we realized that the emulator we used does not give an accurate representation of the way the phones display content. For example, when representing Nokia, the emulator displayed formatting tags while the real phone did not.

These inconsistencies and difficulty in checking them make it difficult to create a consistent design structure, as it is almost impossible to maintain a uniform interface for all WAP phones. It is however possible for the server to identify the client and then generate different WML code for different phones.

As with the Internet WAP also has the problem of compatibility between standards. The phones developed for first WAP standard WML 1.0, which was developed in the fall of 1999, can not read the current format WML 1.1, which was developed in the spring of 2000. WML 1.2 is expected to be introduced in the fall of 2000. Because the browser is build into each phone, the users will have to purchase a new one each time the standard is upgraded, in order to be able to use the services that are developed for a higher standard.

³² : Non breakable space.

³³ An example of this is Computerworld's online news for WAP phones that explains that the gateway of Sonofon cannot be used to obtain their WAP news.

³⁴ According to TeleDanmark there are currently 7 different WAP phones available in the Danish market. As Siemens and Motorola uses the same UP-browser.

³⁵ For example <http://www.yourwap.com> [May 23rd 2000].

8.6 The overall usability of WAP current devices

In addition to the limitations and problems described above, the complexity of using the WAP devices themselves can make surfing and interacting via a WAP phone a slow and cumbersome process for all but the most experienced users. This, together with the problems listed above makes creating a good and easy-to-use WAP site more difficult than it would seem. Assuming, however, that users have acquainted themselves with the functions and use of their own phone, then a service designed to account for the problems mentioned above can succeed in meeting the needs of the user with few usability problems.

It is important, however, to remember the reason for the creation of WAP: it gives the user the ability to access the Internet anywhere, anytime. Therefore, sites developed for WAP devices should be created to provide information or services to users in situations where they could not get the same information in a faster or easier way³⁶. The site wap.krak.dk provides a service in which the user can look up a telephone number via WAP. We performed an informal test to see the time difference between using this new service and calling the traditional information service provided by TeleDanmark. The WAP service, with download and upload time took two minutes, while the information operator was able to provide the number in one minute and 5 seconds. Here, it is important to remember that the WAP phone consists of both the telephone service and the WAP service. Hence, any developed WAP service should give the user an alternative, which is better or faster than using the ordinary telephone service or which offers a completely new and different service.

9 CONTENT AND NAVIGATION

Tranzmobile is primarily an event-based service and the content and navigation structure reflects this. The site is structured around events and, though the site provides information about clubs, this information is located further down in the hierarchy, or is presented as a link beneath an event.

9.1 Content

In the first week of the project we conducted user interviews and tests in order to decide on the specific content of the WAP site. The categories of rating, for example, were decided after the first interviews with the representatives. When deciding on content the amount of information is an essential consideration. Space is extremely valuable and one letter too much on a line will result in the loss of 25% of the display area. Because of this, structure is critical to the usability of the site. The information of the events, for example, has been limited to title, music genre, price, date, begin and end-time as well as a short description of the event. The information could easily have included old reviews of the same DJ/band and characteristics of the performer(s) but due to the above-mentioned reasons the content has been limited to include only the most relevant information.

³⁶ An example of this is the WAP site mentioned in the introduction: www.ibiffen.dk

The index card

The choice of options presented on the index page is based on the assumption that this service will be used for making both immediate and future clubbing plans. The menu options are designed to anticipate the needs of the users and lead them to the information they need through the shortest number of logical steps. Second, the card is created to provide the user with concise information of the site's aim. Meaning that the index card should communicate enough information to enable the first-time user to intuitively guess what type of information they will get under a specific link. It is important that the index does not have too many menu options, because this would require a lot of scrolling. As a result, we have limited the menu options to six. The order of the links is such so that the users have to scroll the least to get to the information they are likely to access the most. The figures below show the index as it appears on the emulator of a Nokia 7110. The two bottom options are not visible unless the user scrolls down, and because we assume that the user of a WAP phone will be accustomed to scrolling, it is likely that he/she will scroll down when viewing a site.

The menu items are presented as links on the index page, and they act as a kind of navigation bar. A limitation in layout control prevents us from having a navigation bar on each page (as is often seen in many well-designed Web sites). As a solution to this, we have coded the index page links into the 'option' button (which does not work on Ericsson), and placed a 'Home' link on the bottom of each page. This enables the quick user to return to the main menu regardless of where he may be in the site.



Figure 2: Tranzmobile index site (Not rated and rated)

The menu items

Tonight/Right Now

The menu option 'Tonight' is a card that displays all the events on the present night. It can also be found under the 'Calendar' option but it has been placed in the index to meet the needs of the "immediate" user. To further meet the needs of the "immediate" user 'Tonight' is automatically exchanged with the option called 'Right Now' when an event has been rated for that night. 'Right

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'Now' links to the most up to date information about the events of that night. In this case the navigation structure changes to reflect the changing needs of the users as the night progresses. The information that was previously available under 'Tonight' is still available, under 'Right Now' along with new information about event ratings.

Calendar

The menu option 'Calendar' leads to a list of the next 14 days (starting today) where the user can link to the information available for each day. The user tests found that users, when unfamiliar with the site, enter the calendar in order to find information of a present nights' events, if the 'Tonight' option on in the index has changed to 'Right Now'. This indicates that the calendar is a powerful label. In the calendar, the user is presented with the same 'Right Now' option, along with the day's date so as to eliminate any confusion as to which day 'Right Now' will link to.

Clubs

The 'Clubs' card is presented as an alphabetical list of the clubs that exists in the Tranzistor database. Should the service expand to include a large number of clubs, they could be categorized according to genre. As it is now, the list of club list is relatively small so that the user is able to get a quick over view by scrolling through the list. When clicking on a particular club, the more detailed information for a club is displayed. On this card there is a link to 'Tonight at club X', which links to a list of the events at that club (ordered by start time). If there are no events that evening the user is given a message indicating such as well as a link to the Calendar. Here we assume that the user may be trying to make plans for the evening and thus send him to the calendar where he can link to a list of the evenings events.

