IT University of Copenhagen

Student project

December 2005

Broadcasting to handheld devices - users' preferences

Thorarinn Stefansson

thorarinn@thorarinn.com

Instructor:

Peter Olaf Looms

Introduction

The transmission of video to handheld devices (in particular mobile phones) is widely mentioned in the media and international conferences as several competing technologies are currently being developed and tested. This is seen by many as the next step in achieving the premise of being able to watch *anything, anytime, anywhere and on any device.*

This paper focuses on the possibilities for broadcast of content to handheld devices, with a special focus on video broadcast. The benefits and drawbacks of broadcasting techniques are described in reference to other methods of distribution.

The necessary technologies for broadcasting to handhelds are becoming available, but the question remains how users will respond to this technique and how feasible it is in comparison to other methods for transmitting video to handheld devices.

As an attempt at providing a basis for drawing conclusions about user preferences I will present three archetypes of users and discuss what can be concluded about their wishes and capabilities when it comes to broadcast content. Finally I compare these discussions with existing research and propose further studies to provide answers to some important unanswered questions.

Problem statement

> *With the technology necessary to broadcast video to handheld devices becoming available, the question remains what type of content the coming users will prefer. Do they prefer conventional broadcast television or does this new medium require new types of content? What research has been done in this area and what possible avenues remain to be studied?*

Methodology

This paper is based on desktop research of existing research and business literature, including news stories and press releases. An attempt is made to detect patterns and present a holistic description of the research area with focus on the questions presented in the problem statement.

Technologies and concepts

Before discussing the user's preferences, I will provide an overview over the most important technologies for the various methods of accessing content on handheld devices.

Competing methods: Broadcast and unicast

Broadcast is the classical method for distributing radio or television content where the same content (data) is transmitted through the whole network. The content is sent from one sender to all connected receivers and broadcast can therefore be described as *one-to-all* distribution.

Users with appropriate receivers can choose what portion of the content they access (such as individual television channels), but have no direct way of feedback or any option to receive the content at a later time (except for scheduled reruns).

Unicast (or streaming) is the prevalent method of sending information on computer networks. In unicast the content is broken down into data-packets. Each packet of data is sent to only one user upon request, with a bi-directional flow of information (a portion of the communication takes place at a system level invisible to the user). Unicast is thus *one-to-one* distribution.

What is sometimes referred to as "internet-broadcasting" is most commonly based on unicast distribution with individual data-streams sent to various users independent of each other.

There are methods, such as "IP multicast" or the use of peer-to-peer networking, that can be seen as hybrids of broadcast and unicast, but ultimately the end-user is usually receives a one-to-one stream of information. For the sake of simplicity this paper will focus on the differences between broadcast and unicast, even if the networks described as unicast may be partially based on multicasting where applicable.

IP-broadcast is a term for sending data-packages over a network using the Internet Protocol, providing the basic technology for digital broadcast. In this paper the terms *broadcast* (in the context of handheld devices), *IP-broadcast* and *IP-datacast* will be used indiscriminately.

Another categorization of distribution methods is whether or not they are bi-directional. That is whether information can only be sent in one direction, as in classic broadcast methods, or back and forth as in packet-switching, unicast networks. This comes into effect when interactivity is called for.

In essence, from the user's point of view, broadcasting to handheld devices is analogous to traditional radio and television (asides from some technical and ergonomic issues discussed later in this paper). This means that just as in television the data broadcasted can be:

- Video and audio; a typical television channel
- Audio-only; radio signal (or an audio-only channel on TV)
- Text based; teletext or
- Combinations of all three.

Obviously, sending both video and audio involves the highest data "rate", audio is also quite demanding, whereas text based data only requires a fraction of the bandwidth needed for video.

The following chapters will mainly focus on the use of different methods for transmitting video content, as this is the most challenging type of content. It can therefore be assumed that unless otherwise stated, the term *broadcast* means *video broadcast*.

Handhelds: Possibilities and limitations

In this paper, the concept "handheld devices" refers to devices that are truly handheld (rather than portable or luggable). This excludes laptop computers, but includes devices such as:

- Mobile phones
- PDAs
- Handheld media players and PVRs
- Handheld game consoles
- Various hybrids combining the functionality of the above.

To be of interest in this context, these handheld devices clearly have to be capable of receiving external data by some kind of wireless communication. The most commonly mentioned type of handhelds when it comes to distribution of video content and

broadcasting in general is the mobile phone, but with the evolution of hybrids and expansion of other types of wireless networks (such as WiFi) more handheld devices are becoming capable of truly mobile connections.

It is precisely the same aspects of handhelds that make them attractive to users that become problematic when receiving transmitted content. The compact sizes provide ergonomic challenges, mobility and the limited battery life provide technical challenges. Any successful broadcast standard for handhelds must therefore overcome these obstacles.

DVB-H: An example of a broadcast standard

There are currently several competing standards for broadcast to handheld devices. Explaining the differences between these is outside the scope of this paper, but the DVB-H is discussed here as an example of these standards.

Several DVB-H trials are now underway, and commercial launches of DVB-H services are expected in 2006.

The DVB-H standard (Digital Video Broadcasting – Handheld) is based on the DVB-T (Digital Video Broadcasting – Terrestrial) standard for the broadcast transmission of digital terrestrial television (that is, neither transmitted via satellite nor cable). The DVB-H is a uni-directional, one-to-many technology.

In order to save on batteries the signal of a DVB-H channel is not transmitted in a continuum as in DVB-T. Instead it is sent in compressed bursts that the device receives, saves and finally decompresses and plays in real-time. The next data burst is received a few seconds later and combined to a continuous playback. This technology is called *time slicing* and allows several DVB-H channels to be sent in the same bandwidth as a single uncompressed DVB-T TV program.

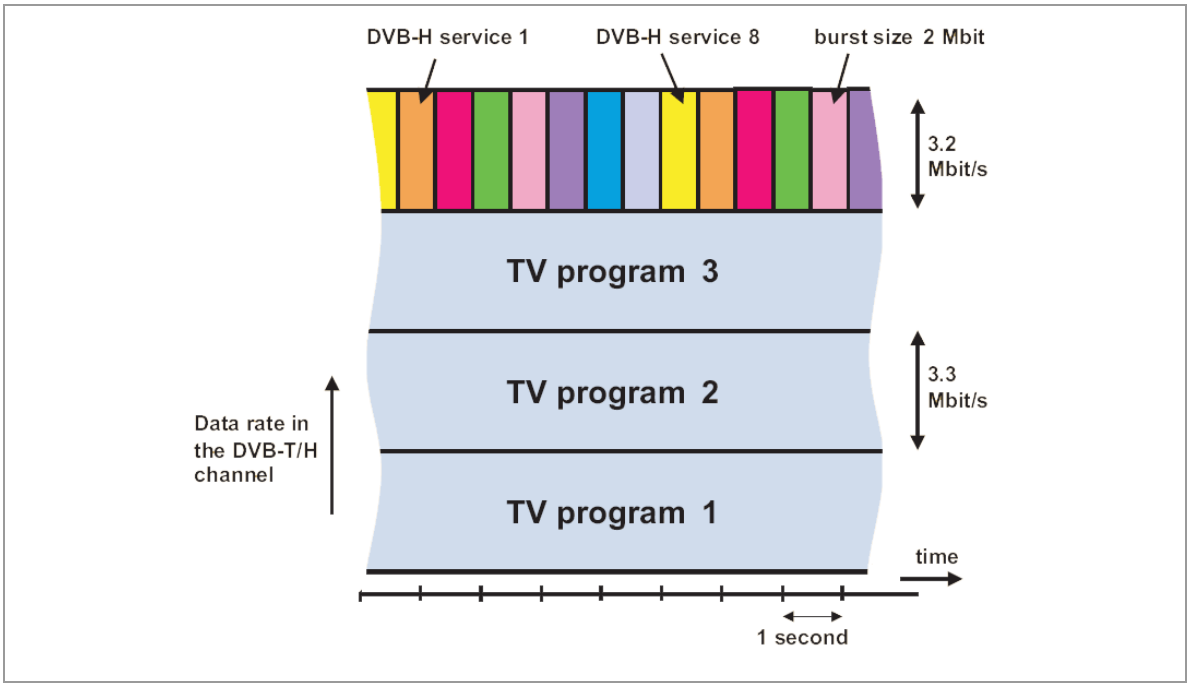


Figure 1: The time slicing principle: Time-sliced DVB-H services in a common DVB-T/H channel (multiplex) including 3 DVB-T programs. [1]

In the above image the total bandwidth of the DVB-T channel (multiplex) is assumed to be 13.3 Mbit/s, with the 8 DVB-H services sharing 3.2 Mbit/s (amounting to calculated 0.4 Mbit/s for each). The actual bandwidth of a DVB-T/H multiplex is dependent on various factors, such as coding rate and error checking, resulting in a bandwidth between 5 and 32Mbit/s. [2]

The mobility of handhelds provides another challenge. In contrast to typical (stationary) television antennas the handhelds are constantly on the move, in and out of buildings, and often at ground levels where the coverage is poorer than at rooftop level (especially in urban areas). Travel in vehicles is also a challenge. As a result “gap-fillers” are needed to relay and strengthen the broadcasted signal and this makes a DVB-T/H network more expensive than a DVB-T -only network.

