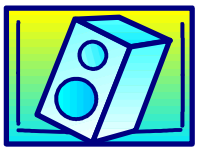

Institut für Rundfunkökonomie
an der Universität zu Köln

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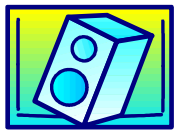

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Mobile TV-Launch in Germany – Challenges and Implications*

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* Slightly modified version of a thesis that was accepted by the economic faculty of the University of Cologne in summer term 2005.

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Abbreviations

1G	First Generation
2G	Second Generation
2.5G	The enhancement of GSM (2G) which includes technologies such as GPRS
3G	Third Generation
3GPP	Third-generation Partnership Project
3GPP2	Third-generation Partnership Project 2
Ads	Advertisements
ARPU	Average Revenue Per User
AVC	Advanced Video Coding
BCMCS	Broadcast and Multicast Service
BSC	Balanced Scorecard
CAPEX	Capital Expenditure
CIF	Common Intermediate Format
DAB	Digital Audio Broadcast
DMB	Digital Multimedia Broadcast
DSL	Digital Subscriber Line
DVB-H	Digital Video Broadcast Handheld
DVB-T	Digital Video Broadcast Terrestrial
EDGE	Enhanced Data Rates for Global Evolution
ETSI	European Telecommunications Standards Institute (3GPP)
FIP	Financial Infrastructure Provider
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications (it originally stood for ‘Group Spéciale Mobile’, name of the European standardization group)
H.263	ITU-T (International Telecommunication Union) Video Coding Standard
H.264	ITU-T (International Telecommunication Union) Video Coding Standard
HSDPA	High-Speed Downlink Packet Access
IP	Internet Protocol
IPDC	IP Datacast
IS	Information Systems
ISDB-T	Integrated Services Digital Broadcasting - Terrestrial
ITU	International Telecommunication Union
Kbit	Kilobit

LBS	Location Based Services
MBMS	Multimedia Broadcast and Multicast Service
Mbit	Megabit
Mbyte	Megabyte
MHz	Megahertz
MMS	Multimedia Messaging Service
MPEG	Moving Pictures Experts Group
MTV	Music Television
MVNO	Mobile Virtual Network Operator
PC	Personal Computer
PCI	Perceived Characteristics of Innovating
PDA	Personal Digital Assistant
PSP	Payment Service Provider
QCIF	Quarter Common Intermediate Format
QVGA	Quarter Video Graphics Array
RStV	Rundfunkstaatsvertrag
S-DMB	Satellite – Digital Multimedia Broadcast
SIM	Subscriber Identity Module
SMS	Short Message Service
TAM	Technology Acceptance Model
TRA	Theory of Reasoned Action
TV	Television
UK	United Kingdom
UMTS	Universal Mobile Telecommunications System
US	Unites States
WAP	Wireless Access Protocol
WCDMA	Wideband Code Division Multiple Access
WLAN	Wireless Local Area Network

Jochen Trefzger

Mobile TV-Launch in Germany – Challenges and Implications

1. Introduction

The idea of watching television while on the move and not at home is not that new. Back in 1982 Sony introduced its first portable television, the Watchman. The first model called FD-200 featured a black and white picture tube and a screen size of 50 mm (diagonal) and was at first available in Japan for a price of around € 286 (K.T., 1982, p. 16). However, the Sony Watchman never really took off to the same extent as its music counterpart, the Sony Walkman, which was launched in 1979 (scienceandsociety.co.uk, 2004). The failure of the Watchman could be traced back to several reasons. With a height of nearly 20 cm and a width of approximately 9 cm, the first model was not really pocketsize and was not suitable as a permanent companion. The screen was tiny and the running time when battery powered was low (Günthör, 2005). In addition, consumers proved unwilling to carry a separate device around solely for the purpose of watching TV while on the move, unless they were sure that they would need it that day.

Today, the story seems to have changed. Mobile phones can be used as devices to receive television. The mobile phone is a permanent companion in most people's lives and thus available at all times.

People are already accustomed to the small size of the display. Furthermore, consumers do not use the device solely for communication purposes, but also for many other tasks, such as managing appointments and addresses, taking photos, playing games and even watching short video-clips.

Increasingly the world has developed into an information society. Nowadays, information and communication have gained importance both in people's private lives and in the business community with various forms of media and communication channels (e.g. TV, Internet, email, telephone and mobile phone) available to a very large percentage of the German population.

Today, television, as a mass medium for news and entertainment, and the mobile phone as a device for communication, are achievements that most people cannot imagine living without. More than any other medium, television determines the daily life of many people with more than two hours of TV programming consumed on average per day in 2004 (AGF/GfK Fernsehforschung, 2005). As the mobile phone is not used solely for communication via voice or SMS anymore, but also for entertainment and information, it appears feasible – if not obvious – also to use this companion to receive TV while not at home or in front of a large TV screen.

Both the TV market and the telephone market are mature and already saturated. To open up new sources of revenue, TV broadcasters as well as mobile phone companies may think about offering mobile TV.

Particularly the phone companies, that acquired expensive UMTS licenses[1] in Germany, are in search for additional revenue sources helping them generate returns on the large investments for licenses and network infrastructure (nano online / dpa, 2001). They are looking for new services with customer value that make use of the new 3G networks' capabilities. With innovative and interesting services they hope to attract new customers and convince their existing subscribers to migrate to a UMTS service plan resulting in higher average revenue per user (ARPU).

The launch of mobile TV in Germany is challenging for all stakeholders. However, when certain prerequisites are fulfilled and some obstacles overcome, it offers the involved parties great potential reward. At first mobile TV is defined and the two basic approaches are illustrated (chapter 2). In chapter 3 end user expectations, critical acceptance criteria and interest in mobile TV services are pinpointed and analyzed. Furthermore the technological and regulatory prerequisites (chapter 4), the value chain (chapter 5) and the services and pricing models (chapter 6) are investigated. Chapter 7 analyzes the economic implications arising from mobile TV for the value chain members, in particular mobile operators and TV broadcasters.

[1] During the German UMTS-auction in the year 2000 six network operators paid about € 8,4 billion each to obtain a UMTS-license (heise.de, 2000).

2. The Concept of Mobile TV - Two Basic Approaches

When first encountering the term 'Mobile TV', most people are likely to think about reception of traditional TV channels on a mobile device. This is also covered by Strategy Analytics' definition of mobile TV, which they define "as real time or near real time streaming of programmed content (usually made for TV) across either wide area cellular or broadcast networks for viewing on handheld devices" (Strategy Analytics, 2004, p. 1).

In this thesis, this definition is further specified as the time independent form of delivering TV content that is accessible on call as a download or stream. Most people will not plan their mobile TV usage as they plan their ordinary TV consumption but will want to have access to specific entertainment and information services anytime. Furthermore, it makes sense to further classify mobile TV in two categories, by the form of content delivered to the mobile device. The first category consists of the pure rebroadcasting of the traditional TV program that people watch on their TV receivers at home to the mobile phone through another delivery network, which is described in section 2.1.

The second way to deliver a mobile TV service, described in section 2.2., consists of developing a complete new TV program specially designed for the reception by a mobile handset. This would include the reformatting of existing content as well as the creation of completely new content.

Not covered in this thesis will be the reception of any kind of TV-signals such as terrestrial analogue or DVB-T signals by special portable devices.

2.1. 'TV *on* the Mobile'

The easiest and least costly way to deliver TV to the mobile phone consists of pure rebroadcast of ordinary TV programming either via the operator's cellular network or via new installed broadcasting networks using DVB-H or equivalent technologies. Idetic in the United States offers a television service called MobiTV that streams over 25 TV channels live over cellular networks; it includes channels such as MSNBC, The Discovery Channel, Fox Sports and is currently available to customers from three national mobile operators (mobitv.com, 2005a). SK Telecom, a South Korean mobile network operator, and TU Media have just launched a digital mobile broadcasting service (DMB) using satellites that offers its customers twenty audio channels and seven video channels among which are also ground frequency retransmission channels (SK Telecom, 2005).

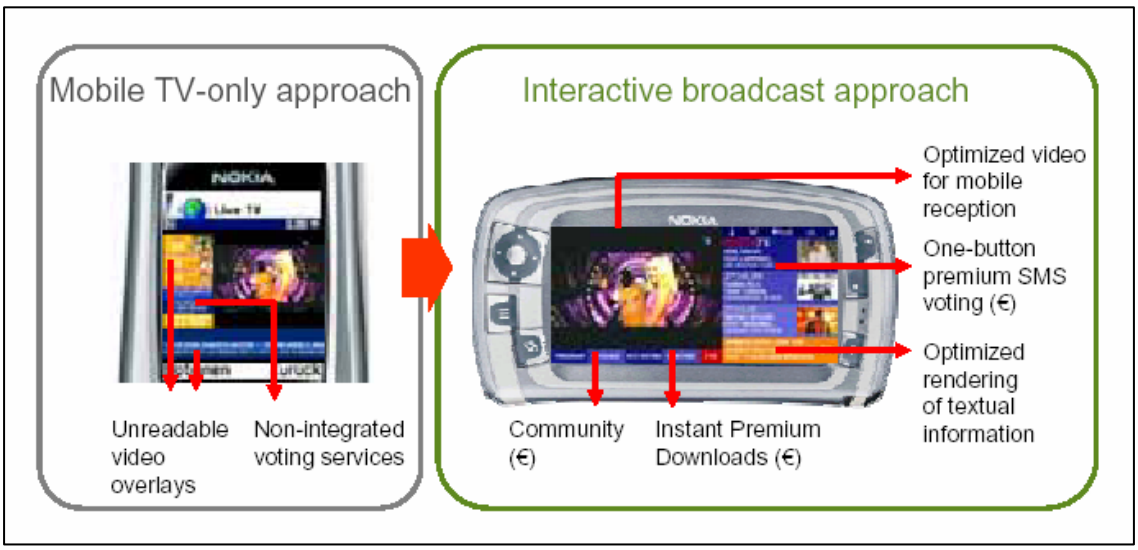
The main question that arises is whether the usage behavior of mobile users, as well as handset constraints such as display size and battery life will allow '*TV on the mobile*' to add enough value and convenience for consumers. Who would want to watch a two hour movie on a small sized display? Furthermore, the battery life of most current handsets is not powerful enough to serve for many hours of energy consuming TV viewing.

Analyst company Ovum believes that, although live TV services are the biggest application for the mobile, simply showing existing broadcast channels will not create value in the long run. However, it can serve as a good way to trigger interest of first-time users (Betti, 2004c, p. 4).

2.2. 'TV *for* the Mobile'

Technological implications of mobile phones and the usage behavior of their owners require a careful thought when offering TV services on the mobile.

Figure 1:
Mobile TV-Only versus Interactive Broadcast Approach



Source: Sattler, 2004, p. 4

Handset constraints, especially the small display size, but also advantages of the mobile medium, such as the availability of a feedback channel, as well as the mobile usage behavior are much more suited to specifically designed content and services. Looking at figure 1, this shows that just broadcasting existing TV on the mobile phone (left picture) would result in unreadable text and a lack of integrated interactive services such as voting (problems of easy accessibility). The *interactive broadcast approach* (right picture) offers optimized video for the mobile reception, readable text (as a result of the optimized rendering of textual information) and integrated interactive services such as voting and downloads as further revenue sources.

Due to the small screen, mainly close-up shots and short, fast cuttings should be used to allow a good TV experience.

According to a study by VTT, users preferred watching short programs such as news and current affair programs on their mobile. The cause for this behavior can partly be found in technical limitations, such as the picture quality, but more importantly in the consumer's viewing habits. Most consumers are likely to use mobile TV when away from home to kill time, e.g. when waiting for a train or

flight to arrive or just to be informed when they are on the go, e.g. to get a quick news update. They will not spend hours continuously in front of their mobile phone watching TV. (Södergard, 2003, p. 167)

As mobile TV will be used in various locations and at different times of the day mainly for short periods, people want to have access to specific information or entertainment anytime and anyplace.

Therefore, we have to move beyond the classical definition of TV that assumes live broadcasted content. People will not plan their mobile TV usage as they plan their ordinary TV consumption. In order to increase service convenience for the customer, programs and content should not only be streamed live, but also be accessible anytime on request, similar to using a personal video recorder at home.

Any kind of video content specifically developed for the mobile channel creating a TV experience for the customer will be defined as *'TV for the mobile'*.

3. End-User Expectations and Demands for Mobile TV

In the past, technical feasibility dominated the development and introduction of new products and services far too often. Less attention was paid to customer requirements. This often did not result in customer acceptance of the new product or service nor in creation of new markets. The number of different product offerings was unmanageable for the consumer and they were advertised more by their technological innovation rather than by their real value. Missing experience and a resulting lack of decision competence and value estimation often led to uncertainty and also to possible rejection of the new product or service by the user. (Terlutter, Purper, Hohensohn, & Ludwig, 2003, p. 133)

If one knows what users expect from mobile TV and which preferences they have, appropriate services can be developed more easily. The mistake of overhyping a service, such as the introduction of WAP, has to be avoided. Consumers' expectations with regard to the mobile TV experience have to be managed and moderated so that consumers do not expect picture and sound quality equal to their home television set. (visiongain, 2004, p. 175)

Apart from what users expect from a mobile TV service, it is necessary to find out if market potential for mobile TV exists and how high the demand for such services would be.

3.1. Necessary Features and Functions for Mobile TV to be Accepted by Consumers

The experience with innovations, which are often affected by the advanced implementation of new technology, shows that technology alone is not the only determining factor for the success of a product. Particularly for products and services developed for consumers, user acceptance is a critical success factor. In the field of mobile applications the relevance of user acceptance is especially high. (Amberg, Wehrmann, 2003, p. 5)

For disposition to use a mobile service and willingness to pay for it, user acceptance is seen as an important influencing factor. If one succeeds in measuring user acceptance, valuable insights for the product development process and the product life-cycle can be deducted. (Amberg, Wehrmann, 2003, p. 1)

3.1.1. User Acceptance and Acceptance Models

Many factors can influence the acceptance or non-acceptance of technical product innovations. Various models and theories have been developed over time trying to analyze and explain user acceptance.

