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Combining Internet Technology and Mobile Phones for Emergency Response Management

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Abstract

Report describing work carried out in the NKS/BOK-1.6 MINEP (Mobile Internet and Nuclear Emergency Preparedness) project. The report is intended for persons involved in radiological emergency response management. An introduction is given to the technical basis of the mobile Internet and ongoing development summarised. Examples are given describing how mobile Internet technology has been used to improve monitoring media coverage of incidents and events, and a test is described where web based information was selectively processed and made available to WAP enabled mobile phones. The report concludes with recommendations stressing the need for following mobile Internet developments and taking them into account when designing web applications for radiological response management. Doing so can make web based material accessible to mobile devices at minimal additional cost.

Key words

Mobile Internet, Web, WAP, XHTML, emergency response

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Combining Internet Technology and Mobile Phones for Emergency Response Management

A study within the NKS/BOK-1.6 project

Sigurður Emil Pálsson
Icelandic Radiation Protection Institute

Summary

The merging of telephone and Internet technology offers new possibilities for emergency response management. By mirroring information between the World Wide Web and the mobile Internet, management and experts may exchange information about an accident while away from their offices, and such a system therefore allows for a more flexible use of manpower.

The WAP (Wireless Application Protocol) standard has formed the initial basis in Europe for these developments. The first generation of WAP phones became available early in 2000 but often caused disappointment: some of these phones were unreliable, the gateways to the Internet were often of poor quality, and the GSM phone system had a limited capability for transferring data. Since then, the situation has improved dramatically. The phones have become more reliable, better and more powerful gateways have come into general use. But maybe the most important factor has been the recent introduction of GPRS services. With GPRS, mobile phones are connected directly (digitally) to the Internet and data transfer rates are much faster. The usage is also charged on basis of information transferred, not connection time.

The objectives of the project have been to introduce and demonstrate the mobile Internet to the Nordic nuclear emergency preparedness authorities, to test the technology during exercises and to make recommendations based on the conclusions of project work. To this purpose, a prototype WAP mirror was designed. This is a special server for transforming information between selected web servers and WAP enabled mobile phones.
The initial test was carried out during the Barents Rescue 2001 Alarm exercise (ALEX) in March 2001. The main testing was done during the JINEX-1 exercise in May 2001, after some minor improvements.

The essential information distributed during the JINEX-1 exercise was made accessible in a summarized form via a WAP telephone. Not only was the latest information summary available in this manner; all information summaries were available from a time-indexed list. Update alerts were sent out via e-mail and to most participants also as SMS messages. These alerts were generally received within a few minutes, even between countries. The mirroring of information was thus not passive, it involved active selection and processing. During the exercises, it was possible to monitor the progress of the exercise in real time using an ordinary WAP phone and it was easy to catch up on events later on due to the time-indexed information summaries.

The exercises demonstrated that the mobile Internet has great potential to be of use in emergency response management. It was easy to mirror information between the traditional World Wide Web and the mobile Internet, provided that the web sites were designed properly. To make information easily transportable to other platforms, the web site has to have a consistent format and its structure should be as simple as possible.

Many of the web based emergency response systems that have been or are being constructed are not well suited for accessing using mobile phone technology. In many cases they could have been easily accessible, if only attention had been paid to this issue in the planning stage. Currently (late 2002), the mobile Internet is still in a phase of rapid development. New standards are emerging that offer new possibilities, e.g. constructing web pages that are accessible both with traditional wired web browsers and new mobile phone browsers. This would be possible simply by adhering to the relevant standards. Anyone involved in the use or design of web based emergency response systems is therefore well advised to follow closely developments within this field. The aim with this report is to assist in this respect by providing an introduction. Having to reconstruct systems later on can be a very expensive affair.

Contents of report

1 Introduction

1.1 Why this project?

This report describes work done within the NKS/BOK-1.6/MINEP project, *The Mobile Internet and Nuclear Emergency Preparedness*. Its roots lie in experiments done early in the year 2000 to test the potential use within nuclear emergency preparedness of the mobile Internet. This was at the time an emerging new technology combining mobile phones and the Internet. There have been rapid developments during the last two-and-half years within this field, and technical possibilities that were relatively unknown at the time are now commonplace on the market. The mobile Internet will continue to develop rapidly and organisations involved in nuclear emergency preparedness need not invest in expensive development work, this is done by the open market. But this report concludes that there are very good reasons for such organisations to follow the development closely, because:

- The mobile Internet has the potential of being very useful for emergency preparedness. Information can be made accessible to key personnel (e.g. experts, managers, directors) at all times, wherever they are, securely through their mobile phone (possibly combined with a small handheld computer, a PDA).
- Many of the web sites currently being designed are based on outdated standards or they simply are not following recommended standard procedures. They may be using features popular in current commercial web browsers, but in doing so they become too tied to a particular software environment and are not "future-proof". There are now emerging new standards enabling web sites to be designed so that they can easily be viewed with a wide range of devices, from traditional web browsers to mobile phones. It can be very expensive for emergency preparedness organisations not to take account of these new standards and to have to reconstruct their web sites later.