DVB-H is a broadcast technology, so the bandwidth is the same for all users and the transmit costs are constant, independent of how many users are receiving the signal. Since the DVB-H signal is different from other network standards currently available

[1] Kornfeld and Reimers (2005)
[2] Wikipedia: DVB-T

(such as WiFi, GPRS or 3G), reception requires a separate antenna and a separate signal processing chip.

3G: An example of a bi-directional unicast method

3G stands for *third-generation* mobile telephone technology and is in fact a shared name for different but related standards. The one most common in Europe is called UMTS, and any specifics regarding 3G can in this paper be assumed to be describing the UMTS standard. The so-called 2.5G or GPRS standard shares many of the characteristics of 3G, but has a lower transfer rate.

According to Wikipedia UMTS currently supports up to 1920 Kbit/s transfer rates, but users in real networks can expect performance up to 384 Kbit/s. The technology allows for improvement and the transfer rates can be assumed to increase in the future. The experienced transfer rates in GPRS are around 30-70 Kbit/s.

3G is a bi-directional transfer method, transmitting data-packets in a predominantly unicast way. One essential difference between 3G and the various broadcast methods is that 3G is a part of the phone network standard so that there is no need for a separate distribution network (although both the network and terminals must of course be 3G capable).

When comparing the transfer rates of 384 Kbit/s and calculated 0.4 Mbit/s (for each DVB-H service in figure 1) it is clear that they are practically the same. Even though both technologies allow for higher transfer rate, they can be concidered as being of similar magnitude. This means that content that can be distributed with time splicing over DVB-H should also be theoretically distributable with 3G.

The key differences between the two technologies lie in scaling and distribution costs. Whereas the broadcast method has a constant transfer rate to all recipients, the 3G is sending an individual stream to each recipient so there is a limit to how much capacity the system has. The more concurrent users, the less bandwidth is available to each – resulting in the paradox that too much popularity can prove negative (with worse service to each user and/or costs of increasing the capacity of the network).

This becomes especially evident if a unicast network is used to simultaneously transmit the same content to a large number of users, such as a popular live event, with an individual stream to each. Therefore the strength of unicast methods lies in sending

specific individual content to each user, the strength of broadcast methods lies in distributing popular content simultaneously to all. Assuming that there is a choice between distribution methods, it is most efficient to send as much content over broadcast as possible.

3G networks are already used to transfer video content on demand, and videos are one of the fastest growing services on high capacity mobile networks. [3] Mobile operators have been experimenting with providing various sorts of content, and in 2006 video and camera enabled handsets are predicted to outsell non-video handsets for the first time. Current key content areas are music videos, comedy sketches, sports clips, TV and movie videos, and adult content. [4]

The concept of video on demand will be further discussed as a recurrent theme in this paper.

Interactivity and interactive television

Interactivity is one of the buzzwords often mentioned in connection with digital television, but what does it mean?

Liu and Shrum (2005) and Jensen (1998), discuss the variety of different meanings for the concept "interactivity" and evaluate various definitions of the concept. For instance in sociology "interaction" is traditionally seen as the relationship between two or more people, whereas in the cultural studies tradition within the field of media studies the term is used to cover processes that take place between receivers on one hand and a media message on the other (this could e.g. involve "interaction" with a book). Within media research and informatics there are also abundant different definitions of "interaction" and "interactivity".

Jensen proposes a definition of interactivity as:

> *[A] measure of a media's potential ability to let the user exert an influence on the content and/or form of the mediated communication.* [5]

[3] Henrik Bengtsson, Sony Ericsson (verbal presentation December 2005)
[4] 3G.co.uk (November 2005)
[5] Jensen (1998)

Looms (2004) divides interactive television into three main categories from a technical perspective:

1. *Interactive digital television on terrestrial, satellite, cable or broadband networks where the viewer has access to some kind of return channel*
2. *Enhanced digital television where the viewer has local interactivity only, as no return channel is available and*
3. *"Participation" television – predominately analogue – where the viewer can participate to some degree in the programme through the use of a return channel such as the phone, SMS or e-mail.*

Looms concludes that the latter two are worthy of more attention than they currently receive in discussions about interactive television, and that there are other factors in the development of digital television that are likely to be of more interest to the users than achieving "true" interactivity. These factors (*more choice, technical enhancements and personalisation*) will be discussed later in the context of handheld devices, but first I will look at how it is possible to achieve the "true interactivity" of the first category, on handheld devices.

In a typical set-top-box situation, the flow of information can be schematically described as in figure 2.

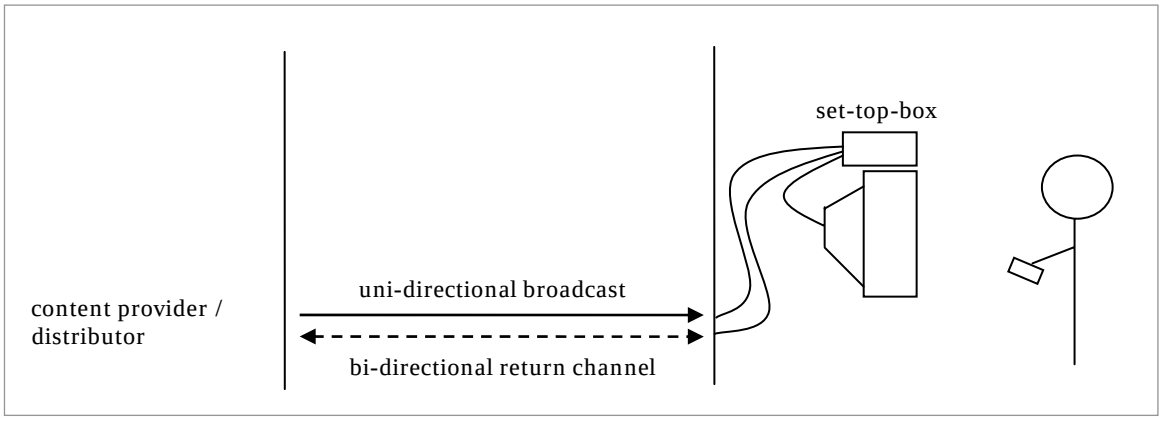


Figure 2: Schematic structure of interactivity on a set-top-box.

To achieve interactivity a separate return channel is necessary for transmitting data from the user to the broadcaster. In interactive television this return channel is typically over cable or regular telephone lines, through a set-top-box that integrates the broadcasted signal and user feedback. As can bee seen from Looms' categories other, more indirect, feedback mechanisms such as SMS messages can also be used as return channels.

The bi-directional return channel can of course also be used for unicast streaming of content (such as in IP-TV and video-on-demand), but as mentioned before the optimal use of the distribution channels for large target audiences usually lies in using broadcast methods as much as possible.

In handheld devices the available return channel would typically be through a wireless internet connection such as WiFi or 3G phone networks. In other words, for handheld devices to be able to offer "true interactivity" with broadcast content, they must take the role of both a television set and a set-top-box; receiving data through one technology, displaying it on screen and then sending possible user feedback through another technology. This will, of course, be a challenge for interaction designers; to provide the user with a unified interface and the appearance of a full integration.

To summarize, the following matrix gives an overview of the different distribution options discussed in the previous chapters.