TZ Chat

'TZ Chat' is a menu item that has been discussed from the beginning of the project period. It is evident from the user tests that for our potential users the location of friends is the most important issue when deciding where to go clubbing. Therefore we decided to develop a chat function. It does not completely solve the problem, but we found it to be an alternative way of using this media in order to meet some of the needs of the user. It might seem as just another SMS function, but the function makes it possible to chat with people you do not know (yet), and who are from the same environment (they are part of the Tranzmobile target group). It also enables users to chat with people at other clubs to get further information before deciding where they want to go next. In this way, the chat function is pushing boundaries of a new media rather than imitating an old one.



Figure 3: TZ Chat and TZ Tonight

The limitations of WAP and the size of the mobile phone's display largely dictate the structure of the chat site. Our goal was to get as much of the chat's content on the screen at one time as possible. Ideally, for usability purposes, the input area should be labeled but due to the nature of WAP and the mobile phones, this would have caused a line break. The result would be that when the chat page was refreshed, only one line of text would appear on the display. Instead, we assume that users of WAP will be familiar with how and where information is entered into a mobile phone, and thus recognize the input area without labeling. A second consideration is that the label would only be necessary the first time, after this users will know how the service functions, and 25% of the screens area would be wasted on unnecessary information. To increase the usability, we have also added an input field at the bottom of the page so if the user is closer to the bottom, he/she can enter the text here as well.

Search

Another important factor to the success of the site is whether or not the user can quickly find events with certain characteristics. The project group found a search engine to be vital to the service. This is however, a very complicated function and the search function is therefore not created in the most optimal way (this is described in more detail in chapter 8). 'Search' is the menu item that enables the user to find specific key words for all venues at a specified date. The default day is the present date, so the user does not have to enter a new date if searching for an event that night.

About TZ

In order to explain what kind of site the user has entered, the last menu option is 'About TZ'. This card explains that Tranzmobile is a part of Tranzistor.dk and a night club service.

9.2 Navigational Structure

The navigational structure is illustrated in figure B and C (appendix). At first glance it might seem rather complex but as described in the above it is necessary for a WAP site to provide the user with relevant links to the information.

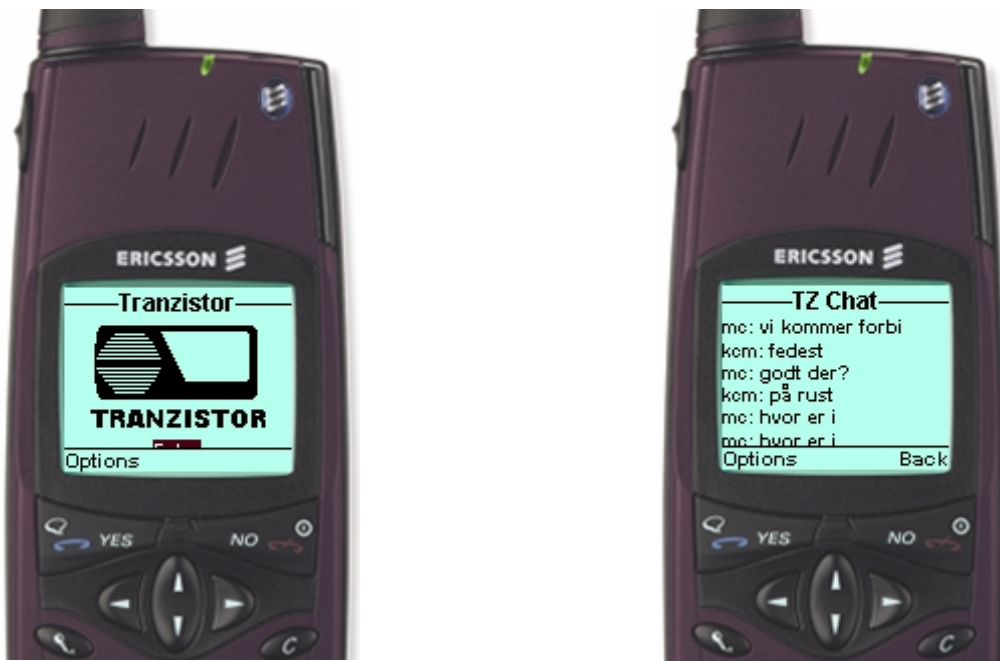
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For example if a user enters a review directly from the card of 'Right Now' and wanted to find information of the club's address, it would then be necessary to go back to the index and into the clubs and then find the right club. As a result, the club name on a review page is made into a link directly to the club information. Because we are unable to give the user all information at one time, we anticipate what information users will need depending upon where they are in the navigation hierarchy. This way the concept of hypertext is utilized. This type of circular navigation exists several places throughout the site, and is used to maintain a flow and prevent a situation where the user must back track to get the desired information. Due to the fact the site is rather simple and does not contain excess information, the user does not get confused or lost. This is supported by the user tests where none of the representatives perceived navigation as a problem.

Another example of the links being utilized the most efficient way is the 'Right Now' card. To indicate that an event has been reviewed the following link appears: 'given x of 7 stars (0:00)'. By using the rating itself as a link to the review page, we achieve three things: we maximize the use of space on a line, let the user know an event has been reviewed, and give the user part of the review information.

Labeling

Simple and concise labeling is essential when creating WAP sites³⁷. Labels for links should be clear and obvious while being as short as possible. In many cases, we reviewed each page to make sure that all labels were necessary. This, for example, resulted in the link called 'read review' with subtext 'given x of 7 stars' being replaced by the link: 'given x of 7 stars'. In this particular case we were able to save a line of display space. With the information structure we worked to give the right amount of information and the right information at the right times. As mentioned above, this demands a navigation flow that is able to anticipate the users needs. It also requires text to be short and to the point. Unlike the Web, with a nearly limitless volume of information, WAP's strength lies in its ability to give limited, yet vital "on the spot" information.