No other name is associated as closely with research of innovations as Everett M. Rogers; he is seen as the founder of economic diffusion research (Dethloff, 2004, p. 94). He developed the *Diffusion-of-Innovations-Model*, which describes the individual adoption process of innovations in detail (Rogers, 1962, 1983,

1995). Part of this model is also the *Innovation-Decision Process* which covers the following sequence (Rogers, 1983):

- knowledge (about an innovation)
- persuasion (of its benefits)
- decision (leading to adoption or rejection)
- implementation (if adopted, innovation becomes part of consumer's daily routine),
- confirmation (search for information confirming the prior decision)

"*Diffusion* is the process by which an innovation is communicated through certain channels over time among the members of a social system." Mass media can be a communication channel that is most effective in creating knowledge about innovations while interpersonal channels are more effective in influencing attitudes toward a new product. (Rogers & Scott, 1997)

Another effect, basically identical with the *diffusion process*, is the *interaction effect*. It describes the process through which consumers in a social system, who have already adopted a new product, influence those, who have not yet adopted (Rogers, 1962, p. 138).

The social system defines the boundaries within which an innovation can spread. A social system means a group of individuals with certain common grounds that interact with each other over time. (Dethloff, 2004, p. 49)

Innovators are interested in *product innovations* and they are the first within a social system to buy new products, as they are attracted more by newness appeal than later buyers (Robertson, 1971, p. 15). Innovators (and also early adopters) and their pioneer behavior play an important role in the *spread of an innovation* (diffusion process); the experiences they gain about product appliance and value will be the basis for other consumers' adoption decision (Dethloff, 2004, pp. 68, 73).

Rogers (1962, 1995) defined five categories, in which he classified the adopters depending on their *innovativeness*:

- innovators
- early adopters
- early majority
- late majority
- laggards

Innovators are the 2,5% within a social system or market segment, that are venturesome and adopt an innovation immediately. While an innovator may not be respected by other members of a social system, they play a crucial role in the diffusion process by importing the innovation from outside the system's boundaries. *Early adopters* are the 13,5% that adopt a new product after the innovators; they are more integrated in the local system than innovators. As they are

quite close to the average individual with regard to innovativeness, they serve as a role model for many other members of a social system. Early adopters are respected persons and have the greatest degree of opinion leadership in most systems, with potential adopters often asking them for advice. *The early majority* is the next 34% of consumers, who adopt an innovation just before the average member of a system, but sometimes with deliberate willingness to adopt. They interact frequently with peers but seldom own an opinion leadership position in a system. This group is an important part in the diffusion process because it represents nodes in the interpersonal network of a system. The *late majority* presents the subsequent 34% adopting an innovation just after the average consumer of a social system. Innovations are approached with a cautious and skeptical air and even if they are convinced from its benefits they need additional pressure from their peers to adopt new products. Limited financial resources postulate that all uncertainties are removed and the weight of system norms must definitely favor an innovation before the late majority are convinced and adopt an innovation. *Laggards* are the last 16% of individuals to adopt an innovation. They are the most locally attached with their attitudes, many nearly isolated in the social networks of their systems. Laggards are suspicious regarding innovations and make decisions according to how they acted in the past. Resistance to innovations can be completely rational from the laggards' point of view, when their resources are limited and before they adopt they want to be sure that the innovation will not fail. (Rogers & Scott, 1997)

Similar to Roger's Diffusion Theory, Forrester Research has segmented the European mobile phone users in three clusters:

- Fanatics
- Followers
- Fugitives

Fanatics always use up-to-date technology and own the newest handsets. They are keen on trying out new products and services and also interested in the technology behind them. 16% of the mobile users belong to this cluster. *Followers* represent with 42% of users the populace. They judge technology by its practical usefulness and they adopt it when they believe it is mature. The last 42% of users belong to the *Fugitives*, who prefer easy usability and proven forms of usage. They do not adopt new technologies until it is absolutely necessary. For them it is only important *that* the technology works, and *not how* it works. (Forrester Research, 2002)

With regard to mobile TV one can see that it is important for the adoption process to initially target the segment of innovators and early adopters or, following the segmentation model from Forrester Research, the Fanatics. They are the first to try out new services and they need to be persuaded that the new service gives them added value. It has to be achieved that they make use of the new mobile TV service regularly and integrate it into their daily routine. If they are convinced and accept the new service, other market segments will follow as result of the diffusion process (and the interaction effect).

Next to attitudes and behavior the successful usage and application of a product or service is very important for technical innovations. This crucial factor is regarded in many multi-level acceptance models of information management, which split the adoption process in several phases. In the area of Information Systems (IS), the *Technology Acceptance Model (TAM)* is one of the two dominating models - next to *the Perceived Characteristics of Innovating (PCI)* model - and being one of the most popular acceptance models in the Anglo-American world. (Dethloff, 2004, pp.135, 136, 138)

Davis, Bagozzi and Warshaw have developed the TAM to predict and explain user acceptance and rejection of informational-technological applications at the workplace, e.g. word processing or email-communication. The TAM is directly derived from the *Theory of Reasoned Action (TRA)*[2]. (Davis, Bagozzi, & Warshaw, 1989, pp. 983, 985)

Their research has identified two variables as especially important to influence the user acceptance of information technology. People will adopt a new application to the extent that they believe it will increase their job performance; this is referred to as *perceived usefulness*. At the same time they might believe that the new product is too complicated to use, therefore outweighing the performance benefits of usage; this influencing variable is the *perceived ease of use*. (Davis, 1989, p. 320)

Perceived usefulness is defined as “the degree to which a person believes that using a particular system would enhance his or her job performance” while *perceived ease of use* describes “the degree to which a person believes that using a particular system would be free of effort.” (Davis, 1989, p. 320)

Most acceptance models – including the TAM – concentrate on some specific aspects of user acceptance, which are then analyzed in detail, but the in-depth results from the time-consuming analysis are often not adequate to improve application design. Furthermore many existing models lack the feasibility of integrating the analysis and evaluations into an *overall methodical approach* for the development of services. (Amberg, Hirschmeier, & Wehrmann, 2004, p. 249)

The TAM seems to be suited to analyze the user acceptance of mobile TV. Although the TAM was developed for analyzing user acceptance of computer technology at the workplace, it could easily be adapted for mobile services, which are also used for leisure activities. A mobile TV service is intended to give users added value (→ perceived usefulness) and at the same time it should be convenient and easy to use (→ perceived ease of use).

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2 TRA is a widely studied model from social psychology which examines the determinants of consciously intended behaviors. It is very general and “designed to explain virtually any human behavior”. (Ajzen & Fishbein, 1980, p. 4)

However, the TAM focuses mainly on the service itself but does not integrate the *contextual conditions* of a service which are crucial when regarding mobile services (Amberg et al., 2004, p. 252).

For the analysis of user acceptance of mobile services a new approach is needed.

3.1.2. The Compass Acceptance Model

As classical acceptance models are not very well suited for the acceptance analysis of mobile services, the *Compass Acceptance Model* was developed, which extends on the TAM for the missing dimensions. The Compass Acceptance Model is an instrument for the analysis and evaluation of user acceptance of mobile services and extends on the *Compass* approach. It aligns itself alongside the structure and idea of the *Balanced Scorecard (BSC)*[3]. With an examination and analysis of different, individually measurable acceptance criteria, it is possible to differentially evaluate user acceptance. (Amberg, Hirschmeier, & Wehrmann, 2003, p. 79-80)

The basic structure consists of the complementary classifications *benefit/effort* and *services/general conditions of services* (figure 2). This leads to four distinguishable dimensions:

- perceived usefulness,
- perceived ease of use,
- perceived mobility,
- perceived costs.

The first two dimensions, namely: *perceived usefulness* and *perceived ease of use*, are taken directly from the TAM. They are both assigned to the service-specific acceptance (*services*). The Compass Acceptance Model extends the two dimensions of the TAM-approach by the two dimensions: *perceived mobility* and *perceived costs*. These two dimensions are used to examine the general conditions of mobile services. The dimension *perceived mobility* considers the mobile device, the available mobile networks and, depending on the regarded service, also the degree of situation-dependency. The dimension *perceived costs* is used to consider monetary costs but also non-monetary costs as for example health risks. (Amberg et al., 2003, p. 80)

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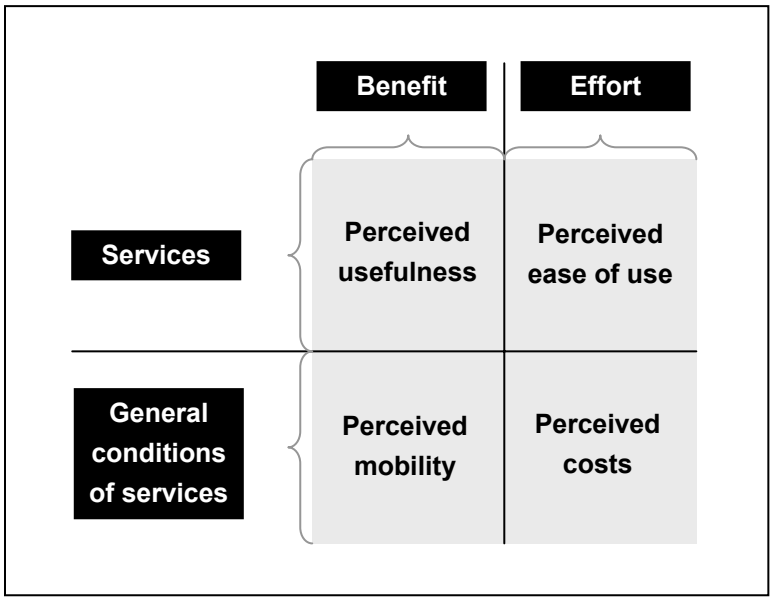
[3] Balanced Scorecard: A strategic management system developed by Robert Kaplan and David Norton. Eliminating some of the weaknesses of previous management approaches, it shows companies what to measure in order to continuously improve strategic performance and results. The BSC-approach also allows companies to clarify their vision and strategy and translate them into action. (Arveson, 1998)

Figure 2:
Four Dimensions of the Compass Acceptance Model



Source: Amberg et al., 2004, p. 258

A further partition of the dimensions is typical and often necessary. For the acceptance of mobile services, it makes sense to split-up in *first use* and the following *regular usage*. The first use represents a barrier for regular usage of a service. The Goal is – similar to the BSC-approach – to have as few measurable acceptance criteria as possible which show a high significance. For balance it is usual to specify and equal number of criteria for each of the identified regions (in our case it would be eight regions – the four dimensions each split in first use and regular usage); if the number of criteria is unequal weighting factors might become necessary. For evaluation of the criteria a measurement scale, the measuring method and measuring indicators need to be specified for every acceptance criteria. (Amberg et al., 2003, p. 81)

As basic procedure for applying the Compass Acceptance Model a breakdown in four phases is considered reasonable. In the first phase the structure of the approach is questioned, eventually adjusted respectively further refined. It has to be verified if the chosen four dimensions and their further partitions are appropriate for the evaluation of the regarded mobile service. In the second phase the acceptance criteria and the needed weighting factors, measurement scales, measuring methods and measuring indicators are defined in accordance with the structure. The measurability of the criteria and the balance are checked for plausibility. As a third step the actual acceptance survey is conducted after a representative group of respondents has been selected and the general framework for the evaluation has been defined. In the fourth step the responses of the surveyed users are evaluated statistically. The results can be visualized with the DART-approach. (Amberg et al., 2003, p. 81-82)

The Compass Acceptance Model can be flexibly adapted to the development status of various mobile services and thus illustrate the acceptance at different points in the life cycle of mobile services. The quality of the insights from the model is generally dependent on the type of mobile service and the point in time of the examination. Concrete mobile services can be evaluated much easier than abstract classes of services. Furthermore an analysis of the user acceptance is easier in the late development phases, as e.g. functioning prototypes exist, than in early stages of development. (Amberg et al., 2003, pp. 82, 86)

The Compass Acceptance Model is best suited for analyzing user acceptance of mobile TV services.

3.1.3. Critical Acceptance Criteria

New products and services will only be accepted by consumers if they meet their expectations, and above all, they must offer users added value and be convenient to use. The initial uptake of MMS was relatively slow compared to uptake of SMS; next to limited numbers of MMS enabled handsets and interoperability issues, this was mainly due to service complexity, high and complex pricing and the failure to provide added value in the customer's perception (Strategy Analytics, 2004, pp. 5-7,10).

When further dividing the four main dimensions set up by the Compass Acceptance Model, one can identify several criteria that will play a role with the acceptance of mobile TV services. Most relevant criteria can be attributed to the service itself such as the quality of content and the display size on the handset. Other factors that have an impact on user acceptance include socio-demographical factors, mobile usage behavior and social and cultural influences (Amberg & Wehrmann, 2003, p. 24, Amberg et al., 2003, p. 82). Table 1 gives an overview of the identified service-specific acceptance criteria relevant for mobile TV, assigned to the four dimensions of the Compass Acceptance Model. These criteria can be attributed to the *first use* and the *regular usage* of the service as the user will probably value attributes differently after the first use and later when accustomed to using the service.