Distribution option	**Uni-directional or bi-directional**	**Packet-based**	**Latency**	**Quality of service**
Digital broadcast One-to-all	Uni-directional	No	None	Independent of the number of users. High if the signal can be received
IP-datacast One-to-all	Uni-directional	Yes	Next to no latency	Independent of the number of users. High if the signal can be received
Streaming One-to-one	Bi-directional	Yes	Initially when establishing streaming	Inversely dependent on the number of simultaneous users

User convenience and personalisation

As previously mentioned, Looms describes three important factors in the development of digital television; *more choice, technical enhancements and personalisation.*

In the context of IP-broadcast to handhelds the focus on the first two factors is evident in the effort to squeeze as much information as possible into available bandwidth, and in the ability to send content of different types (video, audio, text). Good picture and sound quality is clearly one of the main emphasis in developing these standards; the efficient use of digitalization, compression and error checking in order to provide as good a quality as possible (with the necessary trade-offs due to the ergonomics of handheld devices).

When describing the third factor, personalisation, Looms refers to the "Anything, Anytime, Anywhere" paradigm attributed to Bill Gates, in the sense of users being able to watch any content, when and where they choose.

It can be argued that the essence of transmitting content to handheld devices is the "anywhere" part of the paradigm; being able to view content in practically any location at will, also known as *place-shifting*. "Anything" is clearly a challenge to content providers and distributors, and some reflections on the questions facing them will be presented later in this paper. Finally "anytime" involves breaking free from broadcasting schedules, the so called *time-shift*.

Time-shift options

As mentioned before, broadcasting to mobile devices has the same inherent limitations as traditional broadcasting in that the same content is sent throughout the whole network, and there is no economically sustainable way of sending individual content on request (as in unicast). In order to choose when to watch or listen to broadcast material, the user has to have access to a recorded version. That is, the handheld device has to function as a personal video recorder (PVR).

With storage medium becoming increasingly more compact, today's handheld devices are capable of storing a lot of data without becoming too bulky. This is perhaps most evident in MP3 players like the Apple iPod, currently available with hard disk storage up to 60GB or flash based memory up to 4GB. The evolution of ultra-compact storage will continue in the foreseeable future; Samsung has announced that it will release 16GB flash cards in 2006 and according to sources both Samsung and Seagate are working on hybrids that will be a combination of flash chips and hard disk drives: "The hybrid drives

will have the best of both worlds – lower power consumption, less wear and tear, thinner width, faster boot times and large storage capacity." [6]

For comparison a 45 minute TV-show (Lost) from Apple iTunes, in a resolution of QVGA (320 x 240 pixels) intended for hand-held viewing, takes about 200MB. Assuming a similar resolution and compression, each GB should be able to store between 3.5 and 4 hours of video and a 16GB flash card could store up to 60 hours.

On-demand options

Traditional methods of providing video on demand can be divided in two; delivery over a package-based network ("true" Video On Demand – *VOD*) and broadcast carouseling (Near Video On Demand – *NVOD*). In VOD the user requests a data download and the content is sent individually to each user. In NVOD several channels are used, each sending the same (locked) content but at stacked intervals; a movie might start at 8 o'clock on one channel, 8:30 on the next, 9:00 on the third, and so on. After accessing a payment function of a set-top-box a user can then get access to the next scheduled screening on an appropriate channel, or "jump on the carousel". Carouseling does not involve individual (one-to-one) data-streams, but it requires a lot of channels that are in effect all sending the same content.

Individual delivery is practically impossible in broadcast to handhelds and carouseling would be a waste of channels and bandwidth. Kelly L. Dempski (2003) has described a method where a programmed PVR silently records and locks content broadcasted over the network, possibly in "off-hours" such as during the night. The technique requires a rather large-capacity PVR that can predict what content each user is likely to request (for instance based on previous purchases or general popularity). When the user then requests the content, it is unlocked and instantaneously played. In case the user requests content that has not been recorded, the system records it the next time it is transmitted. This model could in theory be adapted to handheld devices with adequate storage capacity, thereby making video-on-demand over broadcast one possible revenue model for content providers.

To summarize, true video on demand requires either content that is stored centrally and can be accessed at will (in a unicast stream) or a large storage capacity at the user end.

---

[6] Financial Express, Indranil Chakraborty (October 2005)

For comparison *promise.tv*, a system under development that locally stores a whole week's worth of television content from a multitude of channels uses several Terabytes of hard drive storage. [7]

In handhelds it is not realistic to provide a true video on demand from storage only, but a continuum is conceivable where local storage could be used to lighten the load of a predominately unicast VOD system, in a similar way as described by Dempski. This is not necessarily limited to pay-per-view situations, as for instance the newest episode of a popular free-to-air show might be silently stored at broadcast time, even though the user is not watching at that time, thereby becoming available for instant on-demand viewing (with the handheld acting as an intelligent PVR).

Users and users' preferences

As the previous chapters have shown, the technology for broadcast to wireless devices is becoming available. There are various methods technologically possible for improving the user experience such as interactivity, time-shift and on-demand services. Most of these methods can be implemented in a continuum, that is; providing a basic functionality is relatively simple but to fully achieve the conceivable possibilities would involve combining various technologies and/or costly devices.

The key question is therefore what the users' actual preferences are: What will be the motivating factor for them to purchase broadcast enabled devices? Where and how would they use the option to receive broadcast content in their handhelds? What type of content do they prefer? Is broadcast the optimal method of providing them with that content? Will the popularity of services be enough to justify the costs of implementation?

In the following chapters I will attempt to shed a light on some of these questions. First I will look at the general usage situations for watching video on handhelds and some ergonomic limitations. Then by presenting three interesting user segments I will attempt to come up with some educated guesses as to what their motivations for purchase and preferences for content might be.

[7] Informitv News (August 2005)

Concurrent media use and multitasking

Video viewing is primarily a foreground activity (requiring the use of both visual and aural senses), compared to for example listening to music that can both be a background and foreground activity. It is possible to listen to music during activities such as jogging or riding a bike, but watching video in these circumstances is difficult or impossible.

Multitasking is a concept derived from computer science where it describes how multiple tasks (e.g. various programs) share common processing resources. The concept has later been transferred to the human behavior of simultaneously doing more than one thing.

It can be argued that *successful multitasking* involves doing one foreground activity and having simultaneous background activities, switching them between foreground and background as needed. [8] Trying to do more than one foreground activity at the same time can be difficult or dangerous (such as watching video while riding a bike).

Related to multitasking is *concurrent media exposure* (CME), a term for concurrently experiencing more than one media (also called "media multi-tasking"). This might for instance involve having TV in the background while working on a computer or reading a newspaper.

Media studies by Ball State University have showed that over 96% of the study's participants had experienced CME, and that on average it constituted 30.5% of the media day.[9] The combination of TV and other media was the most common pattern, with TV and the web being the dominant concurrent media pair.

The ability to use several media at the same time is especially apparent with teenagers. A research commissioned by Yahoo! and OMD on global youth, media and technology provides insight into this pattern for youth in different countries. The research shows that the mean number of other things done while using Internet or TV in one month lies between 2.3 and 3.2 extra activities while watching TV and between 3.5 and 4.2 extra activities while surfing the Internet (varying between youth in different countries).

[8] Adapted from Nic Price (September 2005)
[9] Ball State University (date missing)

> *The Internet is the most pervasive and intensive medium for youth, and its usage tends to accompany multiple other activities. The Internet is beginning to converge in significant ways with content that has traditionally been associated with TV. Streaming and downloading movies and TV shows have become popular activities among youth outside the US, and another way for them to self-direct and self-program their media use.* [10]

Having grown up with concurrent media exposure, today's youth are experts at multitasking and are on general able to switch activities between foreground and background more easily than adults. [11]

The ergonomics of watching video on a handheld device

Watching video on a handheld device usually involves holding the device at a suitable distance from the eyes and often (especially in difficult lighting) at a specific angle. This is another reason why it is troublesome to watch video on handhelds while moving, it is simply more difficult for instance to walk holding a device in front of one at a constant angle than if the device can be kept in a pocket or held to the side of the face.

If the device has an adjustable viewing angle (for instance a hinged screen) or comes with a cradle of some sort, it can be placed on a table while viewing – but if the user is forced to hold it at arms length, longer periods of viewing can become tiresome.

These factors could bee seen as indications that, given a choice of devices and a viewing session of more than just a few minutes at a time, a user would be more likely to choose a device with a larger screen such as a TV or computer monitor than a handheld device for displaying video in a concurrent media exposure situation, perhaps using the handheld for playing music or some other non-visual activity.