³⁷ Rosenfeld, (1998:77).

Figure 4: The Tranzmobile WAP site on an Ericsson Phone

10 TECHNICAL FACTORS OF THE WAP SITE

Most dynamic Web sites³⁸ today consist of a database and a set of program files written in a programming language, such as TCL, PHP or ASP. When a client requests a page, the Web server interprets the corresponding program files and the output (usually HTML) is redirected to the client. The Web site of Tranzistor is based on the same back end technology but with Flashmovies acting as the client, interchanging variables with the database via TCL.

The structure behind the Tranzmobile WAP site does not differ greatly from a normal dynamic Web site; the only difference is that the generated output is WML rather than HTML as this is the only language the WAP browser can read. In the building of this site there were many considerations to take regarding the choice of programming language and the structure of the database. This chapter will describe the choices made and the technology behind the Tranzmobile WAP site and present examples of the actual implementation.

10.1 Choice of technologies and languages

The Web server that runs the WAP site is an AOL-server connected with an Oracle 8.1 relational database. The server supports the programming language TCL as the server scripting language. TCL (Tool Command Language), which has an open source code interpreter, is simple and particularly good for working with strings³⁹. As strings are exactly what both WML (and HTML) pages and in essence SQL statements consist of. String manipulation is at the heart of dynamic WML page publishing.

The group members have all followed the course Web design II at ITU this spring where there was instruction in TCL, together with Oracle SQL and HTML. The project group found the idea of TCL with WML to create a dynamic Web site to be an exciting challenge. The principles of dynamic Web sites, which the project group has studied in the course, are the same that are used in the Tranzistor WAP and Web sites, with the addition of WML which was a new and unfamiliar language to all members of the group prior to the project.

10.2 Database structure

The database structure is created with the intention of developing a set of tables that can be used for the management of the Tranzistor WAP site and blend in easily with the existing Web site www.tranzistor.dk. Both the WAP site and the Web site are based on a common database so that they can access data input from both sides. For example, raters are able to rate events that have been entered into the database via the Web site, and users are able to view these “mobile” ratings on the Web. Extensibility is a keyword in the creation of the data model, as the radical change of database structure of an existing site can be a painful process. Thus the database has to take into consideration

³⁸ We use the term ‘dynamic web site’ to refer to a web site in which the page content is updated according to the content of an underlying database and/or programs and the variables sent from the client along with the request. This is as opposed to ‘dynamically generated web sites’ in which the (static-) pages are generated once and for all by some kind of software package or the like.

³⁹ Greenspun (2000).

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all possible circumstances in order not to paint the future administrators and developers of the system into any corners. It is also important to eliminate redundant data and insure that it is possible to refer from one table to another. It has been evident from the beginning of the project that it would not be possible to implement all of the considered features and functions of the WAP site, as a result of this some of the tables in the database are created with future use in mind. We have followed Lauesen's (1999) compendium on data modeling in order to maximize the structure and make use of normalization of the database. Fig D shows the data structure without column names and appendix 5 is a printout of the SQL statements used to create the tables.

The *users*⁴⁰ table holds the information on the Tranzistor users, be it plain users, raters, DJs, club owners or system administrators. Because it is important to differentiate between security levels (for example should only an administrator be allowed to insert categories in the database), a column (*user_clearence*) is created in the User table, with five levels of security. This anticipates that at a later time Tranzistor might need to distinguish between several levels of user access. At present we use level 1 for system administrators (create, read, update and delete all data), level 3 for raters (can create new venues/events, clubs and ratings) and level 5 for the plain user. In the near future level 4 could serve as clearance level for club owners wishing to maintain their own clubs and venues in the database. A generated user id (an integer) is used as primary key in this table. User names, which may not always be unique, or email addresses which may change or any of the other entities in the table would be ill suited as the primary key.

The *club* table holds the clubs and other locations in which events relevant to the Tranzistor site could take place. It holds data such as the name of the club, the address and a short description. It is connected to the *users* table via the *responsible* table. *Clubs* and *users* are not associated directly (through a reference in either *users* or *club*) as this would prevent more users from having altering rights on the same club or the same user having altering rights on several clubs. At present this feature of the database structure is not used, but a connected table called *responsible* is created to anticipate future needs.

'Venue' is the term for a specific event, for example a concert or a theme night at a nightclub. An entry in the *venue* table is always associated with an entry in the *club* table. The entry has two kinds of relations to a user, one through the *booking* table and one direct reference through the *user_id* in *venue* that references *user_id* in *users*. The reason for including the *booking* table is to consider for example the situation where a person reserves a club for a special event and wants to enter information and be able to correct this. Another example could be if a rater stumbles upon a smashing event not yet in the database and has to create it prior to rating it. The *booking* table holds the booking of one or more DJs or entertainers.

The *Review* table has a column that holds a reference to users to indicate who rated the event and a column that holds a reference to *venue* to indicate which event the rating concerns. It also has a column that is used to store a rating from one to seven and one that stores a comment made by the rater. On top of this, the table has its own primary key (*rev_id*) which is referenced from the *venue* table.

⁴⁰ Since 'user' is a reserved word in Oracle, we have been forced to name this table in plural. All other tables, however, are named in singular form, since this is the standard of table naming (Lauesen, 1999).

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The *value* table holds different ratings of various categories with one column to store the name of the rating parameter in use, one column to store the rating's value and a column that indicates how high a priority in the presentation on the site this category should be given.