The quality and scope of content offered by the mobile TV service is highly critical for user acceptance. Participants of a trial carried out by VTT in 2002/2003 expected that all content from conventional television would also be available on the mobile, even if it was not suited for mobile viewing. Participants hence were disappointed with the range of programs that were receivable on their phone. The viewers were not familiar with the idea of content specially designed for the mobile and expected just regular TV channels. Nevertheless, some users mentioned that they would be interested in special mobile TV content such as micro-movies or summaries of existing programs. The users mainly watched short programs or only parts of programs due to technical constraints such as picture quality and viewing habits dependent on their length of stay in public spaces, where the service was mainly used. (Södergard, 2003, pp. 144, 166-167)

Table 1:
Acceptance Criteria for Mobile TV

Dimensions and their value		Acceptance criteria
Perceived Usefulness	First use	• User expectations • Location and time independent usage • Program offering / number of channels • Quality of content • Interactivity
	(Regular) usage	
Perceived Ease of Use	First use	• Display size and resolution • Picture quality • Interface design / navigation • Login procedure
	(Regular) usage	
Perceived Mobility	First use	• Battery life of handset • Reception quality (at different locations) • Location dependent functions
	(Regular) usage	
Perceived Costs	First use	• Costs for service (pricing, transparency) • Costs for device • Acceptance of advertising • Tolerated forms of advertising
	(Regular) usage	

Source: own illustration following Amberg & Wehrmann, 2003, p. 47

Analysts believe that just showing existing broadcasted channels on the mobile would not create value in the long term but is also not very well suited for the intended usage behavior of mobile TV. They believe TV content specifically designed for the mobile reception needs to be developed. (Betti, 2004c, p. 4, visiongain, 2004, pp. 156-157)

Mobile content consumption today (e.g. news via MMS, games) is mainly used to kill small gaps of time (often only 2 – 3 minutes) between other activities, for example while waiting for or taking the bus or train, waiting in airports or having lunch in a fast-food restaurant. The usage patterns of mobile TV found in trials and surveys suggested that it would be used in a similar way. Full-length original TV programs are too long and not suited for this usage behavior and would also drain handset batteries rapidly. (Strategy Analytics, 2004, p. 4, visiongain, 2004, pp. 156-157)

News and current affair programs as well as short mobile series such as soaps, are preferred by most users and should not be missing in any mobile TV offering (Södergard, 2003, p. 167). Next to offering live TV channels, mobile TV services should also include video on demand services to offer users more flexibility, allowing for *'TV anywhere, anytime'* (Södergard, 2003, p. 16, Sattler, 2004, p. 3). This feature would be of great value for users considering the different usage framework on handsets and resulting viewing habits for mobile TV consumption. As the mobile phone is providing a back channel, special interactive formats should make use of this and actively integrate the viewer in the mobile TV experience (Betti, 2004c, p. 5, Sattler, 2004, p. 4). *TV on handset* works best when TV becomes part of the user's life (Darling, 2004, p. 21).

Handset restrictions, i.e. size and resolution of the display and the data rate with which the TV-signal is transmitted, limit the achievable quality of the displayed video (see section 4.4.). “As such, the mobile phone can never hope to replicate and match the experience of watching a movie on a large-screen TV at home, but users are realistic enough not to expect this” (visiongain, 2004, p. 60). However, those limitations also demand special adaptations, e.g. the optimization of textual information for the small screen size (Sattler, 2004, pp. 4, 8). Other device-specific attributes such as battery life, which can negatively impact the perceived mobility, will be solved in the near to medium term future.

As mobile TV is to be used in different locations, especially to fill time gaps, a good coverage must be assured allowing the reception of the TV-signal in various places including moving vehicles, buildings, subways and airports.

Important for the user acceptance will also be the usability of the mobile TV service, which will be strongly dependent on the design of the interface and the way of navigating within the service. The ease of use of the handset interface will equal its use (“Mobile Handset Interfaces”, 2002, p. 3). WAP services for example are normally operated by using four to six keys even on a modern handset. User tests have shown that already this limited number of control elements can be complicated to use and raise barriers for unskilled users. The user can end up frustrated not interested to use the service anymore despite initial interest. (Schwab & Bopp, 2003, p. 39)

Otherwise there are many data services that require access to a full keyboard as close as possible to a PC-keyboard (“Mobile handset interfaces”, 2002, p. 3). For mobile TV mapping the keypad of a mobile phone to that of the TV remote control probably resembles the best interface for user input. Given that the TV remote control is likely to have more keys than available on the handset multiple functions can share the same key by working in different modes. Using speech recognition might be another way to let the user navigate through the different channels. As the vocabulary needed to represent all TV remote control functions is relatively small, speech recognition should work reliably despite the compression of a speech and a potentially noisy environment. (visiongain, 2004, p. 61)

Estimating the willingness to pay for mobile TV and developing an appropriate pricing scheme will be crucial for service acceptance. Willingness to pay for mobile TV has already been assessed in some surveys (see section 3.2.). For a broadcast mobile TV service also the costs for the handsets equipped with a special receiver – which can assumed to be higher than those of handsets without one – will be of importance.

Advertising, especially the form of sponsoring, could be used to subsidize services. It could also be used as a form of financing for content that users are less willing to pay for. When rebroadcasting existing channels, the long commercial breaks of the Free-TV will probably annoy users on the mobile even more, since they do not fit into the main viewing framework. Thus if advertising shall be introduced, new advertising concepts are needed (see also section 7.5.2.).

Within the scope of a project of the Seminar of Information Management III of the University of Erlangen-Nürnberg, an acceptance study among 200 people was conducted to evaluate the acceptance of a mobile TV service called 'Mobile Bahn-TV' by using the Compass Acceptance model. In the preliminary stages of the research, 120 individuals were questioned regarding if they could imagine watching TV while on the move, at which locations, in which circumstances and under which conditions. The results from this survey were used to develop a prototype for the service; they also resulted in the usage of a PDA as a viewing device since all respondents considered the displays of mobile phones as too small. As an alternative to UMTS a local wireless network was proposed for service delivery.[4] The mobile TV service should be available in the selected trains of the Deutsche Bahn AG for the reception by mobile devices such as handsets or PDAs. The service works similar to video on demand with the customer being able to choose delivery time and content from a selection of programs; the price of the service was assumed to be an additional €1.50 to the Bahn Card. When configuring the empirical universe it was attempted only to select people of the potential target group. The users were clustered using the segmentation model from Forrester Research, described in section 3.1.1. For the most part, equal or very similar acceptance criteria as in table 1 were identified and used as a basis for the questions in the survey. (Amberg & Wehrmann, 2003, pp. 22, 46)

The evaluation of the acceptance results revealed a high acceptance of the prototype 'Mobile Bahn-TV' across all age groups within the categories perceived usefulness, perceived ease of use and perceived mobility. A clear majority was confident with the program offering, the navigation, display size and login procedure. About every fifth participant would accept advertising if he could use the service free of charge, but 62% would prefer to pay the price of €1.50 for an ad-free program. The high acquisition costs of a mobile TV capable PDA performed worst among the acceptance criteria and were seen as major drawback by users. 73% of the surveyed users said they would be willing to use the service during their train journeys frequently or always. As expected, analyzing the survey result, according to the prior defined clusters reveals that the *Fanatics* show a higher acceptance compared to all respondents. The *Followers* that are so crucial for driving demand also showed better results than the average. (Amberg & Wehrmann, 2003, pp. 48-51)

Concluding can be stated, that the following criteria will be most critical for the acceptance of mobile TV: the scope and quality of TV-content, the pricing of the

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[4] It should be annotated here that the large display size of a PDA would require higher data rates for a good quality of a full-screen picture than a smaller mobile phone display. It may be doubted that the currently deployed UMTS technology is able to handle that data rate. Furthermore the problems with low revenues per Mbyte (see section 7.4) would intensify. Other analyst reports also show that modern handset displays are sufficient for a convenient mobile TV experience (vision-gain, 2004, p. 60).

service (and if needed: the costs for special handsets), the picture quality and the interface design.[5]

3.2. Consumers' Interest in Mobile TV Services

Mobile phones and TV already show strong links between each other, which have been partially explored. Using the mobile channel for interactive services in TV shows does not mean convergence between both devices but it shows existing synergies that can be exploited by mobile TV. (visiongain, 2004, p. 22)

Recently a lot of shows with interactive elements in them have gained popularity. The interactivity is often accomplished by using the mobile phone as feedback channel. Shows such as 'Pop Idol' and MTV's 'Videoclash' include services such as SMS voting and texting, which are an integral part of the TV-formats and generate additional revenues for the broadcasters. (visiongain, 2004, p. 22) MTV has noticed that SMS voting is gaining such a great popularity, that it developed the program Videoclash which is entirely based around the concept of SMS voting. MTV says that during each show, around 40.000 SMS are generated, achieving a conversion rate[6] of 27% (visiongain, 2002, pp. 47-49).

As the figures show - users - especially younger ones, have already widely accepted these services and make intense use of them. Since there is already a link between both worlds, it would make sense to further integrate products and formats – with the final outcome being mobile TV. Consumers would only need one device to watch the program and to interact, e.g. vote for a music video.

Many surveys and trials already show strong consumer interest in mobile TV services. A survey among mobile phone users carried out in Japan in 2004 revealed that TV capability is the most desirable function for future mobile phones with 43% of respondents pointing to it (NEAsia Online, 2004). Around 40% of users surveyed by Sony Ericsson showed interest in mobile TV (Strupczewski & Carew, 2004). The survey of participants in a trial for mobile broadcasted TV in Germany conducted by bmco[7] showed that even 77.8% of the participants regarded mobile TV as a good or excellent idea, with 80% of people willing to pay €12 per month for it (Strategy Analytics, 2005, pp. 12-13).

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5 Analysts from visiongain (2004) in its mobile TV report come to a similar conclusion and believe that pricing, an intuitive user interface and compelling TV content and services will be the three most crucial variables for mobile TV acceptance (p. 176).

6 Conversion rate: "the percentage of visitors who take a desired action" (marketing-terms.com, 2004). Here it means the TV viewers, who voted via SMS.

7 bmco (Broadcast_Mobile_Convergence) was a joint project in Berlin between Nokia, Philips, Universal Studios Networks Deutschland GmbH and Vodafone, conducted between August 2003 and October 2004 to evaluate the business potential offered by the convergence of digital terrestrial television (DVB-T/H) and mobile communications technologies (bmco, 2004, pp. 1-2).

However, an own survey conducted by Strategy Analytics' Advanced Wireless Laboratory showed contradictory results. According to the survey, over 70% of US consumers had little or no interest in using the mobile phone to access short TV programs, while European respondents were scarcely more positive. Strategy Analytics believes that the survey by bmco which validated the case for launching mobile broadcasted TV was so positive because the results came from trialists which had already used the service. They believe that the results did not reflect the real challenge of convincing disinterested consumers lacking the necessary information regarding new services. Thus the appeal of mobile TV to consumers to their opinion is still largely uncertain although the supply of TV services is ramping. (Strategy Analytics, 2005, pp. 11-12)

One has to keep in mind that the number and configuration of participants in these trials and surveys is often not evident and thus one always has to question, if they are statistically representative (which could neither be proved nor disproved for the quoted surveys in this paper). Furthermore, if an equipment manufacturer or operator has conducted the survey, they might only publish the results which reflect their own interests.

Despite surveys showing different results, evidence from other countries indicates that the take up of mobile TV services could be very high. In South Korea, video-based mobile services account for around 50% of the network provider's data revenues (visiongain, 2004, p. 120). Of course the market development and consumer behavior can not be transferred 1:1 from Asia to Europe. Japan and South Korea have a highly tech-savvy population and represent the most advanced mobile markets in the world; they have always been two to three years ahead of Europe regarding technology and user trends (visiongain, 2004, p. 118). Hence, developments on Asian markets could be seen as indicating future trends for the European markets.

Mobile TV fulfills consumers' inherent needs for information and entertainment whilst on the move. Using the big screen at home for watching television will of course always be preferred when possible, but the location independence of mobile TV gives users more added value and convenience. (visiongain, 2004, p. 31)

4. Technological and Regulatory Prerequisites for Mobile TV

To enable the reception of television services on the mobile phone some prerequisites need to be fulfilled. These are mainly technical aspects such as the availability of the different delivery networks and bearer technologies with their particular advantages, aspects concerning video quality and handset issues. However, regulatory aspects such as broadcasting licenses also need to be considered.

4.1. The Different Bearer Technologies and Their Particular Advantages

Different networks using various technologies can be used to deliver mobile TV to the recipient. These technologies are called bearer technologies. There are three main radio technology families, on which the various delivering technologies are based:

- mobile cellular networks (e.g. UMTS)
- terrestrial digital broadcast networks (e.g. DVB-H)
- hybrid satellite gap filler systems (e.g. S-DMB)

Each of these technology families contains various specific technology standards, which are not equally prevalent in all parts of the world and sometimes only used in certain countries or regions (e.g. is DVB-T the technology to deliver terrestrial digital TV in Europe. In Japan ISDB-T is used for that purpose). (Alcatel, 2005, p. 4)

They are not all suited in the same way for the delivery of mobile TV and they all have their specific advantages and disadvantages. In the following, only technologies which currently exist in Germany or whose deployment seems possible over the next few years will be described.

Mobile Cellular Networks

In Germany, most mobile subscribers currently use the GSM-networks, belonging to the 2G families. In their basic version (GSM-only), they were mainly designed for telephone and simple data services. Hence their data throughput rate is very low and not suitable for delivering sufficient quality for mobile TV. Later a new technology for non-voice value added services called GPRS, which is regarded as a subsystem within the GSM standard, was incorporated in the 2G mobile networks. It uses packet-switched data for transfer and allows for much higher data throughput rates (up to 115 kbit/s), a specially equipped mobile phone presumed. EDGE technology can be applied as an add-on to GPRS (it cannot work alone) and further enhance data rates on the radio link for GSM. EDGE offers significantly higher throughput and capacity, data rates for a single connection can be up to 384 kbit/s. Furthermore EDGE can leverage existing GSM systems and complement WCDMA[8] for further growth. Networks equip-

[8] WCDMA is the underlying technology in European UMTS networks.

ped with GPRS or EDGE technology are also called 2.5G networks. (Ericsson, 2003, pp. 3-4)

Since June 2004, all four operators in Germany offer the third generation (3G) UMTS networks (Merrill Lynch, 2005, p. 11) which have much higher data throughput rates (up to 384 kbit/s) and were specifically designed for multimedia delivery. In early releases of the UMTS standard a single cell supports only a small number of simultaneous high bit rate connections, typically three 384 kbit/s streams (de Vriendt, Gomez Vinagre, & Van Ewijk, 2004, p. 2).

A single cell in a mobile network can only handle a limited number of users simultaneously and a certain amount of traffic. If the population of customers increases in the cell area, the only solution to handle this is to increase the number of base stations in this area.[9] A channel in a cell has a certain capacity (varying dependent on the cellular technology) and dynamic channel allocation allows assigning users more channels, if they need more capacity for data services. However this also implies that users in the same cell have to share the limited resource bandwidth, and if many subscribers make use of data intensive services at the same time, they all get assigned less bandwidth. (Wikipedia, 2005)

The achievable data throughput will also vary with the strength of the radio signal, i.e. if the user is near by a base station he/she can achieve higher data rates (M. Haase / Ericsson, personal communication, May 19, 2005).