Combining the above, the most likely usage situations for viewing video on handheld devices seem to be situations where the user is passive (sitting or standing) and where the viewing is the foreground action. This would include situations like commuting with public transport and periods of inactivity while waiting or simply killing time. In a social context this could point to user groups that are likely to use public transport (especially for long periods of time) or that have leisure time outside the home or work-place.

---

[10] Yahoo! and OMD (September 2005)
[11] CBS5, Sue Kwon (November 2005)

Three user groups of special interest

When it comes to describing the needs and wishes of users, some segmentation is necessary to avoid overly broad generalizations. In this paper I've chosen to focus on three user groups (or archetypes) and try to summarize their apparent needs and preferences. These three groups are by no means representative of the whole user market, but are chosen to provide different perspectives and demonstrate the variety in motivations for purchase and usage of new technologies.

Professional users (business users) are chosen as representatives for early adopters, where price and ease-of-use is less important than innovation and a variety of functions. This is a segment that currently accounts for nearly half the market for advanced handheld devices in Denmark, according to market analyst John Strand.[12]

Teenagers are a very interesting user segment when it comes to new technologies, especially in communication technology, as they are quick to understand and embrace new options and have a need for staying in touch with each other.

The "established" private user is representative for the majority of users that may be slow to adapt new technologies, but are essential for long term success because of their numbers.

Professional users

A large portion of recent technological innovations are directly aimed at professional users looking for tools to organize their busy workday or keeping up with the demands of work.

The professional user can be assumed to be approximately 25-50 years old, educated and used to working with technology. Traditionally early-adopters of technology have been seen as predominately male, but recent studies show that this is not necessarily true. [13]

> *While women are not likely to buy something for the sake of being first, they are early adopters of technologies that will clearly improve their lives. New technologies such as home networking [...] and WiFi [...] are favorites among women, allowing them to do more in less time.* [14]

[12] Oral communication.
[13] Intel Press Release (December 2004)
[14] Mobile Tech News (May 2005)

The archetypical professional users tend to show a willingness to adopt new technologies, even though they may be expensive. This willingness to invest in expensive innovations might be attributed to rationalizations about improved efficiency or seen as a necessary symbol of being up-to-date (the latter more likely to be a motivating factor for males than females according to the sources mentioned above). Also the usage costs are often paid for by employers, which of course has a positive effect when it comes to adapting a technological innovation.

With the new technologies maturing and prices falling, they often find their way to the more slow-adopting majority of users: Examples of technologies aimed at professional users are PDAs and the capabilities of "smart phones" to access email and function as organizers with calendars and contact lists (in essence to emulate the PDA). Technologies originally marketed to professionals that now are mainstream-commodities are for instance the laptop computer and the use of email (and of the Internet in general).

In his 1962 book Diffusion of Innovations, Everett Rogers stated that adopters of any new innovation could be distributed on a bell curve. He divided the adopters into innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%) and laggards (16%). According to this theory the success of a new innovation is dependent on the early adopters to adopt it and promote it to the majority. [15]

It is my postulate that when it comes to adopting and popularizing broadcast to handheld devices the professional users as described here can be seen as early adopters in Roger's categorization. Therefore they will be an important user group, especially in the first phases of marketing.

Generalizations about the archetypical professional user in the context of this paper:

- Early adopter
- Mobile work environment
- Need for always-on connections (sending and receiving data)
- Perceived usefulness in work situations important
- Cost not necessarily a determining factor

[15] Wikipedia: Diffusion of innovations

Teenagers

Teenagers today have grown up surrounded by technology, and as the success of the SMS has showed they have a knack for adopting and modifying technology for their needs: In 1998 European teenagers discovered the little used SMS capabilities of mobile phones and promoted this in interpersonal interactions to other teenagers. The SMS quickly became the primary drive for teenager purchases of mobiles and a keystone in their social network. [16]

The previously mentioned multi-tasking that teenagers have grown up with, combined with the options that mobile phones provide, allows them to juggle different social connections simultaneously. For instance a teenager participating in a family event, such as a holiday, can at the same time stay in contact with his friends via SMS. [17]

Even though teenagers as a group could be divided into Roger's categories, I have chosen to present and discuss them as a single user segment. The reasoning for this is that the drives and needs of teenagers are generally different from the more mature technology users, and comparing the stereotypical teenager to archetypes of older users is in this context more interesting than dissecting the teenager population into further subgroups.

The previously mentioned study by Yahoo! and OMD describes three aspects of socialization that motivate and drive today's youth, which the study refers to as the "My Media Generation": *Community, self-expression and personalization*. As motivators for media and technology use, these aspects are in many ways fundamentally different from the motivations of adult users. They will be further discussed later in this paper when dealing with the user situation of handhelds for teenagers.

Generalizations about the archetypical teenager in the context of this paper:

- Need for always-on (ping*-like) connections
- Used to a variety of communication methods
- Quick to adapt new technologies
- Emphasis on *community, self-expression and personalization*
- Costs could prove a crucial factor, as finances are limited

---

[16] Sue Kunda (2005)
[17] Johan Winbladh (2005), unpublished lecture

* *Ping* is a computer network method of sending and receiving short data packets to check that a particular host is operating properly. In the context of mobile communications the analogue lies in that the act of "staying in touch" may be seen as just as important as the actual messages sent back and forth.

The established private user

This archetype is chosen as a representative for the slower adopting majority of the eventual target group of a new technology. The private user does not necessarily choose innovations for use in a work situation (at least not as a primary rationalization) but rather for leisure use. Costs are probably more important than to the business user, but not as much as to teenagers.

The motivation for adapting a new technology might be recommendations from early adapters, teenage children or as a peer-pressure of sorts. Not all of the purchases lead to active use, as evident from a research from 2004 that shows that 40% of the owners of mobile phones had a "smart-phone" without ever using their advanced functions. [18]

It is vital that the technology is easy to understand and use, as the mature private users are less willing to spend time and energy on learning how to use a new gadget than professional users and teenagers.

Due to the size of this market segment it is potentially the best income source for technology producers, a segment that is most likely to purchase a new technology when it has matured somewhat and quantity production starts to result in more attractive prices.

In the book "Crossing the Chasm" (1991) Geoffrey A. Moore expands on the previously mentioned diffusion of innovations theory from Everett Rogers. Moore argues that there is a chasm between early adopters and early majority, as they have very different expectations. [19] In the context of this paper the challenge for marketers lies in crossing this chasm by finding uses and/or content that is attractive to a more reluctant public than early adopters and teenagers.

---

[18] Johan Winbladh (2005), unpublished lecture
[19] Wikipedia: Crossing the chasm

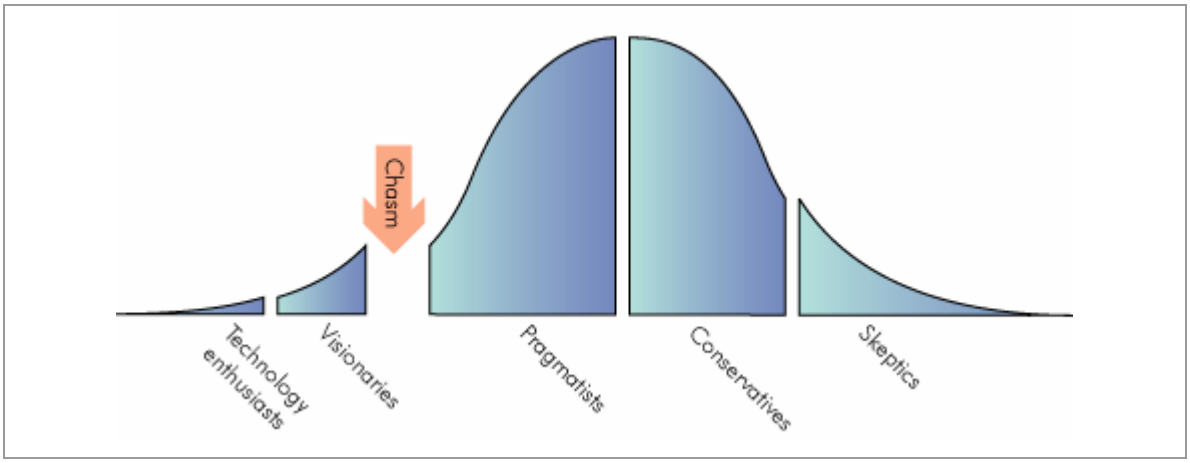


Figure 3: Graphic representation of Moore's chasm. (Note that although Moore uses other terms for the categories than Rogers, size proportions are the same). From Wikipedia.