The categories themselves are generated via the *category_generator* table. In this table the administrator inserts different categories and corresponding values for a selection list. When an event is being reviewed, the request made by the client (the rater with his WAP phone) triggers the creation of several selection lists based on categories and values from the *category_generator* table. Values stored in the *value* table are thus based on the rater's choice of categories with one value given to each.

This way, no other tables in the database refer to the *category_generator*; likewise the *category_generator* does not hold any reference to another table. Because of this the administrator has the liberty to create new rating categories in the *category_generator* without influencing old ratings; he/she does not have to change any column names in the database or even variable names in the TCL files. The Administrator can do it with a simple insert or update in the *category_generator* table. Since many of the chosen rating categories are time specific (an example is 'Buffalo Index' as a measure of the shoe height on a certain fashionable kind of shoe) it was essential to create a flexible data model on this point. We found this to be the most efficient yet still quite simple way of dealing with this concern.

10.3 The TCL files of the WAP site

In terms of file structure, the WAP part of Tranzistor consists of two separate systems. One is the user system, with all program files located in the */web/tz mobil/www/wap* folder of the server. These files serve the normal user of the site. The other system is the rating system with all files except the login file located in the password protected */web/tz mobil/www/wap/rate* folder. These files serve the raters employed by Tranzistor and all filenames end with *_rate.tcl* to distinguish them from the user side pages. Appendix 6 contains printout of the TCL-files.

As all pages in the site rely on dynamic content, no static WML pages are used (with the exception of *about.wml*). Instead the various TCL files generate output text strings which are sent to the client (the WAP phone, WAP emulator etc.) with the specified MIME type (*text/vnd.wap.wml*) telling it to interpret the stream as WML. The output depends on several variables: the variables sent with a request, which TCL file is requested by the client, the time of the day and the content of the database.

The user system consists of 13 TCL files with most of them are generating one separate type of deck (all but the start page consist of only one card). All files use the *wml_top* procedure to create the options menu and the *wml_bot* to create the home link. Whether the menu's first menu option links to *tonight.tcl* or *rightnow.tcl* depends on the result of the procedure *rated_lately*, which is based on a database request that finds out if any events have been rated within the last six hours. If that is the case, the link will be *rightnow.tcl* otherwise it is *tonight.tcl*.

The rating system consists of a login page *index_rate.tcl* in the *wap* folder and 11 TCL files. As the pages in the rating system have different options in the menu, the files use the *rate_top2* procedure to generate the menu.

As an example of the TCL code we will describe one representative TCL file below.

rightnow.tcl – generating a list

The purpose of this TCL file is to create a WML card step by step by adding text strings to the variable *venue_rate*, which is then returned to the client. At first the card definition and headline are added and at the same time the variable with the `set venue_card "<card..."-command` is created. Then we get a handle to the database and store it in the variable *db*.

The next step is to create the SQL query and send it to Oracle while letting the variable *selection* hold the selection. The information we need is stored in three different tables: *venue*, *club* and *review* that we join in the query. The joining of *venue* and *review* are made as an outer join, so as to include the venues that have not yet been rated in the selection. In order to only get the venues of today, we set up the restriction, using the `where` clause, stating that the date in the *venue_date* field of the *venue* table must be the same as the current date. The day is pushed six hours however, taking into consideration that the clubbing night typically ends a lot later than 00:00 and that a list of Saturdays' events is not much use on a Friday night.

At this point *selection* holds the selection from the database and we now use the `ns_db getrow` command wrapped in a while loop to obtain the selected rows one by one. In the beginning of each row, we store the selected values in variables corresponding to their column names. If the *rev_id* is not null we append a string to the *venue_card* variable containing:

- a. The title of the venue wrapped in a link to `venue.tcl` with and the variable *venue_id* attached to the link, which links directly to details on this particular venue.
- b. The name of the club
- c. A link to the latest rating (if the variable *rev_id* is null we append the string "not rated yet").

As the selection provides us with a great deal of redundant data, should one event have been given more ratings, we wrap all the above in an if-statement checking if this is the first time this particular event occurs in the selection. We only want to present the latest of the ratings to the user so we use the `order by` sort function of SQL to make sure that this is the first one in a group of rows concerning the occurrence of the same event/venue.

Last we return the result to the client with the MIME type specified as WML wrapped in the usual `wml_top` and `wml_bot` which produces the beginning of a standard WML document with the Tranzistor WAP options menu and the home link at the bottom.

10.4 Interesting features of the system

Here a few interesting features of the Tranzistor WAP system are briefly discussed.

Password check and security

The rating system of the Tranzistor site is password protected, so only registered raters have access to the TCL files that write in the database. This is done by loading a procedure in the TCL catalog of the Web server (`tranzistor_pass.tcl`) which listens for request of files in the folder containing all the rating files (`/web/tzmobile/www/wap/rate`).

With every request for a file in the folder the listener calls a procedure (`tr_verify_person_filter`) which then looks for the variables *pass* and *login* that are sent with the request and uses them to obtain

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the clearance level associated with the login and password. If there is no match in the database or the clearance level obtained is higher than five the user is denied access to the folder and returned to the login page which is stored in the non password protected catalog holding the rest of the Tranzistor WAP site.

In order for this to work every request made for a file in the *rate* catalog has to be followed by a login and a password. Since the WAP phones do not yet implement a common standard for “cookies”, this could be a painful process. The WML language, however, supports the storing of variables across multiple decks which makes it fairly easy to include the two variable values with each request in the rating system, without the user (or programmer) explicitly having to send the variables from deck to deck. They exist independently, stored in the cache of the WAP browser, and are easily sent along with any request.

The quick and dirty search engine

The search engine of the Tranzistor WAP site is a quick temporary solution to a complex problem: that is how to present the users with an easy way to get directly to the information that meets their specific requests. We did not have enough time to implement the right answer so here comes the dirty one.