Cellular networks were designed for distributing content from one device to another (one-to-one delivery). Hence they are very inefficient and waste a lot of spectrum resources when delivering the same content to a large group of users. If 100.000 people wanted to watch a live-stream of a goal-scene, the network would have to send the necessary data 100.000 times to each one of them. This type of delivering mobile TV over the existing 2.5G and 3G networks is called ‘cellular unicast data delivery’. Most operators already offering mobile TV services (such as T-Mobile, Sprint PCS, Vodafone) are using this method for delivery. (Betti, 2004a, pp. 4-5)

Cellular networks will continually evolve in future providing higher bandwidth and larger network capacity; network operators need to employ the most advanced technologies to stay competitive and use the limited resource bandwidth in the most cost-effective way (Nokia, 2004, pp .4-5). HSDPA is a technology-enhancement for current UMTS networks. It offers a four-fold improvement in network capacity and peak data rates of up to seven times higher – as much as 14 Mbit/s in the downlink – than the most advanced UMTS networks today (Ericsson, 2004, p. 14, Lucent Technologies, 2005, p. 1).

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9 For a simple cellular network the number of base stations is equal to the number of cells (Wikipedia, 2005).

Most operators will upgrade their current UMTS systems in the near future with HSDPA as it is a cost-effective way to improve efficiency (Lucent Technologies, 2005, p. 4) as well as end user experience significantly (Ericsson, 2004, p. 11).

The higher bandwidth provided by future technology enhancements such as HSDPA can be used to offer higher quality TV-streams or to reduce the delivery costs when maintaining the same quality. The higher capacity of the network can also be used to deliver more video content simultaneously (Alcatel, 2005, p. 6).

A content server which distributes content to several users simultaneously must handle a separate point-to-point connection for each recipient. Especially when numerous users of a mobile TV service are located within the same cell - e.g. fans in a soccer stadium monitoring parallel games on their mobile phone - the radio access network can become a serious bottleneck. In this case the cellular point-to-point distribution would be very inefficient if not prohibitive. So distributing mobile TV content over a cellular network with point-to-point connections is feasible for low to moderate numbers of users, but when subscribers increase, network overloads can occur and this approach is not economical anymore. (Bakhuizen & Horn, 2005, p. 2)

Mobile Broadcast/Multicast in Cellular Networks

Another way of delivering mobile TV over existing cellular networks is the emerging multimedia broadcast and multicast technology specified as MBMS (by 3GPP) respective BCMCS (by 3GPP2) . This technology is an IP datacast (IPDC) type of service and can be applied to GSM and UMTS networks. It has been standardized in various groups of 3GPP and 3GPP2. MBMS and BCMCS allow establishing point-to-multipoint connections, where data is transferred from a single source to multiple users simultaneously. (TeliaSonera, 2004, p. 2, Bakhuizen & Horn, 2005, p. 1)[10]

The term broadcast in this context refers to the ability to deliver content to all users in the reception area, whereas multicast is used to deliver content only to users who are members of a particular multicast group. These are commonly users interested in certain kind of content, e.g. in sports or news. (Bakhuizen & Horn, 2005, p. 1)

The required resources for delivering TV channels via unicast today depend on the number of simultaneous users. When broadcasting channels via MBMS the number of content channels – and not the number of users – determines the required radio resources. This enables considerable resource savings in the core and radio network. (Lohmar, 2004, pp. 3-4)

For the deployment of MBMS only minor changes to the existing radio and core network protocols are necessary, reducing implementation costs in the cellular network as well as in handsets. Interactivity is also possible, since cellular

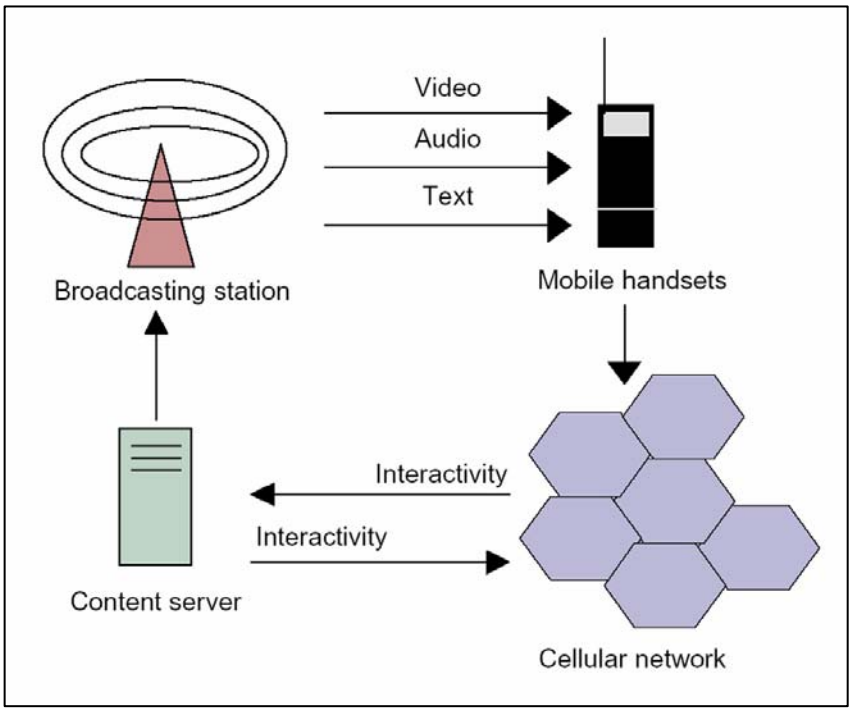
[10] When in the following the term MBMS is used it will be used synonymic for ‘mobile broadcast/multicast in cellular networks’ including the similar BCMCS standard.

broadcast services can be multiplexed with existing voice and data services. The broadcast service can also be easily configured to deliver different content in different areas of the network due to the small size of mobile cells. To efficiently deploy broadcast-like services to mass-audiences over a cellular network will require the implementation of the relatively inexpensive broadcast/multicast technology. (Bakhuizen & Horn, 2005, pp. 2, 8)

Digital Broadcast Networks

These networks are used to broadcast digital TV-content to mass audiences in front of their TV-sets at home. In Germany, the European DVB-T standard was employed for this task. The emerging DVB-H standard is based on DVB-T and adds support for the special requirements that mobile reception on small screen devices brings along. The DVB-H radio standard is combined with the IP technology already known from Internet communication to make content delivery more flexible. With this mobile IP datacast service, which uses small IP data packets for transportation, all kinds of digital content including music, television and games can be distributed. Furthermore a return path over the existing cellular network is integrated in the DVB-H standard to make user interaction possible. (Nokia, 2004, pp. 2-3)

Figure 3:
Mobile IP Datacasting Solution



Source: Betti, 2004a, p. 3

The IPDC technology has the advantage that by using the Internet protocol to transfer small packets of data, every form of content such as video, audio and text can be distributed.

Mobile phones only have a limited power supply, small screens, low processing power and no large external antennas necessary for good indoor coverage. A technology called *time-slicing* enables a longer battery life by sending the content in high-speed bursts, which are buffered in the mobile phone and then played back over a longer period of time. The massive power consuming receiver module can be shut down between the bursts achieving considerable energy savings of up to 90%. To provide a good urban indoor coverage requires the installation of many transmitters to reach a similar density to cellular networks. (Nokia, 2004, p. 3, Alcatel, 2005, p. 5)

A DVB-H network has a high bandwidth of about 11 Mbit/s, allowing simultaneous broadcasting of 25 to 80 TV-channels or video streams depending on the desired quality. To deliver a high quality TV-experience on the small-sized screens of mobile phones, it is sufficient to use 128 to 384 kbit/s of bandwidth per channel. (Nokia, 2004, p. 3)

Broadcasting as a one-to-many connection is very efficient with no limitation in the number of simultaneous users receiving the content within the coverage area. Although, for receiving TV-content over a DVB-H network, mobile handsets need to be equipped with a special receiver module. Deployment of DVB-H will also be dependent on frequency allocation and other regulatory issues such as the analog-to-digital TV switchover (Alcatel, 2005, p. 6).

As the networks do not yet exist, they either need to be built up, entailing high investment costs, or existing DVB-T networks could be enhanced by repeaters that assure good indoor reception even with the small antennas of mobile phones. The second option, even if considerably cost-efficient, would take away spectrum capacity from the terrestrial channels distributed over the DVB-T network. (Betti, 2004b, pp. 1, 6)

Satellite Systems

To deliver multimedia, TV and other streaming services to mobile phones a hybrid satellite / terrestrial gap-filler system can be used, for example Satellite Digital Multimedia Broadcast (S-DMB). A network of medium and low power gap-fillers co-located with mobile base stations next to a high power geostationary satellite are used to deliver multimedia broadcasts with good urban indoor coverage. The system allows broadcasting 18 channels with good quality at 128 kbit/s each. (Alcatel, 2005, pp. 4-5)

The architecture of S-DMB offers a satellite layer for broadcasting, while interactivity is possible over the 3G mobile network. S-DMB is intended to work as a push and store concept where for example twelve hours of permanently updated video and other multimedia content are stored on a memory card in the handset. (Mazzella, 2003, pp. 2-3)

The European MAESTRO[11] project currently studies technical implementations of innovative mobile satellite systems – including S-DMB – targeting the highest possible degree of integration and interaction with 3G and other mobile terrestrial infrastructures (MAESTRO Consortium, 2004). TU Media started a S-DMB based content service in February 2005; the broadcasts are delivered by a satellite that was launched in March 2004 jointly with Mobile Broadcasting, a Japanese company backed by Toshiba (Kirk, 2005). The proprietary S-DMB standard is derived from the Digital Audio Broadcast (DAB) system it differs from existing satellite broadcasting systems in that way to allow users to viewing multimedia content while on the move, even in high speed (SK Telecom, 2004). As DAB enjoys wide use in Europe for radio broadcast, companies such as LG and Samsung, who have made major investments in S-DMB, hope that S-DMB will be adopted as a standard in Europe (Kirk, 2005).

Depending on the deployment and service scenario, S-DMB can complement terrestrial broadcast networks such as DVB-H. It is also fully compliant with the 3GPP standard for MBMS, which requires only minimal additional costs to add support to UMTS handsets for the reception of the necessary mobile satellite service band. (Alcatel, 2005, p. 4)

Table 1 gives an overview of the various technologies which have been described in this section. The technology which performs best in a specific criterion is highlighted in green.

[11] Mobile Applications & sErvices based on Satellite & Terrestrial inteRwOrking (several companies and organizations take part in the project, amongst others Alcatel and British Telecom)

Table 2:
Overview of the Different Bearer Technologies

Technology / Criteria	Broadcast networks	Satellite	Cellular networks			
			Unicast			Multicast
	DVB-H	S-DMB	GPRS (2.5G)	UMTS (3G)	HSDPA	MBMS
Broadcast possible	yes	yes	no	no	no	yes
Number of channels at 128 kbit/s	60	18	-	-	-	13
Max. data rate (per connection)	~ 11 Mbit/s whole network	2 Mbit/s per beam	115 kbit/s	384 kbit/s	14 Mbit/s	128 kbit/s
Typical & realistic data rate	~ 11 Mbit/s whole network	2 Mbit/s per beam	30 kbit/s	30 - 300 kbit/s	550 kbit/s - 1100 kbit/s	128 kbit/s
Common data rate for video stream	128 - 384 kbit/s	128 kbit/s	30 kbit/s	72 - 128 kbit/s	128 - 384 kbit/s	128 kbit/s
Quality of video	very high	high	medium	medium - high	very high	high
Mass market availability	2008	2008	already available	already available	2006	2007
Investment costs (CAPEX)	high	medium	low	low	low	low
Efficiency of mobile TV delivery	high	high	low	low	low	medium

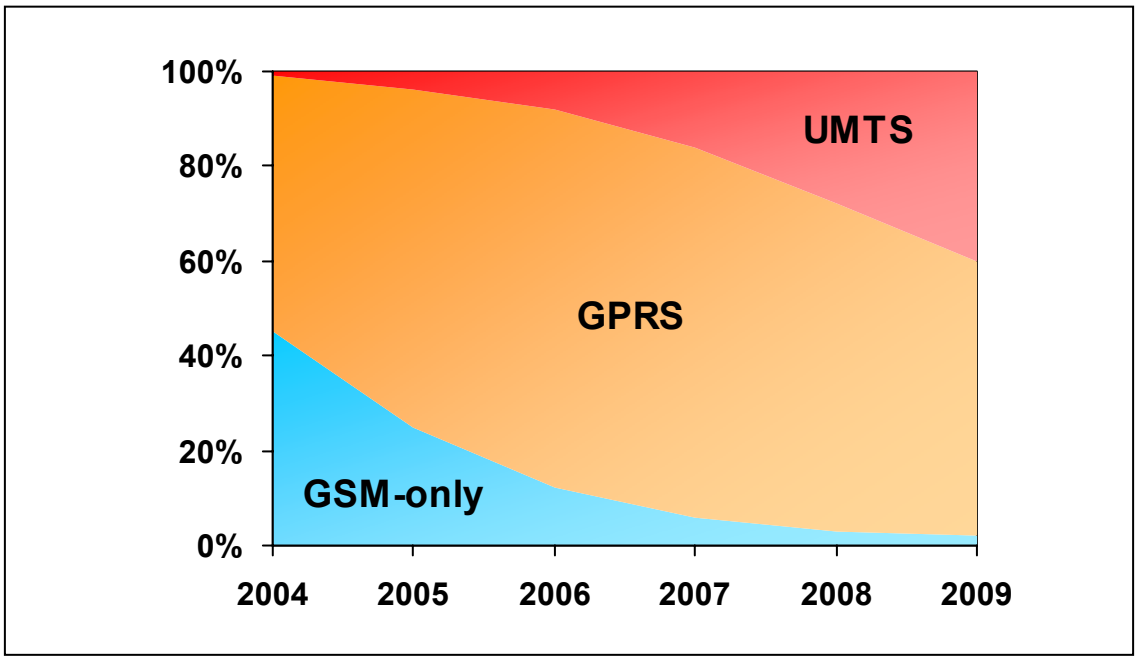
Source: own illustration based upon Alcatel, 2005, p. 5 & Ericsson 2004

4.2. Development Status and Spread of the Various Technologies

Currently in Germany, only cellular networks can be used to deliver mobile TV services to consumers, since mobile broadcasting networks have not yet been deployed. As figure 4 shows, today most Western European subscribers communicate over a 2.5G cellular network and also own a handset that is GPRS enabled.[12] The number of mobile phones in use, equipped with a specific technology, is an indicator for the spread of this technology. At the end of 2006 all GSM device shipments in Europe will be GPRS and / or EDGE enabled (Ovum, 2004). In 2009, GPRS handsets will still account for the dominant share of all phones. By that time, handsets supporting the original GSM-standard without any bandwidth-enhancement-technologies (GSM-only) will be negligibly small, while UMTS-handsets will have reached a strong share of 40%.