Generalizations about the archetypical established private user in the context of this paper:

- Can be assumed to be 25 to 50 years old
- Is employed
- New technology probably most for leisure use
- Costs important but not necessarily crucial
- The technology must be simple to use

Usage context

In a mobile-TV pilot project in Finland 2005,[20] close to 500 users (18-70 years old) tested DVB-H broadcast for 4 months. According to the pilot results the most common uses for mobile-TV were:

- To pass the time (e.g. while waiting for something); 16.3%
- To stay updated (e.g. watching the news); 15.2%
- To relax/entertain oneself; 10.7%
- As background entertainment while doing other things; 9.4%.
- To create own space (e.g. in public transportation); 6.2%
- As a second TV while the household's TV is used by others; 6.2%

[20] Research International Finland, Juri Mäki (August 2005)

(The percentages are calculated from the number of participants that answered that they had used the mobile for this purpose “every now and then”, “quite often” or “often”).

The top 3 usage situations were:

- When traveling using public transportation
- When at home
- When at work.

(Further information is not currently available regarding the precise proportions between these situations).

In general these results concur with the conclusions that could be drawn from the previous discussion; the uses are mainly for entertainment purposes or staying updated, and primarily in passive situations (public transport).

In the pilot project users had access to content from various television channels; familiar programs from the national Finnish television proved most popular, followed by sports and news channels. The content used was not specially made or formatted for handheld viewing. But if content were to be made especially for handheld viewing, what content could that be and what would it be like?

Tailor-made content for handheld viewing

Handheld devices by nature have small screens with limited resolutions and are often playing content that has been compressed, with possible decline in quality. The combined effect of these factors results in some limitations for the production of content, as the following examples show:

- In dramatic content, close-up shots are preferable to wide landscape shots, and action taking place in the background can be problematic.
- Small, fast moving objects can be difficult to follow, so for instance a game of tennis might prove difficult to watch on a handheld.
- On-screen text information (such as subtitles or game scores) suitable for traditional TV quickly becomes illegible when compressed to a lower resolution.

Examples of video content especially taking these factors into account are the so-called “mobisodes”; short television episodes, intended for downloading and viewing on video-

enabled mobile phones. These episodes are often 1-3 minutes long (to facilitate download) and are in some cases specially produced supplements to popular TV-series like “24” or “Lost”.

By using broadcast to handhelds the technology would not limit the length of content in the same ways as in download, but as discussed before the combination of usage situations and ergonomics contribute to users of handheld devices being less likely to view for long periods of time than those watching TV at home.

Usage situations for the three user segments

With a starting point in the previously discussed user segments, I will attempt to provide estimates for the most likely usage situations for handheld viewing, and from there discuss conclusions that can be drawn with regards to appropriate content.

All the segments are likely to use public transport daily (with the possible exception of younger teenagers, attending schools near home). The length of the travel is clearly a factor; with longer continuous rides more appealing situations for viewing than shorter rides or trips involving frequent changes of transport. These travels tend to take place at the same times each day, but not necessarily in accord with scheduled TV broadcasts.

The use of public transport could in fact prove to be one estimate of the predicted popularity of broadcast to handhelds in different countries; with a proportional relation between the average length of transport and expected popularity.

For inspiration to handheld-friendly content that takes height for the needs of viewers watching on public transport, TV-magazine shows commonly aired in the morning provide one example. The TV-magazine format is characterized by short segments, often of a talk-show genre, and with frequent news summaries. This type of program caters to different time-schedules of viewers, allowing them to start (and stop) watching at any time that suits them.

It also has to be assumed that all the mentioned user segments are likely to use their handhelds as tools for general entertainment or passing time, although their preferences for content can be expected to wary. For instance the adult user segments can be assumed to be more apt to use their handhelds to watch news, while teenagers’ needs to “stay updated” likely revolve more around their social network or pop culture.

One usage aspect that is probably unique to the teenager segment is the mobility of their social situations. While for most adults a large portion of their social lives takes place at home or at work, teenagers share their time in a wider range of physical contexts without stationary access to television or the Internet. These situations involve for instance shared transport time, school-time and leisure time outside the home. As a result the social behavior of teenagers is in many ways more varying in terms of locations than for adults, complicating generalizations.

The special user contexts of teenagers are discussed further in a later chapter.

Likely content wishes for the adult user groups

For insights into the extent to which content providers will need to offer more specific content, tailor-made for handheld broadcast, one could look to the needs of professional users. Due to the nature of broadcasting it will never be an appropriate mechanism for providing access to personal data, such as email or other work-related documents which can be readily accessed on handhelds using bi-directional unicast methods.

But as mentioned before, the broadcast technologies such as DVB-H have both video and text capabilities. Textual data only requires a fraction of the bandwidth of a video broadcast so several “data-channels” can be transmitted in the bandwidth otherwise taken by one video-channel. This capacity could for instance be used to distribute specialized news and data that possibly caters only to a limited group, such as stock market information or weather data. A given subscriber would receive a filtered subset of this data stream catering for his or her requirements, perhaps only a fraction of the total amount distributed. The data distributed this way would probably be similar to information available on the Internet, but being tailored for mobile access could make it marketable. With an added encryption layer a subscription model for this specialized data would become possible.

Similarly it is easy to imagine that television news would be perfectly suited for broadcasting to handheld devices, possibly on specialized channels for different types of news (e.g. general news, business or sports).

When it comes to the established private user, it is not evident that there are specific content requirements for this user segment. If the previous assumptions are true – that this segment is likely to purchase a new technology of this sort primarily for leisure uses – it follows that general entertainment content would be most popular. Catering to

specific interests, inspired by the Long Tail concept, [21] could prove to be a valid business model but it is debatable whether or not broadcast would be the ideal way to achieve this.

Broadcast content and teenagers

The previously mentioned research commissioned by Yahoo! and OMD describes three key aspects of socialization that motivate and drive the "My Media Generation", especially in their use of music, the Internet and mobile devices:

> ***Community:*** *Even though they want to stand out and express their individuality, young people strive to feel connected to each other. Shared experiences and constant communication create a sense of community among youth. Reaching out and building new relationships with diverse groups of people enhance and broaden this sense of community. [...]*
>
> ***Self-expression:*** *Young people place an incredible premium on self-expression. A defining attribute of My Media teens and early 20-somethings, this age group manifests self-expression by constantly seeking ways to put their stamp on products and have their voices heard, and by generally constructing, maintaining, and advocating their own self-brands. Self-expression is their way of showing the outside world who they are and what they value.*
>
> ***Personalization:*** *Today's youth thrive on self-directed, self-programmed usage of technology and media. Young people are used to customizing and personalizing everything. They demand products and services that suit their moods and desires, and they will actively search for, modify, or create these products and services.* [22]

Excluding the effect of shared experiences in watching "must-see" television programming like "The OC" and "American Idol" for community strengthening, and the role of radio for listening to music - it is hard to see how broadcast (without interaction) can cater for these needs. The TV still serves a role in teenagers' media consumption, but increasingly as a background media and as discussed before handhelds are hardly ideal for background display of video.

These assumptions about individualism are enforced in the study's conclusions about how youths are applying the freedoms that new technology provides:

> *Freedom for this generation means fewer limits and restrictions on what they can do and when they can do it. They expect that their access to people, media, and information will be unfettered and always-on.*

---

[21] Chris Anderson (October 2004)
[22] Yahoo! and OMD (September 2005)

> *[...] Unlike the old days of waiting for a program or song to "air", young people have taken media programming into their own hands. They aren't abandoning media content by any means, but they are seeking ways to schedule that content to meet their needs. Traditional media networks are giving way to personal networks, informed by blogs and programmed with media from a variety of online and offline sources.* [23]

Personalised access seems to be the key here, with the options of time-shifting to suit individual schedules and on-demand for accessing content recommended by others.

Even though the study shows that (with the exception of US youths) between 30% and 48% of the participants had listened to music on their mobiles in the last month and between 14% and 28% had watched video on theirs, given today's networks this can be assumed to be predominately downloaded or streamed content. In other words the youths are both choosing *what* to view and *when*. Therefore these findings cannot be taken as direct indicators of how popular video broadcast to handhelds will be for teenagers.