The intention of the search engine is to enable the user to freely input his request and let the database search through all the relevant fields and come up with the matching information. Unfortunately this is not quite the proper description of the Tranzistor WAP search engine. There are several limitations:

- a. The search only covers events/venues.
- b. Only one day can be searched at a time (this could easily be changed though).
- c. Only one string (typically one word) can be matched at a time.
- d. One is can never be sure to get a hit.
- e. The context in which the phrase was matched is not displayed.

Technically the TCL file `search.tcl` sends the user’s search phrase along with its request for `results.tcl`, which then does the hard work. It searches through a number of fields in the database to find a (non case sensitive) match for the word or phrase, then joins the concerning tables and returns the venue/event title(s) and a link(s) back to the user.

Creating an unknown number of select lists with unknown numbers of options

In normalizing⁴¹ the database structure and making it more flexible, there is a tendency to make the SQL queries more complex as they often have to span several tables. One of the more extreme cases is the demand for the freedom to, at a later date, change all the rating categories without having to change the TCL files or the database structure, column or table names, and without influencing the already submitted ratings.

The easy way to make a table that holds different values is to create column names to indicate the category with the values stored in the respective fields. In this case, however, it would not be possible to change the categories on a later basis, at least not without making the rating information that

⁴¹ Lauesen, 1(1999:34).

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existed prior to the change worthless. Our solution to the problem is creation of the table *value* and *category_generator* described above. The difficulty however is not storing the values in the *value* table but creating a general TCL file that can generate an unknown number of WML select lists with unknown numbers of unknown categories and values. The file that does this is *rate_form2_rate.tcl*.

The first thing to take into considerations is that initially known how many categories are to be generated. That depends solely on the number of active categories in the *category_generator* table (the column *active* decides this). Due to the WAP browsers limited cache size, it is not possible to simply have all the select lists on the same card. Initially, we attempted to place them on one page, but the Nokia 7110 could not cope. We solved the problem by creating just one TCL file and making the file aware of how many times it has been executed by the same client prior to the current execution. (This more or less had to be the case, as it is impossible to know how many files to make, as the number of categories varies). This is done by sending a variable, *value_no*, along with request for the file and then increasing it for each execution of the file.

After we have selected the active rows from the database we use *value_no* to decide what row number to select. This is done by letting a while loop run through the rows and:

- a. If the number of times the while loop has been executed is less than *value_no*: continue without writing the values from the database to the selection list.
- b. If the number of times the while loop has been executed equals *value_no*: start creating the selection list on basis of the active row from the database.
- c. If the number of times the while loop has been executed is more than *value_no*: break out of the loop.

An inner loop goes through the fields of the row containing the different choices the rater can choose between in the current category. We know that they are named *val_0*, *val_1*..., *val_9*, but we don't know how many of these actually contain values. What we do know is that if *val_4* holds a null value so does *val_5-val_9*. This is quite simply accounted for by breaking out of the loop if a null value is found. The tricky part is that the name of the variable that the loop is working with (for instance *val_4*) is created on the basis of the counter *i* of the loop. The generated variable name *val_\$i* is stored as a string in another variable called *val*. By asking for the value of that variable twice using `[set [set $val1]]` we obtain the value of, for example, the variable *val_4* if we are in the fifth iteration of the loop.

Then we return the select list to the rater who makes his choice and submits it to the same TCL file, *rate_form2_rate.tcl*, this time with *value_no* increased by one. The file does the insert in the database and runs through the above program code once again. This continues until there are no more rows left to select and the variable *values* is thus null, where after we use *ns_returnredirect* to jump to *tranz_rate.tcl* (the raters menu).

Final technical remarks

One remark about the combination of TCL files and WML is that they actually complement each other quite well. The downside of TCL files and working with Web publishing files is that you have to return the whole page to the client as a string. The language, so to speak embeds, the markup language. This can turn into a pretty complicated way of writing markup language if the pages reach a certain level of sophistication. This is opposed to ADP, PHP and ASP where the markup language

contains pieces of program code to be evaluated before the document is returned to the client. These languages make it easier for the developer to make the static parts of the page more complex as he can separate it from the program code.

In making pages for WAP distribution this is no real obstacle as the WAP browsers incapable of holding very large pages. In our system most of the content is dynamically generated anyway. Due to cache and display size, nearly all existing memory and display space is used to present vital information from the database.

Another detail that turned out to be convenient is the fact that WML functions better by calling, for example, the variable n with the syntax $\$(n)$ as opposed to just $\$n$. This enables the variable to consist of characters divided by white space whilst in TCL you can't call the variable n with the syntax $\$(n)$. If you write a string containing "some text $\$(n)$ some more text" in a TCL file you will literally get this and no interpretation errors, whether the variable n is declared or not. TCL simply doesn't recognize variables starting with '\$'. Thus there were no difficulties using the same variable names in WML and TCL.

A quite annoying limit in designing for WAP is the lack of a decent amount of cache in the WAP browsers. At first we tried to place more cards in one deck so that for, instance the club list and the details on the different clubs could be contained in the same deck but on different cards. This worked at first with a small amount of data in the database, but as a more data was loaded into the database the cache of first the Nokia 7110 and later the Ericsson R320s ran out and the pages could not be displayed. Eventually we split up all but one of the decks so that each card got its own deck. This means that every time a new card is requested the phone has to contact the server and download a new deck which, depending on file size, takes from 3-10 seconds once the connection to the gateway is established; the getting connection takes a bit longer (this typically happens once per session).

Eventually this might not be a bad solution if you compare the download time of small files with just slightly larger files. The bandwidth is so narrow that having to download a deck containing cards that might not ever be displayed, is a high price to pay for the convenience of shorter download time for the next card.

11 USER EVALUATION

We have met with our respondents 3 times during the project period. The first meeting was conducted in order to obtain an insight into the lives of the respondents and to clarify if they were part of our target group. Further we wished to obtain an insight in their demands of our service.