[12] The mobile phone technology distribution in Germany will be similar to the one of Western Europe. The superior technologies (GPRS, UMTS) will account for an even greater share, as Germany is one of the most advanced mobile markets in Europe. (M. Haase / Ericsson, personal communication, May 19, 2005)

Figure 4:
Forecast: Western European Mobile Subscribers by Technology, 2004-2009



Source: Forrester Research, 2004, p. 3

HSDPA technology will be available in 2006, at first only data cards for laptops will be available, multi-mode handsets with HSDPA support will follow in early 2007 (The Shosteck Group, 2004, p. 121).

The DVB-H technology was standardized in November 2004 by the European Telecommunications Standards Institute (ETSI) as a European norm for mobile TV (Kornfeld & Reimers, 2005, p. 1). The technology has already been proven in trials across Europe and the US. It is seen as the mobile broadcasting technology with the best chance for deployment in Germany (M. Haase / Ericsson, personal communication, May 19, 2005).

The standard for DMB was defined in 2002 and chips and products are already appearing. The South Korean government's grant of € 40 million for research and development encouraged many national electronic companies to make big investments. DMB is the first mobile broadcast technology commercially available, with TU Media as the first company in the world having officially launched an S-DMB service on the 1st of May 2005. (Betti, 2004b, p. 4, slashphone.com, 2005)

Mobile Broadcast Networks will be available at first in Japan and South Korea with some companies offering first services this year. In Europe networks will not be deployed prior to the end of 2006 with first services available to the masses in 2007. (Betti, 2004a, p. 2, Betti, 2004b, p. 6)

MBMS will be available for the mass market in 2007 (Alcatel, 2005, p. 5).

4.3. Content Coding (Video Codecs), Data Rates and Quality of Video

When watching video content on mobile handsets, the quality of the end-user experience is always a trade-off between the screen size, the number of frames per second (fps), the type of video coding used and the available bandwidth (The Shosteck Group, 2005, p. 42).

For a TV-like experience on the screen of mobile devices, which is much smaller than the one of a stationary TV-set, it is for the most part sufficient if videos are in the QCIF (176 x 144 pixel) or the CIF (352 x 288 pixel) format; this will already reduce the necessary data rates (Bleidt, 2004, pp. 32-33). For comparison: The TV-picture after the analogue PAL-standard in Germany has a resolution of 720 x 576 lines and per second 25 pictures are displayed in the interlaced mode (ETH Zürich, 2004). To reach a picture quality equal to the PAL-standard with digital transmission (e.g. with DVB-T) 2.5 - 4 Mbit/s are needed for one channel using the MPEG-2 coding (hr-online.de, 2004, pp. 1-2).

Also, for the smaller screens a smaller number of frames of around 15 fps is acceptable, which further reduces the required data rate. Nevertheless only the adoption of advanced video coding technologies makes it possible to deliver mobile TV efficiently over the air to mass-audiences. With the lower resolution, the reduced frame rate and usage of state-of-the-art video coding technologies, a data rate of 128 – 384 kbit/s is adequate to deliver a good to high quality TV-experience on mobile phones. 128 kbit/s will suffice, when the video is delivered in QCIF even at higher frame rates up to 30 fps, which is appropriate for most modern handsets. The higher CIF or even QVGA (320 x 240 pixel) resolutions are intended for the larger displays of smart phones or PDAs and require, higher bandwidths up to 384 kbit/s. (Bleidt, 2004, p. 34, The Shosteck Group, 2005, pp. 42- 43)

The audio part is much more important than the picture quality and frame rate. If a video frame is dropped due to network traffic or a bad connection, this will mostly not catch the user's eye. Whereas, if audio information is missing, the audio flow gets interrupted. Anyone will notice this, and it has a strongly negative impact on the overall mobile TV experience.

Digitalization and encoding enables content to be reliably and easily transferred between different locations (e.g. from the content server to the handset) and allows easy processing, editing and storing. The specific coding mechanism, the *codec*, used for digitalizing the video content is a critical element, because in combination with the available bandwidth, it has a major influence on the quality of the end-user experience (The Shosteck Group, 2005, p. 45).

With the improvement of video codecs the needed bit rate for acceptable video quality on mobile phones has decreased, while at the same time the available bandwidth to a subscriber has increased with new generations of mobile technologies (Bleidt, 2004, p. 10).

Delivering video and TV to a mobile device involves extensive encoding (at the source) and decoding (in the subscribers handset) of the signal. Coding must

take into account the special characteristics and requirements of the mobile environment: Small screen size of handsets, limited bandwidth and lowest possible battery drain. The three most common standards for video compression are MPEG-4, H.263 and H.264.[13] (The Shosteck Group, 2005, pp. 45-46)

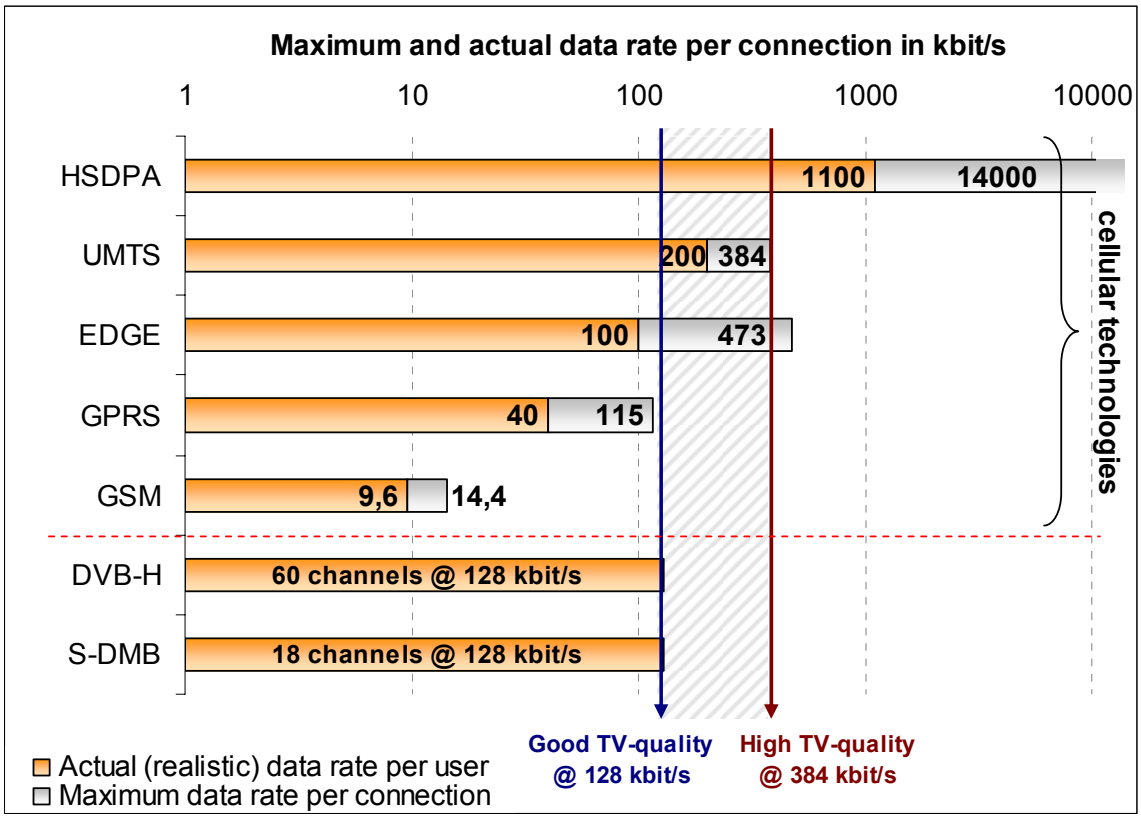
The H.264 standard also known as MPEG-4 Advanced Video Coding (AVC) is the newest and most advanced codec around, designed specifically for broadcast, storage, IP and wireless applications. It offers improved compression rates and can achieve far better quality than its predecessors (or save significant bandwidth at similar quality). The H.264 baseline profile for example requires only 250 kbit/s for a mobile video in CIF resolution. By contrast, MPEG-2 needs 900 kbit/s and MPEG-4 still 500 kbit/s for the same mobile video. (visiongain, 2004, pp. 54-55)

Implementations of the H.264 codec could recently be seen in several places. It has been integrated into a chip and new multimedia products and it has been made part of digital broadcasting standards (DVB-H, S-DMB, ISDB-T). The codec has also been suggested as a candidate for 3G broadcasting in 3GPP MBMS. (The Shosteck Group, 2005, p. 47)

As figure 5 shows most cellular technologies, even UMTS, are not well suited to deliver mobile TV at a good or even high quality, because the maximum data rate per connection is barely reached (due to the fact, that users in a cell have to share bandwidth and the strength of the radio signal at the specific location – see also section 4.1). That is why typical UMTS streaming of video content today is done at about 70 kbit/s with 15 fps, which results in less than optimal quality (The Shosteck Group, 2005, p. 54). Only HSDPA will offer enough capacity to support a medium level of penetration. As mentioned in section 4.1 due to the problems arising from unicast delivery the only solution for delivering mobile TV over cellular networks will be the implementation of MBMS.

[13] MPEG-4 was originated by the Moving Pictures Experts Group (MPEG), H.263 was developed by the International Telecommunication Union (ITU) and H.264 was the result of a joint activity of MPEG and ITU (The Shosteck Group, 2005, pp. 46-47).

Figure 5:
Data Rates of Different Bearer Technologies and Their Suitability for Mobile TV



Source: own illustration

4.4. Handsets

The handset is the interface to the mobile subscriber and used for enjoying the mobile TV experience. Thus, aspects of quality, availability and necessary technology integration (e.g. the integration of a codec or a broadcast receiver module) will play an important role for the success of mobile TV. Depending on the network used for distribution (cellular or broadcast) and the specific technology behind it, the availability of special handsets will be more or less important. This section will deal with those aspects.

4.4.1. Coverage, Quality and Availability of Handsets

The quality and availability of mobile phones capable of receiving and playing back mobile TV will be contributing factors for the success of mobile TV services. The mobile TV services offered over cellular networks will of course be much less dependent on availability of handsets than those offered via DVB-H or S-DMB due to the fact that they do not need a special TV receiver module. They only need a color display and the ability to receive and playback videos either streamed or downloaded and must support the necessary video codec for

decoding of the signal. Most mid- to high-end mobile handsets sold today are already equipped with powerful application processors for video decoding and high resolution, bright color displays (The Shosteck Group, 2005, 81).

Receiving mobile TV via digital terrestrial or satellite based broadcasting networks, requires special handsets with an integrated receiver-module for that specific broadcasting technology, which adds extra costs to the handset. Most handset vendors are interested in mobile TV, but only few vendors have yet announced the introduction of handset models equipped with a digital TV-receiver and even less have such a handset in their product range or even a prototype. However, visiongain predicts things will change in the coming years when operators will widely launch broadcasted mobile TV services. As market demand for those devices (*'market pull'*) increases, additional TV-enabled handsets will be offered from all vendors. Nokia already unveiled its 7700 mobile phone, a DVB-H prototype, at the end of 2003, but it was only used as a pilot tool. Its successor, the 7710, is a multimedia phone featuring support for an attachable DVB-H IPDC module. It was introduced to market in 2005. A mass-market handheld with integrated DVB-H support is believed to be available from Nokia at the end of 2005 or early 2006. (visiongain, 2004, pp. 56-58, 63-65)

Figure 6:
Nokia 7700 – Prototype DVB-H GPRS Handset

Source: Nokia, 2004, p. 1

The DVB-H standard is backed by some of the world's largest handset makers, including Motorola, NEC, Nokia, Siemens and Sony Ericsson (Blau, 2005).

For receiving S-DMB there are currently only two mobile phones available, Samsung Electronics' SCH-B100 and SK Teletech's IMB-1000 (slashphone.com, 2005).

In 2003 already 40% of all cellular handsets sold were equipped with color screens compared to 6% in 2000. By 2008 this figure is expected to grow to

95%. Similarly, 17% of all cellular handsets shipped in 2003 were equipped with cameras, with this figure expected to grow to over 75% in 2008. This illustrates the speed at which new value added functionality can become 'standard'. (The Shosteck Group, 2004, 123)

If TV-functionality requiring a special receiver becomes popular and is regarded as an important added value, it will probably become standard in the better handsets relatively fast. Nevertheless until at least the end of the decade television will not become a standard feature in all handsets due to the extra hardware and software required in the phone (visiongain, 2004, p. 79).

Visiongain gives some device shipment forecasts including a best and worst case scenario, due to the relative immaturity of the market. They estimate 105 million TV-phones to be shipped globally in 2009 in the worst case and up to 380 million, if mobile TV becomes popular (visiongain, 2004, pp. 79-80).