This report will first describe some of the basic technical background, give early examples of practical uses, describe an exercise carried out in 2001 to test the usefulness in a radiological emergency and at last it gives some recommendations for further work.

This report is written for users (existing and potential) of the mobile Internet, not for technical experts. But some technical description had to be included in the report, in order so that some of the features of the mobile Internet could be understood.

It was decided to have this report optimised for web use. It exists in a printed version, but it is also available as a PDF file from the NKS secretariat at:
http://www.nks.org/
If the report is read on a computer connected to the Internet, all links underlined and in blue can be followed to the respective references.

1.2 The Internet as a distributed network offering redundancy

The Internet has changed radically the lifestyle (at work and home) for most people in the Nordic countries, at least those in any way connected with emergency preparedness. The services provided (for business and pleasure) are becoming more and more sophisticated, with moving images and sound. This in turns puts more load on systems and increases likelihood of failures or reduced performance of services.

It is often forgotten (or not known) that the Internet and World Wide Web started as simple but very powerful tools for physicists, enabling much more effective communication and research co-operation. Also not generally known is that one of the roots of the Internet is nuclear emergency preparedness in the early sixties. The problem was to design a telecommunication network that would have the maximum likelihood of surviving a nuclear attack paralysing some parts of a country and parts of the communication system. The proposed solution was to have a distributed network (no one central node) and to let the information flow through the network in packets, where each packet would try to find a way through the network from sender to receiver. The network had a learning capability so that once a path had been found from sender to receiver, the journey for the remaining packets would be easier. The system was thus based on redundancy, with many distributed components being able to replace each other. This property of the Internet is still valuable for emergency preparedness today.

- The reliability of the Internet should not be mixed with the reliability of individual servers.
- Individual servers can easily be overloaded if they contain information for which there is much demand
- Reliability can be increased by using low traffic servers and additionally by mirroring information to other servers

Basing systems on redundancy is as important now as it was earlier. There are many cases where individual servers have not been able to cope with sudden increased load (surge in information demand), but the Internet as such has proven to be reliable due to its distributed nature.

1.3 The beginnings of the mobile Internet

One of the most interesting advantages in Internet development in recent years has been the integration with mobile telecommunication services. Developers and many in the media and amongst the service providers were quick to describe what a new exciting lifestyle this would enable for many, full Internet access in the pocket. This created excitement and disappointment when the crude first generation devices and services fell short of living up to the expectations. The reaction may be compared to that if the Wright brothers had started to advertise trans-Atlantic flights after their first successful flight (120 feet, 12 seconds) in December 1903, although these services could have been foreseeable at the time.

1.4 Increased integration of mobile and Internet services

Recently there has been an explosive growth in the merging of telephone and Internet technology. The WAP (Wireless Application Protocol) formed initially the basis in Europe for these developments. The first generation of WAP phones became available early in the year 2000 and often caused disappointment. Some of these phones were unreliable, the gateways to the Internet were often of poor quality and the GSM phone system has a limited capability to transfer data. An additional problem was that much of the information was not optimised for the small windows of the phones.

Since then the situation has improved dramatically. The phones have become more reliable, often only software upgrades have been needed (users having experienced problems should check that they have the most recent software upgrade in their phone). Better and more powerful gateways have come into general use and now (late 2002) GPRS services have become commonplace. They offer much better methods of data transfer than GSM (faster rates of data transfer and the user can be continuously connected to the Internet, only paying for the amount of data transferred).

The mobile Internet is getting more open, new standards open up new possibilities. The use of the term “WAP” is decreasing, as WAP as it is known now will soon be replaced by far more powerful tools. The mobile Internet can be a very useful tool for emergency preparedness and it is very important for users (not just technical experts) to follow developments in this field.

2 Technical background - References

It is not the aim here to provide a comprehensive documentation on communication technology, only the basis that is necessary to understand the functionality and interaction between the systems being discussed. The end of this section provides references, wherefrom more information can be obtained.

2.1 What is WAP?

Direct use of the Internet on mobile phones was initially based on the WAP (Wireless Application Protocol) standard 1.0 and later 1.1.

One key feature was the division of the structure of communication into layers independent of each other, with Application Layer at the top and the Network layer at the bottom. This meant that applications could be developed independently of the method used to transport the information. Thus it was easy to incorporate new more powerful carriers as they became available, e.g. to use the far more powerful GPRS instead of GSM. Using GSM the connection to the Internet has to be made trough a modem and the user pays for the time used. GPRS offers a direct digital connection to the Internet. The connection takes just seconds, the rate of information transfer is much higher and the user pays for the amount of data transferred, not for the connection time. Within the last year GPRS phones and services have become common.

Another key feature of early WAP is the use of WML (Wireless Markup Language). This is a language similar to HTML (**HyperText Markup Language)** used for the traditional Web, but optimised for telephony. A special WAPGateway is used to access all WML content over the Internet. The information has either to be specially coded in WML or some form of a proxy used to transform traditional web information into WML, a format suitable for WAP.