Another interesting aspect of teen's use of mobiles is described and discussed by Weilenmann and Larsson (2002). Based on fieldwork in Göteborg, Sweden they observed various forms of teenage sharing of mobile phones; "minimal forms" where for instance messages are read aloud or by showing the display to others, and "hands-on" sharing where the phone itself was shared between teenagers, enabling several people to use one phone as a collaborative resource. They argue that the notion of the mobile phone as a *personal* device does not necessarily apply in the group dynamics of teens, where the sharing of phones seems normal and perhaps a symbol of trust towards friends.

The article is published in 2002, when "smart phones" and access to advanced mobile networks (such as 3G) were not as common as they are today. The sharing described is in the form of SMS messages and phone conversations, but the mobile phones of today's teenagers are often additionally capable of playing (and sharing) music and video, as evident from the Yahoo! study. Some of the available "music-enabled" phones even contain a decent loudspeaker, so headphones are not necessary; providing a mixed pleasure for the passengers of public transport when teenagers turn up the volume to play the newest rap-songs for each other.

---

[23] Yahoo! and OMD (September 2005)

Shared music listening on mobiles may be achievable, but the small screen sizes and limited viewing angles of mobiles make it difficult for more than one to view a video at a time. In order to share for example a downloaded “mobisode” the group has to take turns at passing the phone around. This kind of sharing would be impossible with a broadcast video program, unless it was recorded for repeated playback.

Handheld interactivity revisited

The previous chapters have focused on describing “pure” broadcast, with limited emphasis on possible interactivity. Adding interactivity clearly provides more possibilities, especially when it comes to providing the viewer with a more personalized experience.

Célia Quico (2002) describes the experiences of communication services (chat, forums and multi-user games) for Interactive TV in Portugal and how they contribute to building virtual communities. She describes the effect that even a limited interactivity can have on the sense of belonging to a larger group, and in many cases leading to friendships in the “real-world”.

The idea of communication services could clearly apply to the community needs of teenagers, and the idea of participatory broadcast could be applied to the various interests of all the user segments.

But there is a vast difference in the context of interactivity on stationary TV’s on one hand, and handhelds on the other. Whereas the TV has become popular despite its lack of interactivity, the popularity of handhelds (especially mobile phones) lies in their ability for interactions, be they conversational or in the form of access to predefined content.

One interesting perspective in this context is the question which of the following is more likely to be seen as a breakthrough:

1. Adding interactivity to a uni-directional broadcast medium or
2. Adding broadcast to a bi-directional interactive medium.

That is, which concept will it prove easier to “sell” to consumers; the upgrade of classic television to become interactive or upgrading an interactive handheld device to be able to receive broadcast material? In today’s network-enabled handhelds, interactivity such as

chat, forums and multi-user games are all easily accessed with direct connections, without any need for broadcast.

The idea of being able to provide the same interactive programs on TV and handhelds looks alluring, but interacting with a broadcast program such as a sports event or a by-request music video program on the limited screen estate of a handheld provides design challenges. On a larger screen the “broadcast” itself can be viewed alongside the interactivity taking place, but it is difficult to see how this can be achieved simultaneously on handhelds. This in turn, would require modifications of interactive programs before they can be accessed on handhelds, possibly with added production costs.

It might therefore seem likely that producers of interactive TV programs limit their efforts to the larger custom base of stationary TV’s – possibly adding future versions for handhelds of popular programs when the market becomes big enough.

Current status

Having presented the key concepts and discussed some aspects of users, the remaining chapters focus on the current status of broadcast to handhelds; key stakeholders, recent research and suggestions for future studies.

Key stakeholders other than end-users

After focusing on the end users, in order to fully understand the challenges facing the adoption of broadcast to handhelds it is necessary to have an overview of key stakeholders.

There are many stakeholders to consider, but the most important ones are;

- Government regulators
- Mobile and network producers
- Network operators
- Service providers
- Content providers

In many cases these categories overlap as discussed below.

Government regulators

Official regulators allocate the necessary spectrum for broadcast and the currently competing broadcast standards provide them with puzzles, as they have an interest in ensuring that any decisions made do not hinder future development or lead to conflicts. Finland has become the first European country to issue a license for commercial TV service for handhelds, deciding on the DVB-H standard. [24] In South Korea the officially chosen standard is DMB (digital multimedia broadcasting), based on the DAB standard for digital radio broadcast. Satellite transmitted DMB has been available in Korea since May this year and terrestrial DMB was launched by major broadcasters in December. [25] Terrestrial DMB trials are scheduled in France and Germany in 2006 in connection with the World Cup in football.

The picture is complicated even further with DVB-T being the chosen standard for future terrestrial digital broadcast to stationary TVs in most European countries. DAB networks are already in place, but they need to be updated if they are to be used for DMB broadcast, as they are currently using MPEG-2 for audio rather than MPEG-4 used in DMB.

Mobile and network producers

The competing standards are also complicating things for producers, dividing them in different camps. For instance Nokia has been one of the key developers and most outspoken protagonists when it comes to DVB-H, but on the other hand Ericsson has proposed sticking to the existing 3G networks, and building broadcast services on top of it, using the MBMS standard [26] (Multimedia Broadcast Multicast Service, which uses multicast techniques to approach broadcast over a UMTS network).

Handset producers are keen on avoiding the VHS/Beta scenario of betting on competing standards, and are therefore reluctant to invest in developing and promoting products for technologies that have not proved successful. It is also in their interests that different countries implement compatible solutions in terms of standards and spectrum allocations, enabling producers to market the same devices to as large markets as possible rather than individual solutions for each country.

---

[24] The Register, Jan Libbenga (November 2005)
[25] The Korea Times, Kim Tae-gyu (December 2005)
[26] CommsDesign, Junko Yoshida (December 2005)

Currently only Nokia has announced a handset with integrated DVB-H tuner (N92), planned to become commercially available in mid 2006. [27] In South Korea, terrestrial DMB-enabled phones are not yet available, limiting the handheld uses to more expensive PDA's. [28] There are no handsets supporting MBMS available today. [29]

Network operators

TV broadcast to handheld devices blurs the distinctions between traditional TV broadcast networks and mobile phone networks, in particular the DVB-H standard using the same technology as digital TV (DVB-T). It still remains to be seen whether broadcast to handhelds will be done in some form for co-operation between media broadcasters and mobile phone operators, or mergers as in the case of *3 Italia* acquiring Italy's *Canale 7* TV station with the aim of integrating the networks' nationwide digital broadcast project with 3 Italia's upcoming DVB-H services. [30]

With regards to costs the following should broadly describe the differences between various options:

Broadcast costs are independent of the amount of simultaneous users, so once a covering network is in place the costs are the same broadcasting to one user as one million. For unicast distribution the costs increase almost linearly as a function of the number of simultaneous users. So even though unicast may be a cheaper option for transmitting to a few users, there is a cross-over point where broadcast becomes more cost-efficient.

As previously mentioned a nationwide DVB-T/H network is several times more expensive than a DVB-T -only network, as more "gap-fillers" are needed to support handheld devices. A nationwide DMB network would be similar in costs to a conventional DAB network, but as it supports fewer channels than DVB-H in the same frequency allocation the cost per channel are comparable.

Service providers

Some phone operators are openly sceptic about adapting broadcast, and as the majority of mobile phones are sold by operators they hold a key position in marketing of new

---

[27] Nokia press release (November 2005)
[28] The Korea Times, Kim Tae-gyu (December 2005)
[29] CommsDesign, Junko Yoshida (December 2005)
[30] Forbes (November 2005)

models (as evident in the case of South Korea where it appears to be opposition from wireless carriers that causes the lack of DMB-enabled phones).

Phone operators have their revenue models in place and are now experiencing with income models for downloadable or streamed video. Broadcast circumventing their networks could be seen as lost revenue, as consumers are hardly talking or using other services while watching television.

Many television broadcasters are currently in a transition period, switching from analogue broadcast to digital. It is understandable if they choose to put greater emphasis on exploring the options digital TV broadcast brings rather than take chances on a completely new medium. But if their already digitized content can be easily and automatically converted to a format suitable for handheld broadcast, this might be of interest for them – as long as it is financially feasible.

Content providers

Like television broadcasters, content providers are exploring the possibilities of digital broadcast to traditional TVs. (The concept *content providers* in this sense applies to all content producers, whether they are independent or part of a broadcast corporation.)