Large networks (real and also virtual networks) are normally more attractive to users than small ones – the economics term describing this effect is *network externalities*. The more users join a network, the bigger and better it gets, and that is to the benefit of its entire members. Network externalities give also rise to *positive feedback* – the value of a product or service is enhanced with every additional product in use. (Shapiro & Varian, 1999, p. 183) [14]

Owning a camera phone with photo messaging function for example is quite useless if no other mobile users in the circle of friends or colleagues own an equally equipped phone to share the pictures with them. The value of photo messaging increases with every additional user owning an equally equipped phone. Although, mobile TV is most useful when the consumer is by himself with no need or notion to contact other people and just wanting to enjoy mobile infotainment. Thus, handset coverage is not a prerequisite market driver, as mobile TV usage does not require a group of people owning a phone with the same functionality (visiongain, 2004, pp. 167-168)

However the exchange of video and TV content, which has been recorded and saved on the handset, might offer added value to consumers, but will require a group of peers having devices with the same capabilities.

4.4.2. Handset Prerequisites such as Battery Life and Quality of the Display

Mobile phones only have small displays, much smaller than the smallest TV screens and they will never come close to the quality and experience of watching TV at home in front of a normal screen. This is not the intention of the service and users are realistic enough not to expect this. (visiongain, 2004, p. 60)

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[14] In this context *Metcalfe's law* should also be mentioned. Considering n people in a network, and the value of the network to each of them being proportional to the number of other users, then the total value of the network is proportional to $n \times (n - 1) = n^2 - n$. This means that a tenfold increase in the size of the network leads to roughly a hundredfold increase in its value. (Shapiro, Varian, 1999, p. 184)

A handset is supposed to be small and handy, in order to carry it everywhere easily. Just for receiving mobile TV, the size of mobile phones should not increase again to allow for larger displays. This would clash with what handsets were intentionally designed for. As in most cases the screen determines the size and form factor of the device, the trend has been towards clamshell designs to maximize the size of the screen while keeping the overall size of the handset as small as possible (The Shosteck Group, 2004, p. 32).

Of course the display should fulfill some minimum requirements regarding size, resolution and displayable colors to make the viewing of moving images on a mobile phone not only feasible but also enjoyable.

The more multimedia functions are added to mobile phones and the more sophisticated they become, the bigger and better the displays need to be. The key driver for the introduction of high resolution color screens has been the addition of camera functionality to mobile phones. Video streaming and TV services place even greater demands on the display. (The Shosteck Group, 2004, p. 31)

Handset displays will become sharper, bigger and more colorful in the future. Today the majority of handsets sold worldwide already exhibit a color display; the trend is to show more colors - 65.000 colors will become standard. A forecast by isuppli estimates that 93% of all mobile phones will feature a color display in 2008. (Fiutak, 2004)

As the user is already very close to the display when watching TV on the handset, the display does not need to be that big. A larger display with a higher resolution would mean demand for a higher resolution of the transmitted video for experiencing better picture quality. This would make the transmitted videosignal consume more bandwidth.

A lower display resolution slightly reduces the overall TV experience, but for most users the quality would be acceptable to enjoy mobile TV services.

The screen also consumes a lot of power, typically drawing as much as 50% of total battery power consumption (The Shosteck Group, 2004, p. 32). Therefore more energy-saving displays need to be developed. Next to displays the main battery drainers in mobile phones are the application processor (needed for multimedia handling and video decoding), the receiver modules and the memory (The Shosteck Group, 2005, p. 84).

In general, a 3G video based session is twice as demanding in terms of power consumption as a regular 2G voice call (The Shosteck Group, 2005, p. 85). This demands for larger battery capacities, so that even a longer mobile TV viewing session will not be interrupted as a result of an empty battery. As receiver modules needed for broadcasting technologies consume a lot of power, special energy saving features are needed. DVB-H incorporates a feature called ‘timeslicing’ for that purpose (see section 4.1).

Recent developments in battery technology and future advances will allow many hours of mobile broadcast TV viewing at the point when technologies such as DVB-H become commercially available (The Shosteck Group, 2005,

p. 89). In the future also fuelcells will be potential energy sources (visiongain, 2004, p. 58).

If mobile TV-content should be stored in the handset, a large memory is needed, since video data uses much storage space (The Shosteck Group, 2005, p. 93). Some services offered via push-and-store (e.g. S-DMB) require large memory explicitly.

4.5. Licenses – Broadcasting Allowances

Both the broadcasting sector and the mobile telecommunications sector are subject to regulatory issues, in particular the allocation of licenses. If radio transmission is used as the transmission line to deliver data of any kind, a license for the used spectrum is necessary. The licenses are issued by the regulation authorities and are normally valid for a limited period of time and linked to other conditions that have to be adhered to. The allocation of the licenses for the operation of a cellular network such as the GSM network was bound to a defined area or population coverage which had to be achieved within a specified period of time. (Götzke, 1994, p. 94, Heinrich, 1999, pp. 78-79)

As the terrestrial distribution channel is regulated by the state (Heinrich, 1999, p. 78), the digitalization through DVB-T and future mobile broadcast networks such as a DVB-H network also face this regulation.

The DVB-H standard is designed to use frequencies in band III, IV or V, while most developers consider band IV between 470 and 650 MHz to be most qualified, as the these frequencies are low enough to obtain a broad geographical reach and at the same time high enough to largely exclude interference. Besides this, frequency spectrum is regarded optimal for the wireless data communication. If DVB-H used frequencies in band IV this would constrain the spectrum for digital terrestrial broadcasts (DVB-T). Due to these spectrum allocation problems the European Union has not yet taken a decision on which standard to adopt for mobile TV. Indecisiveness and hesitation could result in an inferior technology prevailing. (Yoshida, 2005)

In Berlin, the first two transmitters for DVB-H were installed this year and they use the TV channel 39, which was used as a normal TV channel until the analogue terrestrial network was shut down (Hübner, 2005).

Private broadcasters in Germany need a license granted by the responsible ‘Landesmedienanstalt’[15], a regulation authority of the respective federal state in which the broadcaster resides, to establish a TV channel. This license includes provisions to ensure the diversity of opinion and the freedom from the state. If

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[15] Each federal state in Germany – only Berlin and Brandenburg share one authority together – has a pluralistic ‘Landesmedienanstalt’ for enforcement and control of the broadcast laws. They are distant from the state and organized as independent institutions capable of holding rights under the public law. (Heinrich, 1999, pp. 100-101)

the demand for licenses is higher than the supply, the responsible 'Landesmedienanstalt' appoints a ranking order for the allocation of the licenses, which is mainly dependent on the degree of the expected diversity of opinion of the particular channels. Besides this form of control the production of TV-content – with the primary objective of securing the diversity of opinion – and the financing of a TV-channel – with the main focus on the duration, type and time structure of advertising as the main source of income of private broadcasters – are regulated. (Heinrich, 1999, pp. 97-99)

Accordingly, a mobile phone operator, a broadcaster or any other third party wanting to offer a new TV-channel developed for the mobile audience, which will be broadcasted over any network, e.g. a DVB-H network, would have to obtain a license. This form of distributing content would fall in the legislator's definition of broadcasting. Broadcasting is defined in §2 of the 'Rundfunkstaatsvertrag' as the activity and distribution of all forms of presentations in word, in sound and in vision intended for the general public by use of electromagnetic waves without a connecting cable (§2, Abs. 1 RStV). Due to the regulation of the broadcasting sector the provider is potentially constrained in its program offering and the utilized forms of financing, e.g. advertising.

Delivering content over cellular networks does not require any new licenses. The licenses for the operation of the networks and the usage of the frequency spectrum are already granted. Since today the mobile TV experience delivered over cellular networks is just the on-demand distribution of TV-like content similar to video downloads already offered for quite some time by network operators or the rebroadcasting of existing TV channels and not the broadcasting of complete new TV channels, a broadcasting license will not be necessary.[16]

[16] Austrian operator 3 for example streams the TV channel EuroNews live over its UMTS-network (Hutchison 3G Austria, n.d.) while Vodafone offers some live streams of original TV broadcasts such as the CNN channel, but also a service called Star Wars mobile which contains making-offs from Star Wars movies (Vodafone 2005d).

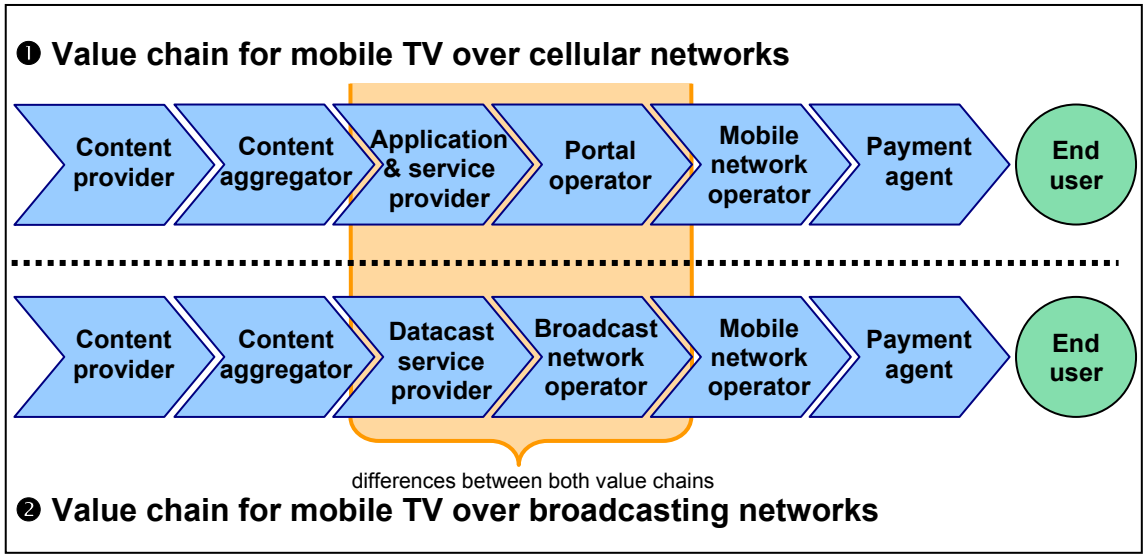
5. The Mobile TV Value Chain

5.1. The Different Mobile TV Value Chain Activities

Offering mobile TV services to the customer requires several different core competencies that cannot be provided by one single company. In the next chapter the different players of the mobile TV value chain will be portrayed in detail. Strictly speaking, you have to differentiate between two slightly different value chains – one for providing the service over a cellular network and one for providing the service over a broadcasting network. Figure 7 shows both value chains which only differ in the two players highlighted by an orange box. For nearly every player in the value chain, partnerships with a number of other players are very important to overcome the complexity of providing a complete end-to-end solution, requiring many complementary competencies. Some partnerships are also necessary because of interoperability / standardization issues and access to essential proprietary assets. (M. Haase / Ericsson, personal communication, May 19, 2005)

Vendors are excluded because they only deliver network equipment to operators or handsets to end-users which does not represent an integral part or core competency for delivering mobile TV services. Nevertheless, the technological advances driven by device and equipment manufacturers will also be of great importance for the further development of these services.

Figure 7:
The Value Chain(s) for Mobile TV



Source: own illustration based on visiongain, 2004, p. 140

5.1.1. Content Provider

A content provider offers original content or a popular brand or personality that is suitable for mobile TV. A popular brand for example could be MTV or Coca

Cola. Content Providers do not necessarily create all content themselves; they also buy or subcontract content from content producers and act as agents for content owners. (UMTS Forum, 2002, p. 13 & visiongain, 2004, p. 140)

Content providers for mobile TV could be new companies that have specialized on content for the mobile channel, as well as TV broadcasters, movie production companies and popular brands.

The formula *content is king* is also valid in the mobile environment (Büllingen & Wörter, 2000, p. 34). Interesting and entertaining high quality content will be critical for the success of mobile TV services.

Content should be aligned with established patterns of content consumption and it should be suitable for viewing on mobile phones. Sports, music, movies and adult content designed in an appropriate way fulfill these requirements and are also attractive to the expected user demographics of mobile TV and video services. (Hatton, 2005, p. 3)

The customer will honor a high quality of the content with an increased willingness to pay. This serves to enhance the content providers' bargaining power compared to other players in the value chain (Collis, Bane, & Bradley, 1997, p. 183).

A well-known brand, format or personality can help to add attractiveness to new services and therefore push user acceptance. Their names serve as a guarantor for high quality content and their popularity and reputation are used for marketing purposes. However, not all mobile operators pursue a strategy of branding and exclusiveness for their content and disagree on its necessity for success of offered content services. The majority of content offered by Vodafone, for example, is unbranded and Vodafone believes exclusive content to be entirely unnecessary. Thus, only a selected number of premium services such as football goal alerts and mobisodes of the TV series '24' are provided exclusively. KPN, the parent of Eplus, in contrast, offers only branded video content from third parties and believes that the attraction of existing media brands is too strong for operators to compete with own content offerings. Instead operators should leverage existing brands. (Hatton, 2005, pp. 3, 5, 6)

Content providers as well as aggregators can also operate their own branded portal, on which they offer mobile TV services. The *content provider centric business model* comprises a content provider with a considerable portfolio that wants to deal directly with the operator and to take up the content aggregator role. Also, if not settled between content provider and network operator, access and traffic charges may arise for the consumer in addition to the price for the consumed content. The main hurdle for the content provider consists in the necessity to handle billing and payment. The model is less convenient for the consumer as he may have business relationships with different content providers involving multiple individual billing methods. In this model, the likelihood that a customer does not return to conduct repeated transactions is relatively high compared with other models such as the operator centric approach. (UMTS Forum, 2002, p. 12)

For this business model, the problem of high data traffic costs arising from cellular mobile TV can also be prejudicial to a great extent because the content provider is dependent on agreements with the operator regarding traffic charges.

In summary, one can say that content providers offering high-grade mobile content play a very important role in the mobile TV value chain(s) and have a strong bargaining position.

5.1.2. Content Aggregator

Content aggregators select and package content from different sources into convenient and attractive bundles and sell these to service operators, directly to consumers or other third parties. They distribute the content through various channels depending on their distribution rights. A TV broadcaster is a content aggregator in the ordinary TV landscape and they could also perform this activity in the mobile TV value chain (visiongain, 2004, p. 141).