2.2 The initial disappointment of users with WAP

WAP technology and devices (phones) were initially introduced with advertising campaigns and media coverage that raised high users expectations. The whole of the Internet was to be available in one's hand. Generally the first experience did not live up to these expectations, it was disappointment. The screens were small, inputting information was cumbersome and the transfer of information was slow and connection times could be long. The root of the problem was not the WAP standard as such, it was simply that the then available GSM technology was very restricted in data transfer. The situation improved greatly with the arrival of GPRS phones and services. Now the connection could be made in seconds and the transfer of data was fast. New still faster bearers of information will continue to improve the rate of information transfer. With GPRS it is already enough for most text applications, new systems would mainly improve the situation for other tasks such as the transfer of images.

2.3 New developments – The future of the mobile Internet

All persons developing or making decisions on services using mobile and/or traditional web services should be aware of important new developments in standards for these applications. These are described in a very readable manner in a recent White Paper on ***Browsing on mobile devices*** from Nokia:
http://www.nokia.com/downloads/solutions/mobile_software/XHTML_A4_0810.pdf

The WAP Forum and the World Wide Web Consortium (W3C) have for several years defined the mobile Internet standards. The WAP Forum has now adopted the **XHTML (Extensible HyperText Markup Language) Basic™** standard from W3C as the basis for the next generation of WAP, WAP 2.0. XHTML is a modular extension of traditional HTML, but in a strict well defined form. It can offer the rich control and precise document layout users of traditional web services have gotten used to expect. At the same time (with the Mobile Profile extension as XHTML MP), it can be shared across many different classes of devices – a desktop computer, a small handheld computer commonly called *Personal Digital Assistant* (PDA) and a mobile device (telephone).

The control of appearance in XHTML MP is done through cascading style sheets (CSS), that describe how documents are presented on screen in each type of browser. The use of CSS has been actively promoted by the W3C on all browsers, desktop as well as mobile. The general layout of documents can thus be separated from the content of each document, and the general layout can be optimised for each type of device. The content provider needs only to be concerned with the information to be distributed.

XHTML is thus to form a common basis for both traditional web applications as well as the mobile Internet. Mobile phone users would then be able to access the same web sites as traditional wired users, without any special proxy servers transforming the information from one language to another.

2.4 Secure transfer of confidential information

Secure transmission of confidential information over the Internet (including the Web) has been possible for some years using SSL, where the information is encrypted while being transferred. New solutions are now being developed.

2.4.1 Secure transfer of documents - ebXML

There is ongoing development work to ensure the secure transfer of documents over the Internet. This is being driven by the business community, but the solutions developed can also be relevant for emergency preparedness organizations. The work within in this field is summarized on the ebXML web site as follows:

> *ebXML (Electronic Business using eXtensible Markup Language), sponsored by UN/CEFACT and OASIS, is a modular suite of specifications that enables enterprises of any size and in any*

geographical location to conduct business over the Internet. Using ebXML, companies now have a standard method to exchange business messages, conduct trading relationships, communicate data in common terms and define and register business processes.

http://www.ebxml.org/

2.4.2 Secure communication channels – The Tetra system

How data is transmitted is beyond the scope of this report. For some official use the Internet does not offer sufficient reliability and security. Many countries have now started to use or are to some degree adopting the Tetra communications system (e.g. for police and similar public safety services). The Tetra system can make use of internet technology (while being separate from The Internet). Much of what this report describes is therefore also relevant for use within Tetra networks. For more information on the Tetra system and devices:
http://www.tetramou.com/

2.5 References for more information

2.5.1 Development of the World Wide Web

For more information about current development of the World Wide Web, please go to the web site of the World Wide Web Consortium (W3C):
http://www.w3.org/

2.5.2 The Internet

For more information about the Internet itself and current developments, **The Internet Engineering Task Force** should be consulted:
http://www.ietf.org/

2.5.3 WAP

Information about the mobile Internet and WAP has been available from the web site of the WAP Forum.
http://www.wapforum.org/

This includes a general introduction to WAP in the **WAP White Paper**:
http://www.wapforum.org/what/WAP_white_pages.pdf

The WAP Forum has now become **The Open Mobile Alliance Ltd (OMA).** More information on current developments within mobile internet technology and applications can be found at their web site:
http://www.openmobilealliance.org/

Currently the OMA site seems to be taking over the material from the WAP Forum site. But anyone needing information would be well advised to search at both sites

2.5.4 Use of the current HTML standard

The W3C **HyperText Markup Language (HTML) Home Page** is recommended reading.
http://www.w3.org/MarkUp/
It describes the HTML standard and in what way XHTML is different. It provides links to various sources of information and gives also very useful guidelines for HTML authors, which will make it more likely that web pages are easy to maintain and look acceptable to users regardless of the type of browsers they are using. These include:

- Proper use of style sheets
- Avoid the FONT tag (which is used by many commercial programs to imitate the look of a printed document)
- Make pages readable by those with disabilities

2.5.5 The new XHTML standard

The following document contains a very informative introduction, describing XHTML and its relationship to other standards and how it can provide one standard platform for traditional web and mobile Internet applications.
XHTML™ 1.0: The Extensible HyperText Markup Language (Second Edition)
http://www.w3.org/TR/2001/WD-xhtml1-20011004/
This was published as a recommendation in August 2002.