The second meeting was conducted at a nightclub in order to test our WAP service on the respondents.

The third meeting was conducted at a bar in order to test our revised WAP service on the respondents and in addition to the tests we performed qualitative interviews on a nearby café.

11.1 Introducing the qualitative interview and testing

The purpose of using a qualitative interview method is to obtain a subtle description of the interviewee's perception and reception of our service. It is not our intention that our interviews

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should lead to unambiguous unequivocal and quantitative meanings of the respondents' view of our product. Thus we can not ensure that each answer is reproducible in another situation and/or with another interviewer. Further, it is not our intention to obtain quantifiable responses from our respondents. However, we do find that our final analysis is valid and reliable as we have taken precautions to element the different factors that would affect the validity.

The goal of the testings were to obtain information from our respondents on the usability and affordance of our site.

In the following we comment on the precautions we have made in order to ensure reliable test results.

Choice of respondents

We have chosen a number of respondents that fit the description of our target group hence they all have the following characteristics:

- 18-30 year olds.
- Techies.
- Mobile owners and users.
- Goes clubbing averagely once a week.

Profile of respondents

The following profiles of the respondents are based on information acquired on our first encounter with representatives of our target group on May 5 2000.

- Respondent 1: Woman, 27 years of age, goes out averagely once a week, prefers Jazzhouse, Rust and Nasa. Likes electronic music but the music factor isn't the most important factor in her choice of clubs. Uses her mobile phone daily both for telephone and SMS. Uses the Internet daily both for work and for pleasure. Does not have a Palm Pilot but knows what it is – and would very much like one.
- Respondent 2: Man, 26 years of age, goes out a few times a week, prefers Stereo Bar, Nasa, Rust, E and Jazzhouse or other places with smaller underground events going on. Uses his mobile phone all the time – both for telephone and for SMS. He is online most of the day both for work and for pleasure. Has a Palm Pilot.
- Respondent 3: Man 25 years of age, goes out averagely once a week, prefers the places around Skt. Hans Torv and Vesterbro (Rust, Puzzy Galore's, Barcelona, Vega, Delicatessen etc.). He uses his mobile phone daily and mostly with friends and family for SMS only a few times a week. He is online daily – both at home and at work. Has a Palm Pilot.

Choice of locations

As our WAP service is meant to be used at nightclubs and bars we performed our second and third meetings at the same location as where the actual user situation will normally take place.

We could have performed the interviews at the IT-C. However, by doing so, there was a chance that the interviewees would have felt more obliged to respond to our questions on an "academic level". There is, of course, still a slight possibility that they felt this pressure as we conducted the interviews our selves (as representatives of IT-C). However we feel that the informal, and familiar surroundings

did prevent the feeling of an academic pressure on our respondents. Furthermore, we find that the settings of the interviews helped our respondents to feel more as informants than as interviewees – or “testers” of a service, that what we needed was a test and evaluation of our site – and not of our respondents.

The first meeting was performed at the homes of the respondents. Since the interview was conducted mainly to get an idea of the needs of the target group we did not need to be at the actual scene of usage. We found that their homes were a good place to perform the interview as they would feel relaxed and comfortable “on their own turf”.

Interpretation of Interviews

In analyzing the test results from our meetings with the respondents we have chosen to use two levels of interpretation: Self-knowledge and commonsense⁴². On the level of self-interpretation we seek to summarize what the respondents themselves understand as the meaning of what they are saying. The interpretation takes point of departure in what is actually said during the interview.

On the level of commonsense we seek to seize a broader understanding than that of the interviewee. We thus seek to read between the lines of the statements. When a respondent informs us that some might find the ‘Daily Drug’ a provocative category it could be interpreted on this level as the respondent actually finds this category provocative himself, but hides behind the “some” so that he does not stand out as being prudish.

Sources of Error

The fact that all our respondents were familiar with the fact that we have produced the WAP service is a possible source of error. It is possible that they, in order to please the interviewers, were more positive than they would otherwise have been had they not known that we were the producers, or had other impartial interviewers performed the interviews. However, as our interviews were mainly to test the usability of our service and not as much as to their liking of our product we do not find that this source of error undermines the results of our interviews.

Another possible source of error is the way we posed our questions. The fact that we developed the service might have made us blind to the fact that some of the questions posed concerning the respondents liking and reception of our service might have been leading the answers to what we wanted them to be. An example of this is the question “Find out what is going on at Salonen right now”. Using “Right now” leads the user to the correct link ‘Right Now’. It would thus have been less leading to use for example “at this moment”.

In analyzing our results we have strived to reach a subjective consensus⁴³. By this we mean that we have made sure that there was agreement amongst us in interpreting the statements made by our respondents. To reach this agreement we have all analyzed the results and then compared and discussed our findings.

As only one of our respondents had previously used a WAP phone the first testing was somewhat colored by the fact that the respondents did not feel very comfortable with the WAP phones. Thus a lot of the difficulties they had was caused by problems with understanding the usability of the actual

⁴² Kvale (1984:60).

⁴³ Kvale (1984:60).

phones. At the second test they felt much more comfortable with the WAP system which could have affected their attitude towards our site; As they felt better about the usability of the phones they might also have let this positively affect their approach towards the actual site.

We have thus taken into consideration different factors in both the interview situation and in the analyzing phase that could have had influence on both our respondents and our analyzes and thereby invalidate our source of data.

11.2 Results of the tests

We met twice with the respondents with the purpose of getting them to test our site. The first time we met at midnight at Vega⁴⁴ and the second time we met at Pussy Galore's⁴⁵ at 10 p.m. As we also needed to perform interviews during our second meeting we went on to Amokka⁴⁶ after having performed the tests as Pussy Galore's became too noisy for the interviews.

The use tests led to a reevaluation of the already constructed features. In the following we summarize the tests and the changes they led to.