As in digital television in general, the concerns of content providers include encoding formats, Digital Rights Management standards, digitalization and access to older material on demand, exploring the options for interactivity and most importantly finding a balance of costs and income.

The before mentioned “mobisodes” have in many cases been seen as extensions of other shows (such as “24”), expanding their branding and keeping viewers hooked. Further handheld-oriented experiments of this sort will undoubtedly continue, either with specially created content or repackaging of older content.

As for television broadcasters, automating techniques will make specialized formatting such as for handhelds more attractive. The approach of “create once, publish everywhere” will likely become more actual as new broadcast formats become available.

When it comes to broadcast to handheld devices and handheld interactivity, the range of options for content providers could be sketched up as follows:

0. Do nothing, ignore handheld broadcast
1. Make current content available to handhelds without format changes

2. Minimal (superficial) modifications to content; for instance by reformatting subtexts and other textual overlay
3. Make special cuts of current content, for instance by using more close-ups than in the TV version
4. Specially produce new versions for handhelds, not available in other formats.
5. Specially produce content with added options of interactivity (e.g. voting or chat) and
6. Specially produce content dependent/centred on interactivity.

How far each content provider chooses to go remains to be seen, but the proportions between expected users of interactive TV to users of interactive broadcast on handhelds indicate that experiments in interactivity are more likely to take place in digital TV broadcast first, and perhaps be modified for handhelds when proven (or when the handheld marked is judged to be large enough).

Pilot test of DVB-H in Finland

The previously mentioned pilot test of DVB-H in Finland is very interesting. The sample of participants is fairly large (close to 500) and the interpretations of the results have been positive.

From a purely technical point of view the test seems to have showed that broadcast to handhelds is feasible. But playing the devil's advocate there are some questions that can be raised when it comes to the recruited users and a more critical interpretation of their feedback.

In the results rapport it is possible to see a comparison of the initial starting sample, the sample contacted and the actual pilot sample. In the starting sample of 6,229 the proportions between genders were; 55% women and 45% men. In the pilot sample these proportions are; 35% women and 65% men.

In the starting sample the percentage of the age group 18-40 is 39%, and for the age group 51-70 it is 41%. In the pilot these percentages have changed to 73% (18-40) and 10% (51-70).

Comparing the starting sample and actual participants, the shift towards young males is therefore quite obvious, which undermines any predictions made from this test about the views of the public in general. The study rather seems to largely present the views of classical early adopters; young males interested in technology.

When considering a new technology as this, it is a valid question to wonder how much of the measured use was the novelty of “playing with a new toy” and how predictive the measured usage is of future use.

As mentioned before the most common use for mobile-TV was “to pass the time” with 16.3% answering that they had used the mobile for this purpose “every now and then”, “quite often” or “often”.

This still leaves 83.7% which used their mobile-TV to pass the time, *less frequently* than “every now and then”. Similarly this means that the use of the mobile as a second TV at home did not amount to “every now and then” for 93.8% of the participants.

As home usage is the second most common usage for active users, this raises the question of how high the percentage was that did in fact use the phone at home (the published results are not explicit about this) and how much of this might be explained by novelty rather than convenience.

The results define “active users” as those who used Mobile TV at least 3-4 times a week, but do not specify how high a percentage this was of the total participants.

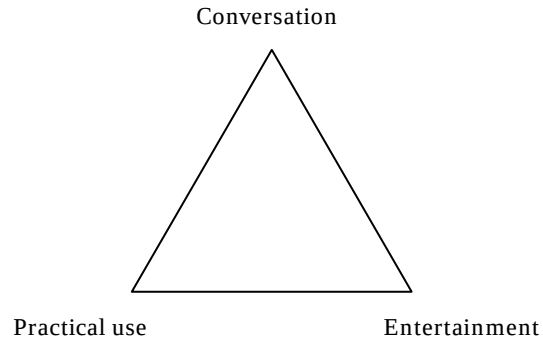
So even if the results at first glance appear to predict a rosy future for TV broadcast to handhelds, there seem to be some questions unanswered about the actual usage share. The demographics of participants seem to be eschewed from the general public, and therefore it is difficult to draw conclusions about how popular broadcast to handhelds will become.

Possible future research and categorization approach

In the following chapter I will propose a categorization that may simplify discussions about interactive usage of mobile phones and shed some light on questions regarding broadcast to handhelds. I will also propose two research approaches that could provide valuable insight for user preferences when it comes to viewing video on handhelds.

Mobile phone uses, a categorization proposal

When looking at the usage of mobile phones, as the most common handheld device, its interactive uses could be described as dividable into three categories:



Conversation in this context is to be understood as in Bordewijk and Kaam's media typology (1986) (as presented by Jensen [31]); when the information transmitted is both produced and owned by the information consumers who also control distribution (for instance in a two way communication). Here the typical example would be telephone conversations, and text messaging on mobiles.

Mobile phones were originally created for this kind of use, and even though new technologies are constantly being introduced and added to mobiles, the conversational uses still far outweigh any other uses of the mobile networks. [32]

Trying to differentiate between what I choose to call "practical use" and "entertainment" from a technical point of view is difficult, as I see the difference in the motivation for use rather than in technical solutions:

By **practical use** I mean options such as calculators, contact lists, calendars and access to email or other external data. In short; all the functions that could prove useful in work-related situations. These uses are classically the major selling-points of mobiles (and/or PDA's) to the professional users previously described.

I see **entertainment** broadly as all the interactive uses not falling into the above categories, involving neither direct conversation nor practical use. This could for instance include playing games, listening to music, watching videos or casual Internet browsing. The motivation is usually some sort of relaxation or for killing time.

The boundaries between the categories are somewhat overlapping; for instance files can both be downloaded from the Internet for practical use and for entertainment, contact

[31] Jensen (1998)
[32] Henrik Bengtsson, Sony Ericsson (verbal presentation December 2005)

lists contribute to conversation options, and it is debatable whether accessing for instance online blogs is pure entertainment or a form of conversation.

When the previously discussed uses for broadcast to handhelds are compared to these categories, most of them clearly fall under entertainment. It is possible to imagine uses for broadcast that approach conversation (such as virtual communities for interactive programs) or practical use (broadcasting specific information), but the majority of uses seem to be centred on entertainment.

This categorisation is of course rather trivial, but it provides a somewhat concrete viewpoint for discussing handheld broadcast. Rather than exploring all the possible uses for broadcast and how likely they are to prove successful, it is perhaps more efficient to start by questioning what kind of entertainment users prefer on their handhelds, and then whether broadcast is the most appropriate way of providing that entertainment. This paper has attempted to provide discussion satisfying both approaches, although more emphasis has been on the former as a prerequisite to the latter.

Such approaches (matching various kinds of entertainment to broadcast possibilities) would likely focus on live-transmitting versus on-demand and time-shift; what is the actual demand for personalisation and what mixture of approaches proves to be most cost efficient for distributors and thereby users?

A related question is how much of the entertainment content users are interested in will come from grass root production. The popularity of *weblogs*, *podcasts* and most recently *videoblogging* could indicate that users may prefer not being limited to content produced for large-scale broadcast.

This categorization also indicates a certain marketing conflict with regards to new models of for instance mobile phone; should the emphasis be on improvements in practical use or in entertainment possibilities? Are there any unexplored conversation options to be marketed? What are the related differences in marketing to different user segments?

Research proposal 1: "…on any device"

In the previous discussion about the ergonomics of viewing content on a handheld device, I concluded that there were indications that when given a choice of devices users would be more likely to choose a larger screen for viewing than that of a handheld device.

This assumption could prove an interesting approach to user research; giving a test group access to the same content on TVs, computers and handheld devices and then monitoring what medium they choose. This would allow researchers to isolate the variable of mobility; compared to stationary viewing, what is the true demand for (and value of) mobility?

This would require the participation of content providers and a mechanism for providing content on-demand. In theory such a test should be possible by simulating broadcast with streaming-technologies to handhelds and computers (using a 3G network and the Internet) in addition to interactive digital television to stationary TVs, thereby eliminating the need for "true" broadcast to handhelds and computers.

For such a test to be conclusive, it would have to include both broadcast and on-demand content, and comparable access on all included media. Additionally, the test period should be long enough for users to develop their preferences and to lower the effects of novelty.

A study of this kind would also provide interesting information about different usage contexts, such as the viewing of video content at work, at home or during public transport. What factors determine which type of content and media is chosen in each situation?