Description on the current (December 2002) status of XHTML development can be found in the document **XHTML™ 2.0** (W3C Working Draft 11 December 2002):
http://www.w3.org/TR/xhtml2/

2.5.6 Useful tool to investigate the new web possibilities

W3C also distributes a web browser, **Amaya**, free-of-charge. It is also an editor and authoring tool. It can be used to demonstrate and test many of the new developments in web protocols and formats such as XHTML pages, as well as CSS style sheets, MathML expressions, and SVG drawings, in addition to traditional HTML pages. Amaya has a "WYSIWYG style" of interface, similar to that of the most popular commercial browsers. For more information on **Amaya** and downloading:
http://www.w3.org/Amaya/

3 Practical use of the mobile Internet for following media coverage

Experts at emergency preparedness organisations need to be able to respond quickly to events and incidents, to assess them and the media coverage. With increasing use of the Internet to distribute news and give access to news sources, the usefulness of the mobile Internet increases. Examples of such use are given in this chapter.

3.1 Case 1: Reported leak in a nuclear power plant

On Sunday, 9 April, 2000 it was reported in a radio news broadcast in Iceland that a gas leak had occurred in a nuclear power plant in the UK. Source of the news was quoted as the BBC news service. More information was needed in order to assess the situation and be prepared for possible inquires from the media. Instead of using an old home computer, information was obtained using a Palm PDA. It proved to be faster than using the home computer and it quickly revealed that there had been no release of radionuclides and there was no serious situation.

The image below shows the beginning of the BBC news report as it was displayed on a Palm screen (dimension of image on the Palm screen: 5,6 x 5,6 cm)

The full text of the news report could easily be read on this small device. Two versions of the BBC web page are available, one low graphics version and one high graphics.

The full story could be read in the usual ("high graphics") format at:
http://news6.thdo.bbc.co.uk/hi/english/uk/newsid%5F707000/707300.stm
A low graphic version could be found at:
http://news6.thdo.bbc.co.uk/low/english/uk/newsid_707000/707300.stm
(this version was used for converting to the Palm format)

Information on the Dungeness B nuclear power plant (from INSC data base)

Further information on the Dungeness B nuclear plant was then obtained from the International Nuclear Safety Center (INSC) data base The image shown below is the screen that appeared after having accessed the web page: http://www.insc.anl.gov/plants/index.html (page no longer active) and requested a list of all nuclear power plants in the United Kingdom.

The incident proved to be not a serious one, but the usefulness of being able to access this type of information at any time, anywhere, didn't escape the author. Shortly afterwards the author could use the technique preparing for a TV interview. He was able to obtain an updated view of a situation from various news web sites while waiting out in the street for the TV crew to set up the camera.

3.2 Case 2: The Kursk accident

The Kursk accident in August 2000 caused considerable media interest and here again the mobile Internet proved to be a useful tool for following media coverage.

The figure above shows the initial coverage of the Kursk accident as done by the BBC news service (here shown as displayed on the screen of a Palm PDA).

3.3 Case 3: Two large earthquakes in Iceland

In June 2000 two large earthquakes occurred in Iceland, each having a magnitude of 6,6.

- 17 June at 15:40
- 21 June at 00:51

In each case the daily paper "Morgunblaðið" had started distributing information via its web site only 4 minutes after the occurrence of the earthquake. For the latter earthquake the first information available on this web site before any information had been broadcast via radio. In previous cases involving smaller earthquakes, the response time of the "Morgunblaðið" web site has been as quick as 3 minutes.


www.mbl.is

Laugardagur | 17. júní | 2000
Innlent | 17/6´00 15:44
Jarðskjálfti finnst á höfuðborgarsvæðinu
Rétt í þessu reið jarðskjálfti yfir landið og fannst að minnsta kosti vel í Reykjavík. Veðurstofan getur ekki sagt að svo stöddu hve öflugur skjálftinn var né hvar upptök hans eru. Svo virðist sem símasambandslaust sé í GSM-kerfi.

The first report on the Morgunblaðið web site on the earthquake of 17 June 2000. It was published only 4 minutes after the earthquake occurred and it says that seismologists do not yet know the origin or the magnitude. First estimates of these followed soon afterwards.

Lessons from the Icelandic earthquakes of June 2000
The news media can be incredibly fast to act (with an Internet news service being fastest to respond during the night time earthquake). The authorities must also minimize their response time.
The communication network functioned, including mobile phones and Internet. The phone network tolerated the usage under stress

3.4 Lessons learned

These early examples demonstrated that the news media was in many cases using the Internet in a very efficient manner, and that it would be an important addition to already existing channels of communication.

The challenge was now, how could the nuclear emergency preparedness organizations use this technology for their own distribution of information

4 Testing the use of the mobile Internet for exchanging emergency preparedness related information

4.1 Mechanism of mirroring information between the Web and WAP enabled mobile phones

When a WAP phone requests information from a mirrored web site, the chain of events is as follows:

- The WAP phone connects to a WAP gateway, normally in the same country as the user
- The gateway contacts the WAP mirror program via the Internet (in this case the mirror was running on a computer in London)
- The WAP mirror program contacts the web site of interest and requests the required information
- The WAP mirror program then sends the information back to the WAP gateway in a changed format suitable for the particular WAP device requesting the information (the format is optimized for the device requesting information)
- The WAP gateway sends the information to the WAP phone.