First meeting

The first meeting with our respondents on May 5th was to gather information on their profiles to know if they did fit into our target group. Furthermore, we wished to gather information on which features they would find most important in our WAP site⁴⁷.

Use tests Saturday May 20th

Ratings system⁴⁸: Two of our respondents had problems with the rating system. Respondent #1 found the star system unhelpful as it only displayed the number of stars given and not the maximum number of stars possible. Respondent #2 did not understand the star system right away and thus began reading the comments in order to find the best rating.

To clarify the star system we have now listed the maximum number of stars. Furthermore, we have written out the rating in words so that it now reads “ 5 out of 7” under reviews.

Respondent #3 read the number of ratings as a sign of the quality of the rated place. Although the actual ratings were better for other places he misread the high quantity of ratings as being equal to high quality ratings.

In order to clear this misunderstanding and to ensure accuracy and comprehensibility we now list only the last rating given.

Rating elements: While trying to find the shortest line outside of a club, respondents #3 experienced difficulties as he found the information “too detailed”. Although he found it very well planned, the amount of information disturbed him.

⁴⁴ Vega consists of three rooms: Store Vega (the concert hall, capacity: 1500 persons), Lille Vega (the club venue, capacity: 500 persons) and Ideal Bar (the bar and additionally the cornerstone of the weekend dance club). Is located at Vesterbro. See www.vega.dk for more information.

⁴⁵ Pussy Galore's is a combination of a Café and a bar located at Skt. Hans Torv. Serves up to 100 people both inside and outside.

⁴⁶ Amokka is a Café and Restaurant located at Østerbro, which serves up to 200 people both inside, and outside.

⁴⁷ See copies of the interview guide and questionnaire in appendix 2-4.

⁴⁸ By 'rating system' we are referring to the rating system as presented to the user and not to the underlying system files.

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In order to make the information more comprehensible we limited the text to only include what is absolutely essential for the rating. Further more, the fact that only the last rating performed is presented adds to the compression of the rating element.

Navigation: Respondent #3 found it illogical that it is not possible to find venues that are already happening listed under ‘calendar’. Therefore, we have now listed what is already going on both under ‘Right Now’ and ‘Calendar’.

Respondent #1 suggested that it should be possible to go through ‘Club’ in order to find next week’s schedule for each club. As she was the only one suggesting this feature and due to the limitations in time this feature has not been included in our site although it is a possible link that could be implemented in the future development of the site.

Use tests Tuesday May 24th

Rating system: All respondents show great interest in including a feature that will allow them to find out where their friends are. They all choose which places to go, depending on where their friends are. As they all list this as a crucial factor in determining whether or not they would use our service we have included a chat function, which will allow them to be in constant contact with their friends. Further more, this feature is also a step towards developing a community.

Rating elements: Respondent #2 expressed confusion over the fact that he could not find price information on all venues. He was unsure if a missing price meant that the venue is for free.

In order to clear up this misunderstanding we have changed the system so that when a venue is for free it will be listed as “price = 0” and when Tranzmobile does not have the information of the price it will be listed as “price = ?”.

Navigation: As neither of the respondents used the ‘options’ link we have included a ‘home’ link at the bottom of each page. The ‘Home’ link will take the user back to the index page. We hope that this feature will make the navigation simpler. And as respondent #1 mentioned that she found the navigation very much like that of the Web we thought it would be wise to include this link, which is a normal feature on most Web sites.

Neither of the respondents showed usage of the zones⁴⁹ listed. Therefore, we have removed this feature from the site. The function is however still a part of the database, which allows for the possibility of future development possible. They all expressed need for a location-function; either to show them nearby places or to help them locate other clubs.

Respondent #2 suggested that the navigation would be easier to grasp if all the different genres were categorized in “techno”, “Pop” etc. We have thus made it possible to search for different genres in the ‘search’ function. Hopefully this will make the different venues easier to find. He also complains that the site was too “deep”, meaning that there was too much information listed. To avoid this problem we have compressed the information to include only the most essential facts.

⁴⁹ We had originally divided the city in zones in order to clarify the location of the clubs/bars. As this only led to confusion or was ignored we have removed this feature in the current version of our service.

11.3 Results of the interview

Rating system: In general neither of the respondents experienced difficulties in understanding the rating system and thus understood the meaning of the stars. However, the respondents did question the quality of the rating system due to two main problems: Respondent #2 found the system weak as long as the user did not have a good knowledge of the person who performed the rating. Respondent #1 found the system irrelevant as long as the maximum number of stars was not displayed. After the maximum number of stars was added to the rating system she no longer had any difficulty with understanding the rating system.

Rating elements: There was some inconsistency in the respondents' view on the elements of the rating. Whereas respondent #1 found the "funny elements" (such as the 'Daily Drug' and the 'Buffalo Index') suitable for such a site respondent #2 found that some people might find the 'Daily Drug' provocative, which we interpret as he himself found the element as provocative. Respondent #3 found the 'Daily Drug' funny but not utterly important. As described in chapter 7 the limitations of WAP leaves no room for excessive information. Thus we should consider if our site leaves room for "funny elements without relevance"?

The profile of the rater: The point made by respondent #2 about the importance of the knowledge of the rater is something, which can already now be obtained through the Web site⁵⁰ and should also be implemented in the WAP site. However, this does not solve the problem of individual taste. As long as one is new to the site the ratings will not have as great a value as it will have after having used the site a number of times. As with all venues it depends solely on the individual taste of the rater and whether one agrees with the taste and opinion of the rater or not. The information depends on the personal experience of the users more than the objective description made by the developers of Tranzistor. Thus the value of the content increases with the number of times the site is used.

Navigation: All 3 respondents found it very logical and did not experience any difficulties with navigating their way around the site. Respondent #1 added that she found the navigation very much like that of the Web and that anyone used to navigating their way around the Web would find the sites navigation logical and easy to grasp.