Alongside young, specialized companies mobile content aggregators are often established media companies that already bundle content in the traditional media value chain. They have the advantage that they have already gained experience in the business and own a strong brand and reputation. (Büllingen & Wörter, 2000, pp. 34, 35).

When broadcasting over cellular networks, the broadcaster can sell its content directly to a portal operator, which is often the mobile network operator, or even operate its own portal. Using broadcasting technologies for mobile TV distribution lets the TV broadcaster directly stream its content over the network if it has bought capacity from the datacast service provider.

If the content aggregator operates its own portal and is in a direct relationship with the consumer, the model is called the *content aggregator centric business model*. The aggregator determines the price of the offered content and bills the customer via a payment agent. The customer can be obliged to pay access and traffic charges to the mobile network operator, but it is also possible that the content aggregator settles those charges with the network operator. (UMTS Forum, 2002, pp. 11-12) In this business model the problem of high data traffic costs (see section 7.4) can have a similar impact as in the content provider centric business model.

Since aggregators continually need new content of consistent high quality, they show tendencies for vertical integration by integrating with content providers (Collis, Bane, & Bradley, 1997, p. 170).

There is also the ability for equipment vendors such as Ericsson and Nokia to expand their core competencies by entering the value chain activity of content aggregation. Nokia already operates a service called Preminet which offers aggregated content from Universal Studios and Warner Music Group to operators including a download and billing framework (Dwan, 2004).

5.1.3. Application and Service Provider

Application and service providers develop, implement or operate mobile entertainment platforms (The Mobile Entertainment Forum, Booz Allen Hamilton, The Mobile Entertainment Analyst, 2003, p. 4). These players exist only in the value chain for mobile TV over cellular networks. They could develop a mobile TV application or operate the mobile TV platform and be accountable for service access and operation. This role can be adopted partly by the content provider / aggregator for development of TV services or the mobile operator for delivering the service via its network. However, third parties could also fulfill this service.

5.1.4. Portal Operator

This player offers mobile TV content and services on its mobile portal in the cellular broadcasting value chain. The portal can be owned and operated either by the mobile network operator or by any other third party, for example a famous brand or a TV broadcaster.

Mobile portals are built by accumulating applications and content from many different sources with the objective of becoming the customer's premier choice for obtaining web-based information and entertainment (Müller-Veerse, n.d., p. 16). One reason for bundling content from different sources under one brand with a strong reputation is to reduce consumer's uncertainty over the expected value of the obtained content (Büllingen & Wörter, 2000, p. 34). This is due to the fact that information is an *experience good* and assessing the value of information is only possible after its consumption (Shapiro & Varian, 1999, p. 5).

For example, Vodafone live! is the portal from the global network operator Vodafone. In general, a portal offers information and entertainment services for users, e.g. the latest news, downloads of games and ringtones, location-based services such as a restaurant finder and much more. Mobile TV will be a new service, which extends the service offering of such a portal. Vodafone Germany currently offers its UMTS customers a mobile TV service, which shows the highlights from sport, music, news and entertainment on many different channels (Vodafone, 2005a).

MTV and Jamba! are examples of operators offering independent mobile portals. While MTV offers content services around music and their own brand, Jamba! focuses on the download of ringtones, logos and games.

Network operators' mobile portals are only accessible to their own customers – at least the usage of paid services that exceed the pure browsing in the portal are not possible – whereas third party portals are accessible for the customers of all network operators, if a billing relationship has been established with each of them. As to third party portals the billing can be handled by the operator itself - then a connection of the portal to each operator is needed to serve their customers - or by another external company such as Paybox that has specialized on payment services and uses an operator and network independent mecha-

nism, which can be linked to a number of payment options such as credit card, prepay card or direct debit (Wireless World Forum, 2002, section 6.3.1.).

The mobile portal is used as an orientation guide for mobile users that reduces their search activities through various default settings. Most operators have made special pre-adjustments to the handsets they sell, which directs their customers to their own mobile portal. The mobile portal is the point of contact with the customer. It is of great strategic importance since the mobile operator holds a strong position as “gate keeper”. (Büllingen & Wörter, 2000, pp. 35-37)

5.1.5. Datacast Service Provider

This player is needed in the broadcasting via TV networks value chain to control the distribution capacity available on the broadcasting network that is used for the delivery of mobile TV in comparison to the cellular phone network that is used in the other value chain. The datacast service provider, also named IPDC service operator, has arrangements with content providers and aggregators and sells either a fixed amount of raw network capacity to them for a certain time period or delivers particular content for them at agreed times, including additional services, such as content protection or billing. The IPDC service operator can market the service directly to consumers based upon monthly or event-based subscriptions and handle billing, customer support and other services. A special service offered by the provider is the ‘Electronic Service Guide’ which is transmitted over the network, in parallel to the content and contains information about the available services / programs and the scheduling times. (visiongain, 2004, p. 141)

The mobile network operator might undertake the task of building up and operating the IPDC network, in order to generate additional revenues from the network operator business (visiongain, 2004, p. 142).

5.1.6. Broadcast Network Operator

The Broadcast network operator is the owner and carrier of the digital broadcast infrastructure including transmitters, mast sites and necessary connections to the site. It has agreements with several datacast service providers and sells broadcast capacity and coverage to them. If a license is necessary for broadcasting and using an assigned frequency, which is the case in Germany, then the broadcast network operator would be the frequency license holder. (visiongain, 2004, p. 142)

Telephone companies, cellular network operators or TV broadcasters could adopt this value chain activity or they could found a company and jointly operate the network.

If TV broadcasters were to own the broadcast network and hold the necessary license, they could offer their TV programs and content to customers without involving the cellular network operator, hence barring it from the process of

value creation. Customers owning handsets equipped with the necessary receiver module can watch TV and the cellular network operator has no ability to control that. This alternative, perhaps even offered for free and financed only by advertisements like the ordinary *Free-TV*, would be the worst-case scenario for cellular operators. There would be no ability for them to extract value from the business and such a service would diminish revenues from other TV or video services offered by the cellular operators over their own networks. In this model the mobile network operator would only be needed for interactive TV services, requiring a feedback channel, which would use the cellular network.

German cellular network operators are highly interested in acquiring the necessary licenses for DVB-H frequencies. However, this is no easy undertaking, as the frequencies are initially allocated to the regulatory authorities of the federal states (‘Landesmedienanstalten’). Those intend to assign the licenses to the TV broadcasters. Now the mobile operators have filed an application to the BMWA (‘Bundesministerium für Wirtschaft und Arbeit’) to reserve one frequency division multiplex (approx. 24 channels) nationwide for new mobile multimedia services based on DVB-H and to assign it conjointly to the four network operators. (J. Witteck / Ericsson, personal communication, June 29, 2005)

In this way, they would manage to maintain control of the customer relationship, including pricing and billing, and thereby own the most important positions in the value chain for mobile TV over broadcasting networks.

Telephone companies are predestined for operating the mobile broadcasting network, because they often already operate other digital broadcasting networks. T-Systems for example, a subsidiary of the Deutsche Telekom, operates the DVB-T network in Germany over which many TV channels are broadcasted for the digital terrestrial reception (T-Systems International, 2004, pp. 1-2).

5.1.7. Mobile Network Operator

The mobile network operator owns and operates the cellular network and holds the necessary frequency licenses (visiongain, 2004, p. 142). Currently, in Germany there are four companies operating their own mobile networks: T-Mobile, Vodafone, E-Plus and O_2. In the value chain for mobile TV over broadcasting networks, this value chain activity is only necessary for providing a feedback channel for interactive TV services via the cellular network.

In the value chain for mobile TV over cellular networks, all TV content and services are delivered over the mobile network, mainly using the 3G networks because of their higher bandwidths. In this case the cellular operator is best positioned, because it controls the delivery of the content to the customer. Due to the already existing billing relationship with the mobile user, it can charge for the TV services and collect the revenues (M. Haase / Ericsson, personal communication, May 19, 2005).

In the so called *network operator centric business model* the customer has a direct relationship to the network operator, which determines the prices for mo-

bile services and manages the billing. The network operator also appears as a content aggregator, since it acquires content from different sources or even creates some content. It then offers the content mainly as bundled packages via subscriptions on its own portal. (UMTS Forum, 2002, p. 20)

If the cellular operator offers TV services on its own portal, it controls a large part of the value chain and can siphon off most of the added value.

5.1.8. Payment Agent

The payment agent is necessary to bill customers for mobile services and to collect the money. This player is also needed for mobile TV services unless they are not offered for free, e.g. when they are purely financed through advertisements.

The payment agent performs two functions, which could be fulfilled by different parties: A financial infrastructure provider (FIP) and a payment service provider (PSP). The financial infrastructure provider stores the money owned by the customer and on request by the merchant it will debit him/her and pay the merchant. The FIP can be a bank, a credit card company or a mobile network operator. The latter charges the consumer directly either on their monthly phone bill or the amount is deducted from a prepaid account. The PSP provides the technology, service or application needed to perform business transactions between the merchant and the consumer. This includes the contribution of all information required for the transaction and negotiation between all involved parties of the value chain. The PSP also provides linkage to the consumer's funds for enabling settlement. (Wireless World Forum, 2002, section 6.2.1 – 6.2.4)

The customer could get a separate invoice from every merchant, whose content or mobile services he makes use of, but this would lead to complexity, high transaction costs as well as to problems with consumer acceptance, particularly when the invoice amount is small. It appears that one company should handle the billing for all merchants. The mobile operator, who has already established a billing relationship with the consumer since it charges him for telephone and data services via the monthly mobile phone bill, seems predestined for this role. (Büllingen & Wörter, 2000, p. 38)

In these operator-based solutions the mobile network operator adopts both the function of the FIP and the PSP, making it the banker and network provider. It is the most feasible option in the medium-term (Wireless World Forum, 2002, section 6.2.4., 6.3.2.).

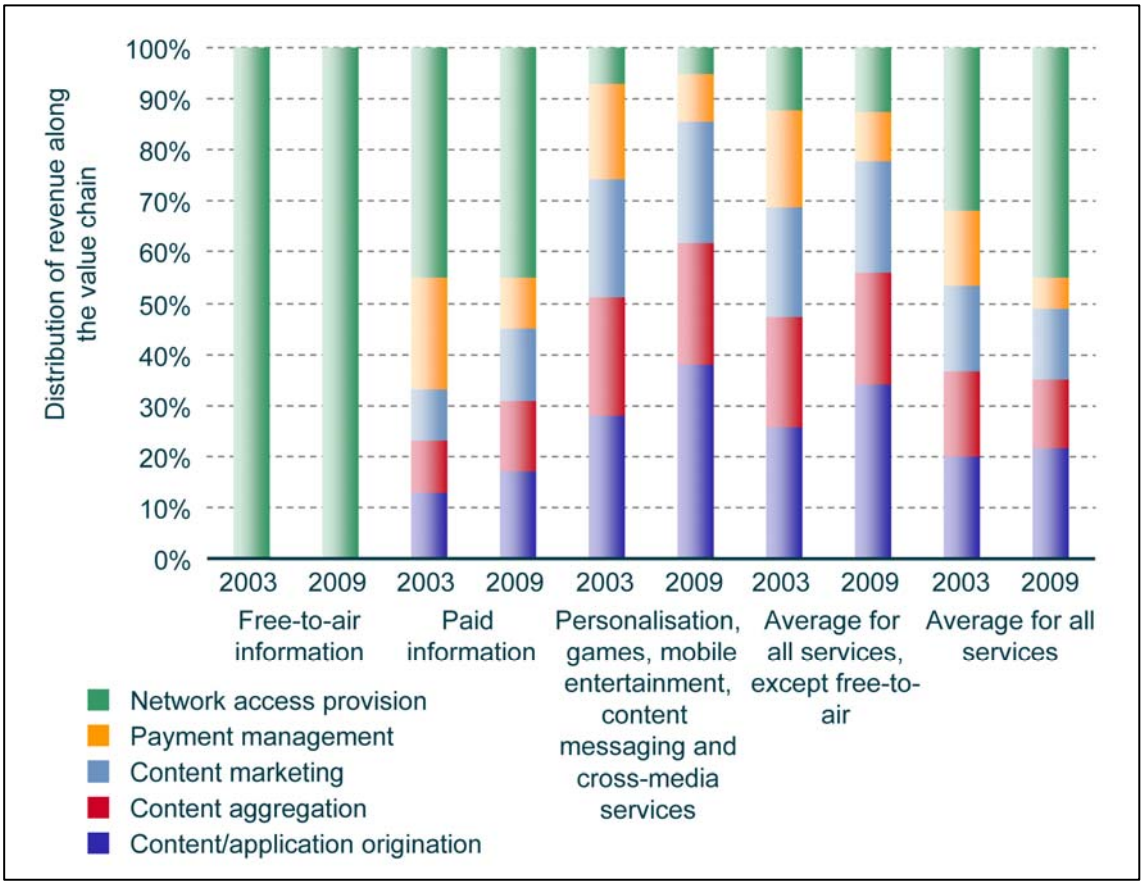
5.2. Revenue Split between the Different Value Chain Members

Since many different stakeholders are involved in the provision of mobile TV services, revenues have to be split among them and revenue sharing is a method already common in the mobile and media industries (Zadvorny, 2004, pp. 75-77). For encouraging growth the revenues from mobile entertainment

have to be shared between the different players of the value chain in proportion to each company's risk to an adequate extent (The Mobile Entertainment Forum et al., 2003, p. 7). Thus already at an early stage all involved parties should agree on a revenue split satisfactory for all to enable progress and growth for mobile TV.