4.2 A system for mirroring information between WEB and mobile phones

It was decided to test the potential usefulness of the mobile Internet for nuclear emergency preparedness, by establishing a special web site to be mirrored to WAP devices, and also to mirror a few selected Nordic web pages and permission was also granted to mirror the IAEA ENAC web site in this test.

A tested commercial software solution was used: **Dimon Server 3** (previously *Waporizer*) from Dimon Software,
http://www.dimonsoftware.com)
The program can be instructed to:

- select information from (almost) any web page and even databases
- restructure the information
- make the selected (and possibly restructured) information available on mobile phones (at that time using the WAP standard).

Effect of screen size on information displayed
A desktop screen can be large and contain:

- more information
- more complex layout

than the screen of a handheld mobile device.

This must be taken into account when moving information from the Web to handheld devices. The window of a mobile device is (and will be) much smaller than the window of a desktop computer. This needs to be taken into consideration, whatever improvements are made in rates of data transfer. Information optimised for a desktop computer needs somehow to be

condensed if it is to be optimised for a mobile device. This can be easy if the information is static (not changing). If the information is however changing, the problem becomes more complex and the mirroring (or mapping) has to be based on the structure of the information, not its contents.

Requirements for successful use of WAP mirror
The mirroring is dynamic, changes in the contents of the web page are instantly reflected to WAP (the requested information is extracted from the web page when a request for information is received from a WAP phone). The structure of the web page must however not change (the program recognizes the information to fetch from the web page's structure, not contents).

4.3 Testing in exercises

The initial testing was done during a Swedish nuclear emergency preparedness exercise, ALEX, in spring 2001, the final more comprehensive testing was done during the international Jinex-1 exercise shortly afterwards.

The figure shows a simulated display of the MINEP title page on a WAP phone (Nokia 7110) during the ALEX exercise.

Exercises used for testing

- The experimental WAP mirror was after initial testing used in the following exercises:
  - **ALEX** (Swedish exercise with international participation)
  - **JINEX 1**

Web sites used in the experiment:

- IAEA ENAC web site (SSL secure, requires user name and password)
- Swedish SWEREM site, emergency preparedness information
- Norwegian site (NRPA), exercise use
- Finnish site (STUK) public information
- MINEP TEST site (operated by the Icelandic Radiation Protection Institute), information summarized for experts and managers

Figure showing images from SWEREM, ENAC and the MINEP TEST site.

4.4 Construction of a special MINEP web site, to test mirroring information

A special MINEP test site was constructed to test the mirroring of information between a web site and mobile phones. Both push and pull modes were used at the site. The structure of the MINEP test web site was deliberately kept simple. It proved to be very easy and relatively fast to set up the special MINEP test web site, establish access control, and define the rules for its use.

Short summary on the Web:

- written after new information was received
- placed quickly on the Web
- thus also instantly also accessible on WAP mobile devices

e-mail / SMS notification:

- of Web update sent out to registered receivers. The SMS message contained the essence of the new information

A combination of push-pull technology was used, alerts with information summaries were sent to participants (subscribers of service), they could then fetch more detailed information if and when they wanted. The following design criteria were used for designing the MINEP test web site (to be mirrored to WAP):

Structure:

- Simple. A table used for dividing text into blocks.
- Time of publishing to the Web used as index.

Writing style:

- Short condensed text.
- Descriptive sentence at beginning of block.
- Source of information quoted.
- Time given when information was valid.

The information transfer involved the following steps:

1. Information compiled and put on a web site
2. Alarm messages sent out by e-mail and SMS summaries to mobile phones, notifying subscribers that new information was available, the

new information was also summarized. (Note: It is very easy to automate this in a system, so that alerts are sent every time now information is posted on a web site).

3. The subscribers could then read the new message (and previous ones) on a web page
    - using an Internet connected desktop computer
    - using a PDA computer and a mobile phone on a WAP page
    - using a WAP mobile phone
    - using a PDA with a WAP simulator and a mobile phone
    - using an ordinary desktop computer with an Internet connected WAP emulator

Details of the MINEP test web page are as follows

On this page short summaries were prepared and published a few minutes after relevant important new information had been received. The page has the following structure:

- The summaries are placed in chronological order, with the newest placed on top of the page.
- The time of publishing the summary is used as an index.
- Each summary is written so that the beginning of the text would be indicative of the contents of the summary. This makes it possible to use the beginning of each message as a header when the information was mirrored to WAP.
- Each summary also identified the source of information.

It should be noted that the mirror image on the WAP site has additional features not found on the source web site. Understandably the information is divided into small pages ("cards"), one summary on each page. The listing of pages gives the time of publishing and the beginning of text of each summary. The mirrored WAP site offers the user the option of reversing the time order of the listed summaries. Thus a user can go quickly to the first event listed (and then go forwards in time) or to the latest event (and go backwards in time).