Content: There was general satisfaction with the existing facts. However, all three respondents had suggestions to facts that they found would greatly improve the quality of the facts. Respondent #1 and #2 both suggested that the site linked to transportation options such as taxi companies or bus/train schedules. Respondent #2 in particular found this feature very important. As he has lived in Copenhagen only a few years he often has difficulties finding his way about the city. All agreed that you do not want to deal with difficulties of finding places in such situations (they would rather give up a place they did not know than have to start spending time and energy on locating the place).

Their evaluation was very colored by their opinion of WAP. Especially respondent #2 showed great skepticism of WAP and mentioned himself that this might influence the way he perceived the Tranzmobile site.

All three respondent agreed that the site would gain incredible value if a feature that could keep one informed on the whereabouts of your friends was added. They all found "the friend factor" most

⁵⁰ www.tranzistor.dk

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important in choosing what club to go to. At the present state of the WAP site we have included a chat function, which to some extent can fulfill this need.

Respondent #1 added that she would like a guide to the nearest breakfast place and respondent #3 missed a service that would inform him of the three closest places to the location. These are not services that we are including at this point but that could be added in a further development of the site.

Use of the WAP site: All three respondents showed moderate interest in the site. They all found that the feature of a “friend index” would be a crucial factor in deciding whether or not they would use the site. Respondent #3 thought that the usability of the site is very equal to that of the Web: It is only interesting through the number of people that are using it. If only a few uses it the idea falls apart. However, if the site is used by many – and by friends it becomes a much more attractive service.

11.4 Sub conclusion

As mentioned during the above resume of the user tests and interviews we have tried to correct or ease the Tranzistor WAP system where possible to comply with the users needs and wishes. We have not had the time to implement a few of the ideas that occurred or were emphasized during in tests and interview though we found that they made sense.

First of all it seems evident that we should strengthen the community feeling of the WAP (and Web) site, so that you would know the rater’s taste and be able to find out where your friends are. The latter could be done through some kind of sign up system where you, as community member, log onto the WAP site and input information about which club you are currently attending. Then any other member of the community could log in, send you an SMS from a Tranzistor SMS service page and call you to the chat board.

Another feature, which could be implemented in the future, would be a service, or link to a service that would give the user information about how to get to a particular club, or which club is closest to their current whereabouts. We have included the field *zone* in the database, anticipating that a future, more sophisticated, search facility this could serve as a search parameter. An idea could be to include a function that would provide the number of the busses stopping near by and (for the slightly intoxicated) provide a phone number for a few taxi companies.

12 CONCLUDING DISCUSSION

Integrating WAP with existing Internet technologies

One of the more technical challenges with the Tranzmobile project was to get the WAP site and the Web site to draw from the same information pool. They had to both store and read information from the same database . Furthermore, they had to store it in such a generalized way that it could be easily formatted to suit both media.

We found that both systems could use the same backend technology. This enabled us to keep the sites on the same web server and use the same database (Oracle) and server scripting language (TCL) to suit both front end technologies (WML/WAP and Flash/Internet). Limits in the amount of text that could be conveniently transmitted, displayed and submitted with WAP phones might, in the future,

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lead to both a short and long version of the same basic content. For example, the description of a night club or DJ could be more elaborate for the web site. In formatting the information for both media we had to create different TCL files serving the same data to the two different media.

Convergence with a vengeance

In order to integrate two media it is essential that both media serve a role that emphasizes their particular strengths, and that the other medium can seamlessly take over where the first one falls short. By acknowledging the limits of the different media and dividing the tasks to fully make use of the spectrum that the media spans, new and exiting possibilities may arise.

As of now the Flash and streaming media of the Web site serves the role of presenting astonishing graphics, background information and sweet, electronic beats for the audience sitting at home by their computers. The ability of the Web site to give its users access to this content does not extend beyond the computer, and it is here that the WAP phone enters. Not by trying to compete with the Web site but by supplementing it, creating the possibility to wirelessly update and read actual information about the here and now.

What content, to whom and in which way

An essential for the success of any medium is the combination of the right content, aimed at the appropriate people, and delivered in the best way. WAP sites are no exception. We do not claim to have solved the apparent usability problems of the WAP phones, but believe to have created a service that could not have been implemented in any other existing medium. It might turn out that other backend technologies will take over before the use of WAP phones becomes wide spread. But even before handheld wireless data transmission devices are accessible to the larger population, Tranzistor can still use the existing WAP technology to submit on-the-spot information to update the 'old' medium of the World Wide Web. This is a valuable feature in a fast paced world where only right now is soon enough.

The content is right, the users are there, and wireless is the way to go. The only question remaining is, is WAP the way wireless will go.

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...the DJ at Lab is OK, but doesn't really play music that you can dance to, so he checks out Lab's WebCam, and right enough, it looks like a rather relaxed happening. Jim logs into his Tranzmobile community group, to see if any of his friends have posted any messages lately. John is having a private garden party, and the whole group is invited. Jim calls up Jack, and convinces him to bring his friends over to the party. The party turns out to be a hit, with great music and a lot of common friends. Jack and Jim decide to broadcast the music on the net, so others can enjoy it. Jim hooks his Palmpilot to the mixer, and sets up a link connection to the server.

Meanwhile Julia is standing on Lab, waiting for Jim and Jack. She tries to contact them, but Jack's old WAP phone can't connect to the outdated GSM system. Jim doesn't seem to respond to any of the requests (his handheld is connected to the mixer, and Jims hangs in the bar), so she logs into their user group, to see if any of the boys is logged on the GPS tracking system. The system indicates that Jim is

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in a backyard somewhere in Frederiksberg. She pads her transport unit, and with a disappointed voice she says: “Beam me up Scotty....”

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15 APPENDIX I - XI