Research proposal 2: The preferences of teenagers

As I have discussed previously, the teenager user segment provides many interesting challenges and it appears that there is not much research available on their preferences when it comes to broadcast to handhelds.

I have been unable to find any data on actual teenage use where TV broadcast to handhelds is currently available, which at this point is practically only over satellite distribution in South Korea (where it is quite possible that the teenagers cannot afford the necessary terminals or the subscription costs). In the Finish study the youngest age group was 18-30 years, and it is not evident that there was any focus on the teenage segment as such.

From the Yahoo! study it is evident that teenagers are using their mobiles for viewing video, but it would be interesting to monitor their choices given the options of both broadcast and on-demand content.

An approach using “pseudo-broadcast” over 3G networks, in a similar way as described in the previous proposal, could provide very interesting information on the actual viewing preferences of teenagers. Providing access to both broadcast and on-demand content on handhelds (probably mobile phones) over a 3G network to a limited group of participants should be technically feasible, and adding ethnographic studies of group behaviour and interaction between the teenagers would be invaluable.

Alternatively, an ethnographic approach to studying how teenagers access and use the video content available today would also be interesting. It should be possible to conduct the study in such a way as to get insight into the teenagers’ wishes for future content and some indication whether or not broadcast would be of interest to them.

Conclusions

As evident from this paper, without hands-on research of users it is difficult to give but relatively vague predictions about their preferences. Nevertheless the discussions leading up to these predictions should provide some insight to the many and complex factors at hand.

Handhelds and in particular mobile phones are showing more and more signs of functionality convergence. One evidence of this is the fact that the majority of all digital cameras sold today are in the form of camera-enabled mobile phones (currently 5 out of 6). [33] There seems no doubt that there will also be a continuing demand for the convergence of content, and that access to video on handhelds is and will be a “hot” selling-point, primarily for entertainment.

Broadcast is a cost-efficient distribution method for video content being sent “live” to a large group of viewers, but the initial costs of building a distribution network are high. Conclusive tests of how important “live” content, compared to on-demand, is to customers do not seem to be currently available. This question appears especially important when it comes to teenagers – traditionally a strong market for new technologies – that are used to mix-and-mash media to create their own entertainment. How will they respond to broadcast?

[33] ZDNet IT Facts (October 2005)

Teenagers will undoubtedly try and find their preferred use for this new technology; the question is what this use will be and whether it turns out to be seen as indispensable. If the technology becomes too expensive teenagers might choose to skip it altogether and search for other options.

With various personalisation technologies such as (stationary) interactive digital TV and PVRs likely to grow in popularity in the coming years, it is possible that by the time broadcast to handhelds becomes a reality for the majority of consumers, they will have grown accustomed to a more personalised viewing and turn out to have other preferences than they might show today, currently being used to predominately broadcast. These imminent changes in media consumption will undoubtedly influence the adaptation of any new technologies, including broadcast to handhelds.

Even though the technology for broadcast to handhelds is becoming applicable and test results are positive, there are many stakeholders that have to be involved if broadcast to handhelds is to become a success. In light of the slower adoption of 3G technologies than anticipated in the enthusiasm of 2000, when gigantic sums were paid for licences, both operators and customers might be hesitant to bet on a new technology before it has been proven.

With so many questions remaining unanswered, this is clearly a field that needs further studies, and there is an understandable scepticism evident for many stakeholders – suggesting that the technology might be a bit further from taking off than the most optimistic protagonists claim.

Bibliography

(All links visited December 21st 2005)

- 3G.co.uk (November 2005): "Significant Growth Potential of Mobile Video in Europe" *(web text)*. http://www.3g.co.uk/PR/Nov2005/2155.htm
- Anderson, Chris (October 2004): "The Long Tail" (Wired Magazine). http://www.wired.com/wired/archive/12.10/tail.html
- Ball State University (date missing): Center for Media Design; "Concurrent Media Exposure: Some Key Findings". *(web text)*. http://www.bsu.edu/cmd/conmedexp/
- Bengtsson, Henrik from Sony Ericsson (verbal presentation December 2005)
- CBS5, Sue Kwon (November 2005): "I-Teens: What's Up With All The Multi-tasking?" *(web text)*. http://cbs5.com/topstories/local_story_331212948.html
- CommsDesign, Junko Yoshida (December 2005): "Mobile TV stalls in Sweden". (web text) http://www.commsdesign.com/news/insights/showArticle.jhtml?articleID=174900570
- Dempski, Kelly L. (May 2003): "The Use of Broadcast Infrastructures for On-Demand Services". http://www.accenture.com/Global/Services/Accenture_Technology_Labs/R_and_I/TheServices.htm
- Financial Express, Indranil Chakraborty (October 2005): "Rebooting storage" *(web text)*. http://www.financialexpress.com/fe_full_story.php?content_id=105746
- Forbes (November 2005): "Hutchison's 3 Italia to invest 220 mln eur in mobile TV project". (web text) http://www.forbes.com/afxnewslimited/feeds/afx/2005/11/28/afx2354947.html
- Informitv News (August 2005): "BBC opens Pandora box on a Promise" *(web text)*. http://informitv.com/articles/2005/08/07/bbcopenspandora/index.shtml
- Intel Press Release (December 2004): "Women Online Have New Tech Attitude, According To Survey". (press release). http://www.intel.com/pressroom/archive/releases/20041208corp.htm
- Jensen, Jens F. (1998): "'Interactivity' – Tracking a New Concept in Media and Communication Studies". http://www.nordicom.gu.se/common/publ_pdf/38_jensen.pdf
- The Korea Times, Kim Tae-gyu (December 2005): "DMB Service Starts With Uncertain Prospects". (web text) http://times.hankooki.com/lpage/tech/200512/kt2005120515503411780.htm

- Kornfeld, Michael and Reimers, Ulrich (January 2005): "DVB-H – the emerging standard for mobile data communication" (EBU Technical Review). http://www.ebu.ch/en/technical/trev/trev_301-dvb-h.pdf
- Kunda, Sue (2005): "Teens Let Their Fingers Do The Talking". http://www.txt2nite.com/forum/archive/teens-let-their-fingers-do-the-talking-246.htm
- Liu, Yuping and Shrum, L.J. (2005): "Rethinking Interactivity: What It Means and Why It May Not Always Be Beneficial" (in *Advertising Promotion, and the New Media*, eds. Marla Royne Stafford and Ronald J. Faber) http://faculty.business.utsa.edu/ljshrum/Interactivity_Book_Chapter.pdf
- Looms, Peter (February 2004): "Digital Television in Europe – How Important is Interactivity?" www.itu.dk/courses/PDI/E2005/DTV_in_Europe_0.93.doc
- Mobile Tech News (May 2005): "Survey Results Reveal Women Are Early Adopters". (web text). http://www.mobiletechnews.com/info/2005/05/05/195745.html
- Nic Price (September 2005): "Useful definition of multitasking" *(weblog)*. http://www.beatnic.co.uk/2005/09/09/useful-definition-of-multitasking/
- Nokia (November 2005): "Presenting the Nokia N92: TV goes Mobile". (press release) http://press.nokia.com/PR/200511/1019230_5.html
- Quico, Célia (2002): "Are communication services the killer applications for Interactive TV?" http://www.brighton.ac.uk/interactive/euroitv/euroitv03/Papers/Paper12.pdf
- The Register, Jan Libbenga (November 2005): "Finland to license commercial mobile TV service". (web text) http://www.theregister.co.uk/2005/11/14/license_mobile_tv/
- Research International Finland, Juri Mäki (August 2005): "Finnish Mobile TV Pilot – Results" (unpublished).
- Weilenmann, Alexandra and Larsson, Catrine (2002): "Local Use and Sharing of Mobile Phones" (in *Wireless World – Social and Interactional Aspects of the Mobile Age*, eds. Barry Brown, Nichola Green and Richard Harper).
- Wikipedia: http://en.wikipedia.org/
- Winbladh, Johan (2005): "Samspillet mellem Kvantitative brugerundersøgelser og Projektledelse af digitale produkter" (unpublished lecture).
- Yahoo! and OMD (September 2005): "Truly, Madly, Deeply Engaged – Global Youth, Media and Technology".
- ZDNet IT Facts (October 2005): "500 mln cameraphones sold in 2005, 900 mln by 2009". (web text) http://blogs.zdnet.com/ITFacts/?p=9346