If the summaries are well written, then it is possible for an expert (or manager) to follow the development of an accident away from the office using only a WAP mobile phone.

This is just a simple example of possible uses. Other types of summary pages could also be used, e.g. having a continuously updated status summary with a given structure (e.g. based on the IAEA N-2 form; a list of potential countermeasures etc.).

The web version of the MINEP test web page can be found at:
http://www.gr.is/Jinex-1_exercise/

JINEX-1 Initial information placed on test Web site

10:12 IAEA N-2: "Site emergency" at Gravelines NPP. On-site emergency plan activated at 6:00. Provisional INES rating 2. No severe damage to fuel, no release. Info received at 10:03, valid at 8:00.
Note: Information has now been placed on IAEA's ENAC site.

09:40 IAEA N-1 notification has been received. "Alert" at Gravelines NPP France. No radioactive release, not considered likely. No off-site protective actions. Info received 9:34, valid at 6:45.

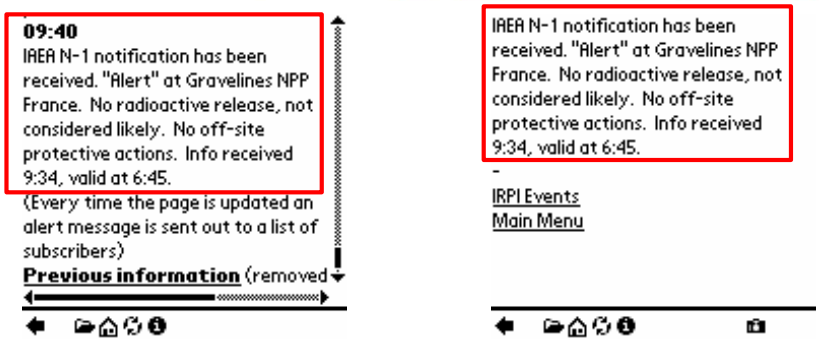
This figure shows how the initial information was displayed on MINEP Information page at the beginning of the JINEX-1 exercise.

It was essential for successful mapping that the mirroring program could somehow recognize the contents of the web page as blocks of information and know how to treat each block. In this case the text was arranged in a table. In the HTML code used for web pages each cell is marked with tags at the beginning and end (in this case "<td" and </td>").

Example of the first text cell:

```
<td width="79"><b>09:40</b></td>
 <td width="548">IAEA N-1 notification has been received.
&amp;quot;Alert&amp;quot; at Gravelines
 NPP France.&amp;nbsp; No radioactive release, not considered
likely.&amp;nbsp; No off-site
 protective actions.&amp;nbsp; Info received 9:34, valid at 6:45.</td>
 </tr>
</table>
```

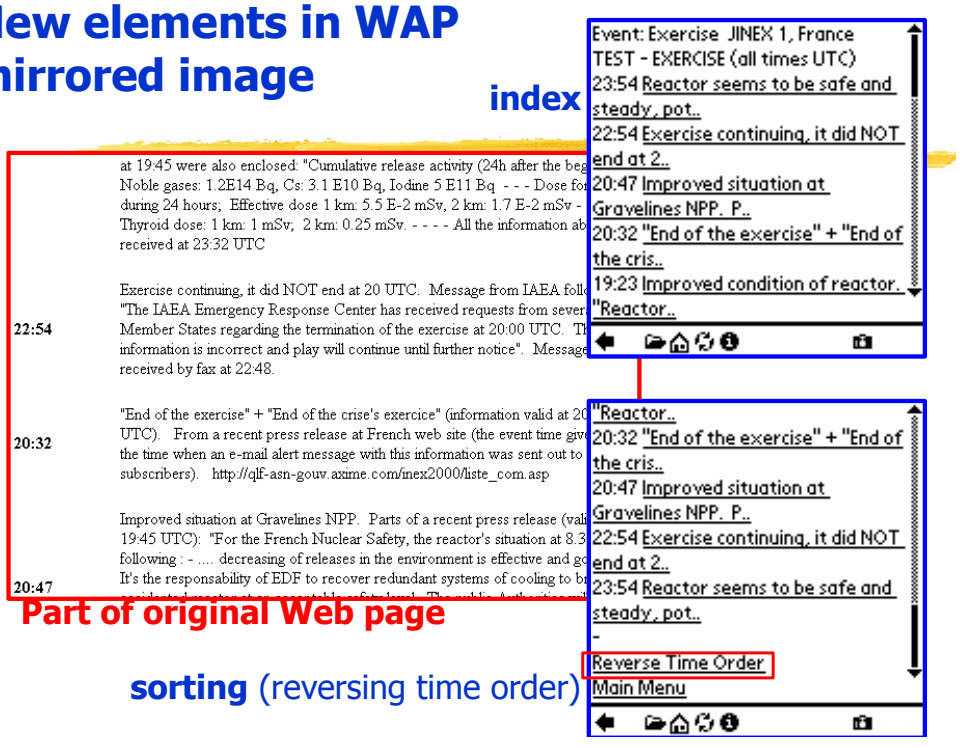
Mirroring of contents of cells in table (to a mobile device)



Original Web site **WAP mirror**

The figure above shows for comparison how information from the original web site and the WAP mirror site was displayed on the same mobile device.

New elements in WAP mirrored image



The figure above shows how text cells in the original web page on the left were mirrored into a different format on the WAP site, with two new elements added, index and sorting:

- The beginning of the text in each cell was displayed with the time of publishing as an index line, the rest of the text in the cell could be viewed

by selecting the index line (thus it was possible to get an indexed overview of messages, even in a small mobile phone display)
- The new index list could be sorted with newest events displayed first (at top) or in chronological order with first event listed at top.

4.5 The test and its outcome

4.5.1 Reaction of test users: Very positive

Felt that they could continue to monitor developments after having left the workplace in a convenient way:
- Receiving an SMS message with a one sentence summary
- Being then able to read the whole text on their WAP phone

The system was also tested in by users situated in Spain and the UK during the exercise.

4.5.2 Technical performance

The amount and formatting of information sent to mobile devices using WAP depends very much upon the type of mobile device (phone) used. Current phones have more memory than first generation WAP phones that became common early last year, and they can thus store and display more information before having to request more data. In this test the NOKIA 7110 mobile phone was used as an example of a popular first generation phone and that was taken to represent the phone of a typical current user. Current phones can offer better performance and GPRS phones that have appeared on the market this year can offer still better performance (e.g. through being continuously on-line). The performance of individual sites was monitored using the special mirrored site cited above. Afterwards the information was also viewed in a *Dimon Server 3* development tool, which enables the developer to view (and control) how the information is displayed on various types of mobile phones and small computers (such as Palm) with an WAP emulator.

It was possible to view most of the web pages (constructed with HTML code), as long as the structure of the page had not been changed. If e.g. information was divided using different dividers than had been used when the transformation was designed, then the mirroring failed.
- Almost any web page could be mirrored to WAP, as long as it had a clear and unchanged structure
- Preferable to design web pages bearing in mind possible mirroring to other platforms (use simple, consistent style)
- The WAP mirroring can be used to introduce new structural elements (e.g. index, sorting of information)

4.5.3 Importance of consistent structure when mapping from Web to WAP

The success of mapping from the Web to WAP depends on the web pages having a well defined consistent structure (the content can be changing), "as seen from the viewpoint of a computer", that is the program reading the HTML code of the page. It is not enough to keep a consistent appearance of a

document, the structure of the underlying computer (HTML) code has to be consistent. Blocks of text can e.g. be separated by using HEADINGS or by paragraph separators and enlarged ordinary text. The appearance on the computer screen may be similar, but the difference can be decisive to a computer program trying to understand the structure of the text.

Problem: Consistent appearance
does not necessarily mean consistent structure

This text is enlarged changing the font size and using bold type face

This text is normal text

This text is enlarged by defining it as "heading 1"

The first and third line in the web text above have the same appearance, but the underlying structure (HTML code) is very different. The first line is generated through changing the font size, which is not recommended as was mentioned in the Introduction.

The web text above was generated with the following HTML code. The tags that define the appearance of the first and third line have been highlighted.

```
<p><b><font size="6">This text is enlarged changing the font size and using
bold type face</font></b></p>
<p>This text is normal text</p>
<h1>This text is enlarged by defining it as &amp;quot;heading 1&amp;quot;</h1>
<p>&amp;nbsp;</p>
```

As long as the web source documents have a well defined form and are used in a consistent manner (incl. keywords) then an intelligent mirror can be used to compile information and display to web and WAP devices, e.g.: Compiling information about plant site situation, releases, INES ratings etc.

4.5.4 Conclusions of test

Greatly extends the reach of the traditional Internet / Web

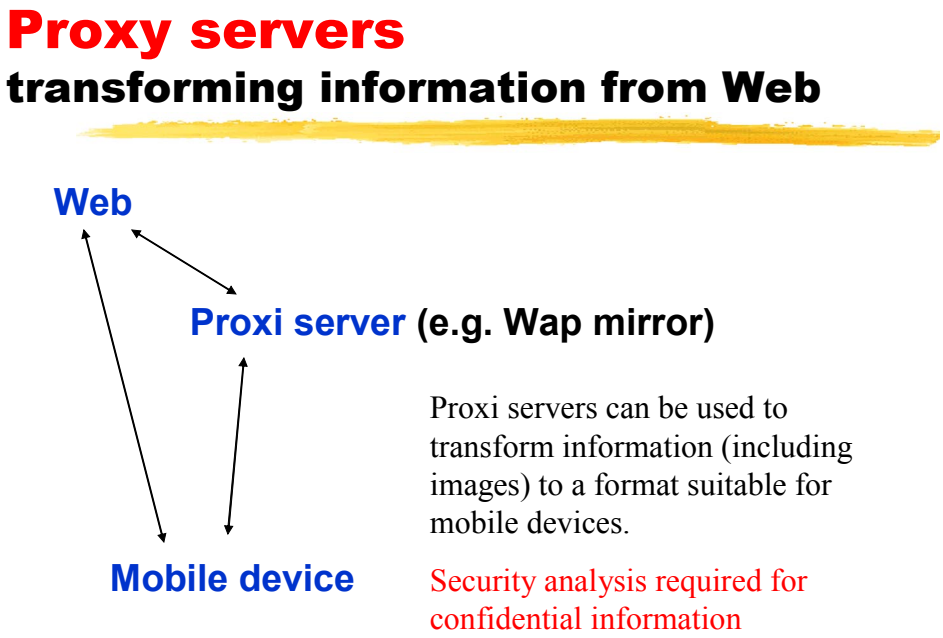
- Just one simple type of use presented here, interactive use and use of databases are easy to implement
- Greatly improved services and devices now becoming available.
- Information availability on the Web probably now the limiting factor

The test demonstrated:

- Potential usefulness of the mobile Internet, using only already available components
- The need to show care when designing web sites to be used for emergency preparedness, keep them as simple as possible and well structured. This does not need to be limiting for the functionality of the web site in any way, but lack of structure and unnecessary complexity can significantly reduce the possibility of mirroring the information to other platforms (not only mobile devices).

5 Using proxy servers to mirror information – pros and cons

Using a proxy server to mirror or even process the information can be very useful, especially when it is used to reconstruct the information and e.g. make summaries suitable for small screens, as was done in this exercise.



But **not** using proxy servers can also have its advantages.

The advantages of not using a proxy server for mirroring information:

- Increased reliability. The user is not dependent upon the operation of a special server (which may get overloaded)
- It is easier to demonstrate secure treatment of confidential information (information can be transferred using 128 bit bank grade SSL encryption from web site to mobile device, like to any other web browser.

The advantages have to be weighed against the disadvantages in each case, depending also on the technical solutions available at the time.

6 Presentations of project work at meetings

Results of project work were presented at an OECD/NEA meeting in June 2001. The project was regularly presented at meetings of the NEP group, with experts from the Nordic nuclear emergency preparedness organisations and useful feedback was obtained at these meetings.

7 Conclusions and recommendations

Mobile devices linked to the Web e.g. make it possible (or easier):

- for local experts and managers to stay updated while away from the workplace (better utilization of limited manpower)
- domestic official / expert information exchange
- to make information (e.g. assessments) available to co-operating authorities in other countries.

The test carried out in 2001 showed that there are already commercial systems available that can select key information from a web site and mirror it to mobile devices, provided the structure of the information stays consistent. This could also be done for secure web sites using SSL technology.

Use of proxy servers to convert confidential information can require analysis of the risk to confidentiality. Furthermore all special servers the information has to go through decreases the characteristic redundancy of the Internet, all such servers have to have enough capacity to avoid the risk of overloading.

The use of the new standards for XHTML would make it possible to have the same web site accessible for both traditional web browsers and new browser for mobile devices. The new standards make it possible to define browser dependent layout for the information.

Currently some of the institutions responsible for radiological emergency preparedness seem to be using web servers that are not suited for access by mobile devices. Of course not all web pages need to be designed to be accessible in such a way. But it can be very expensive to have to reconstruct a web site afterwards in case this feature is required and would have been available, if only e.g. the new standards had been followed in the design phase.

It is therefore highly recommended that the relevant emergency preparedness originations follow development in this field and harmonise their actions to the degree they feel is relevant.

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NKS
http://www.nks.org/

Dimon Software
http://www.dimonsoftware.com/

9 Disclaimer

The reference to specific devices, tools or services does not indicate special endorsement by the NKS or the author.

Appendix

List of acronyms

CSS	Cascading Style Sheets (controlling layout on web sites)
ebXML	Electronic Business using eXtensible Markup Language
GPRS	General Packet Radio Services (extension of GSM, direct fast digital connection to the Internet)
GSM	Global System for Mobile Communications
HTML	HyperText Markup Language (used for WWW)
INSC	International Nuclear Safety Center
OMA	Open Mobile Alliance Ltd.
PDA	Personal Digital Assistant (a small handheld computer)
SMS	Short Message Service (service for sending short text messages to mobile phones)
SSL	Secure Sockets Layer (protocol for secure transfer of information over a internet)
W3C	World Wide Web Consortium
WAP	Wireless Application Protocol (a standard for mobile Internet)
WML	Wireless Markup Language (similar to HTML, used for WAP 1)
WWW	World Wide Web
XHTML	Extensible HyperText Markup Language (extended new HTML)
XHTML MP	XHTML with Mobile Profile extension (for mobile and wired browsers)

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Abstract	Report describing work carried out in the NKS/BOK-1.6 MINEP (Mobile Internet and Nuclear Emergency Preparedness) project. The report is intended for persons involved in radiological emergency response management. An introduction is given to the technical basis of the mobile Internet and ongoing development summarised. Examples are given describing how mobile Internet technology has been used to improve monitoring media coverage of incidents and events, and a test is described where web based information was selectively processed and made available to WAP enabled mobile phones. The report concludes with recommendations stressing the need for following mobile Internet developments and taking them into account when designing web applications for radiological response management. Doing so can make web based material accessible to mobile devices at minimal additional cost.
Key words	Mobile Internet, Web, WAP, XHTML, emergency response

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