In the case of SMS-to-TV, service operators and TV broadcasters could not agree on acceptable terms for the sharing of revenues. Operators are taking a 40% to 50% share of the revenues from TV related SMS while the remaining share is split equally between solution providers and TV stations, which had initially wanted a greater share of the revenues. These problems and disagreements on revenue sharing will also arise in the mobile TV environment, not least because there are more players involved. (visiongain, 2004, p. 160)

Figure 8:
Distribution of Revenue along the Value Chain, by Service, 2003 and 2009



Source: Zadvorny, 2004, p. 77

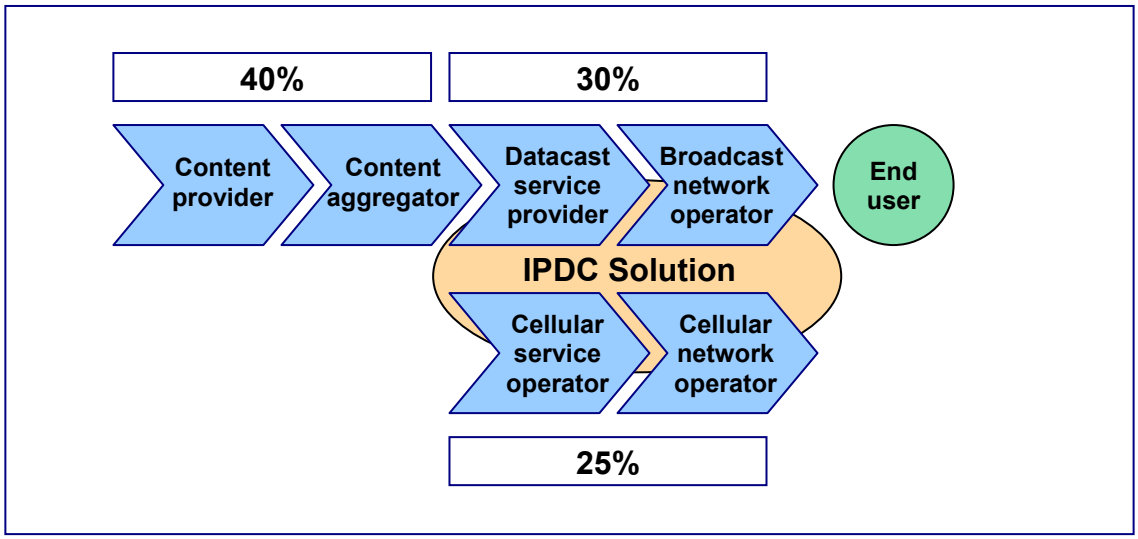
Figure 8 reveals that mobile entertainment and cross-media services belong to the service categories with the greatest share of revenues accruing to content providers and aggregators. Their collective share of over 50% in 2003 is expected to rise to over 60% in 2009, whereas mainly the share for content creation will rise. This is due to the fact that content owners and media companies become increasingly important and powerful, which may force operators to cede

a greater share of the revenues to other players in the value chain (Zadvorny, 2004, p. 77). Mobile TV, as part of mobile entertainment, should develop a similar revenue split. This is also underpinned by the fact that content providers and TV broadcasters are supposed to have a strong position in the value chain for mobile TV (see chapter 5).

Figure 8 also shows that network access provision and payment management, which will typically be provided by the mobile phone company for cellular mobile TV services, takes only about 25% of the whole revenues in 2003 and this share will further decrease to about 15% in 2009.

Figure 9 shows an assessment by Strategy Analytics on how revenues are likely to be shared between the key players in the value chain for mobile TV over broadcasting networks. Companies providing and aggregating content will take 40% of revenues. A share of 30% will go to the datacast service provider and broadcast network operator. Cellular service and network operation will receive 25% of the mobile TV revenues.

Figure 9:
Revenue Share Assessment for Broadcast Mobile TV (IPDC-solution)



Source: own illustration following Strategy Analytics, 2005, p. 15

6. Services and Pricing Models

Offering interesting and compelling services combined with the right pricing will be crucial for the success of mobile TV services. The following chapter will give an overview of available and future services as well as various pricing models.

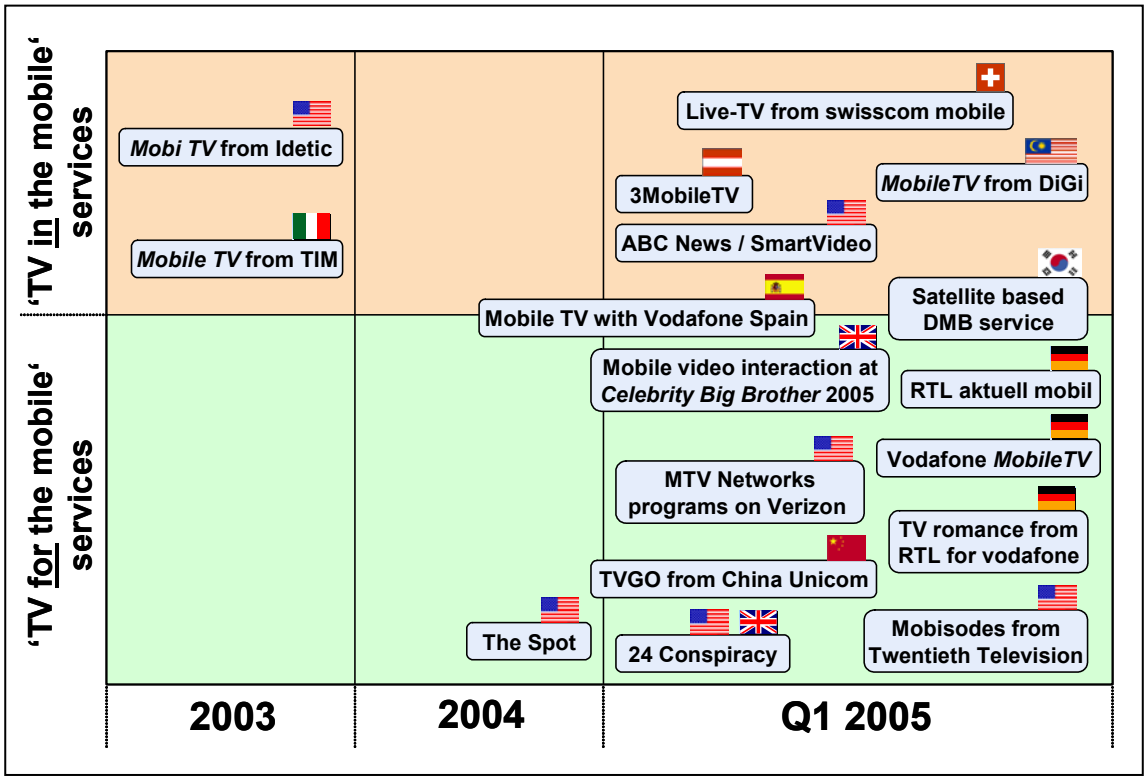
6.1. Services

Many TV services are already available worldwide, most of them launched in recent times. In the near future many more services will surely emerge. With technology evolving, completely new, interactive services will become possible.

6.1.1. Available Mobile TV Services at Present

Figure 10 gives an overview of services already introduced to the market, but it is not exhaustive. As one can see, especially in 2005, several mobile TV services were launched by operators worldwide. With the exception of the satellite based DMB broadcast service of SK Telecom in South Korea, all mobile services are based on cellular technology mainly making use of 3G networks.

Figure 10:
Selection of Available Mobile TV Services



Source: own illustration based on press releases of mobile network operators

Some operators such as 3 in Austria or Sprint in the US just redistribute existing TV channels live using their cellular networks, while others such as T-Mobile with their newscast 'RTL aktuell mobil' offer TV-content especially developed for mobile phones. Vodafone in Germany offers a mixture of live-streams from channels such as CNN and Eurosport and mobile video-channels with clips that mostly consist of theme or channel related TV-content. The content from the video-channels has been re-arranged and reformatted for the mobile channel. For example, Vodafone features a channel with a selection of content from ProSieben and one with soccer highlights from the German Bundesliga or the Champions League. As a special, Vodafone offers a channel called Star Wars mobile with behind-the-scenes footage and makings from the latest three movies.

Mobi TV from Idetic in the US was one of the first mobile TV services. Launched in 2003, it initially delivered its content using GPRS-enhanced GSM networks due to the absence of 3G networks. In the beginning the quality of the service was poor and the experience could be more compared to a slideshow with audio than to television. Meanwhile quality has greatly improved and the service can also be made available over 3G networks depending on the mobile operator (M. Haase / Ericsson, personal communication, May 19, 2005). The service from Idetic is currently available to customers from US-operators: Sprint, Cingular/AT&T and Midwest Wireless and offers live mobile redistribution of over twenty channels such as MSNBC, CNBC, FOX Sports and Discovery Channel.

An interesting mobile TV format is 'The Spot', the first reality drama delivered to the mobile phone and available to Sprint's PCS vision customers. The viewers have the ability to directly influence the flow and plot of the program.

Fox Film has produced a series called "24 Conspiracy" which includes 24 one-minute long special mobisodes (mobile episodes) of which one new episode was made available each week for download. The mobile series complements the popular TV series 24 and is available to Vodafone (UK & US) and Verizon Wireless (US) customers. Both mobile phone companies are also going to offer their subscribers 52 one-minute original mobisodes of the serial dramas 'Love and Hate' and 'The Sunset Hotel' produced specifically for the mobile channel by Twentieth Television.

6.1.2. Possible Future Services

In the future, mobile TV services will probably make exceeding use of the interactive possibilities of the mobile device and also use the localization functions of cellular networks for special location-based services.

A key result from a survey in Japan showed that the interactive service, most wanted by respondents, would provide maps guiding consumers to locations appearing in TV programs. Such a function would bear a huge marketing potential as the consumer is already on the move and can avoid the laborious process of memorizing and finding the specific address. Hence, consumers are

much more likely to head to the advertised address straight away. (visiongain, 2004, p. 157)

A mobile TV service will not only feature video and audio content, but also textual information which comes in the form of hypertext and therefore links different elements. The hypertext functionality should be seamlessly integrated and work across services and networks. A symbol on the screen or a highlighted name could be used as a link to obtain more information, for example, to take part in a vote or to buy a product. (Betti, 2004c, p. 10)

The interactive element of the mobile channel will allow for a variety of mobile TV concepts. One can imagine that users could decide via voting how the story of a TV-series, e.g. a mobile soap, evolves. Broadcasting the soap once a week should allow enough time to produce one mobile episode with a playing time of presumably only a few minutes. In addition the production process would be rather simple due to the TV-format and also to save costs.

Another interactive format could be a live mobile quiz show similar to “Who Wants To Be A Millionaire?”.[17] Candidates would be able to take part in the show from wherever they were – at home or ‘on-the-go’. The image, even a moving one, and voice of the candidate could be displayed in the show using the built-in-camera featured by all video-telephony[18] capable phones. At the same time, the users could view the show on their handheld device and interact by pressing buttons on the keypad.

Mobile TV content could be built around communities with its members being included in the process of content creation and offering them opportunities to interact rather than showing them only passive TV-content. Some non-conventional content such as local webcams or a chatting and dating service among the mobile TV channels are also likely to be offered. (Betti, 2004c, pp. 4-5)

In combination with LBS, one could think of an interactive tourist guide that automatically shows a matching video with information regarding the sight or spot the tourist is just visiting. In the rather distant future using more evolved handset and network technology live multiplayer reality games might even become possible. The game would play in a real-life or near real-life atmosphere, similar to a movie, with the ability to customize the played character in the game with the user’s own face by using the handset’s digital camera. Independent from their actual location, many mobile users could play against each other or together in a virtual world.

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17 “Who Wants To Be A Millionaire?” is the world’s most popular TV quiz show and available in many countries including Germany, Great Britain and the US (millionaire.itv.com, n.d.).

18 Not every camera phone would be suited for this application as the camera needs to be on the same side of the phone as the display. But video-telephony capable phones of course fulfil this requirement due to their intended purpose.

6.2. Pricing Models

When offering a mobile TV service, the involved companies – mainly the mobile operators and TV broadcasters – must evaluate and decide how to earn money with the service. At first they have to decide if the user should pay for the service or if it should be offered for free and financed through advertisements or sponsorship by any other third party e.g. a famous brand.

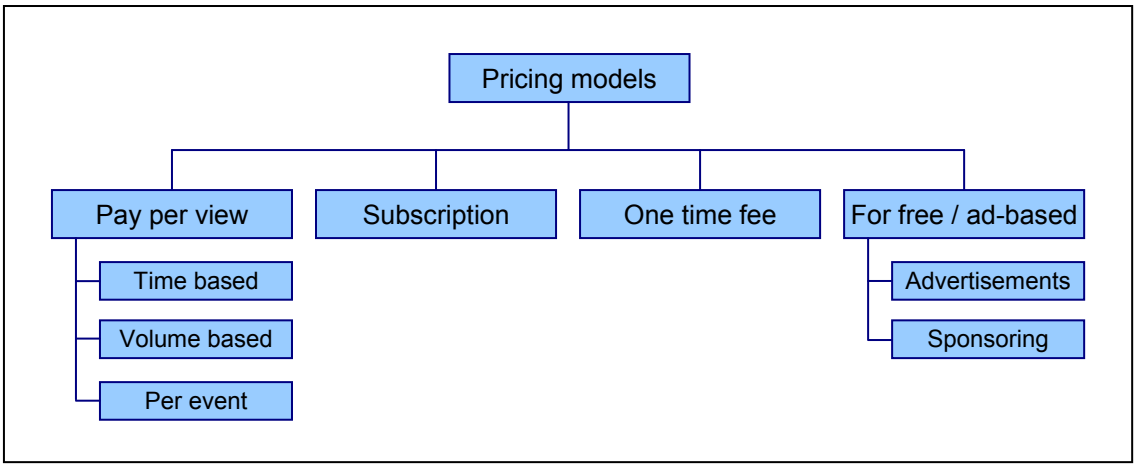
The price for the mobile TV service and the costs for specially equipped handsets in the case of broadcast mobile TV are two crucial factors in meeting the demand of interested consumers. Tech-savvy users would be willing to pay more for a mobile TV experience than the average customer (visiongain, 2004, p. 161). The right strategy of revenue generation and pricing will be important for determining demand, usage and finally the success of the mobile TV service (visiongain, 2004, p. 160) next to attractive content / programs and good marketing. For fast service penetration the pricing should be aligned with the targeted user groups of the mobile TV service. For example, the consumer market is typically more price sensitive than business and enterprise segments (visiongain, 2004, p. 161).

6.2.1. The Main Pricing Models for Mobile TV

There are many ways to generate revenues with mobile TV, but not all are equally suited, especially with regard to maximizing revenues. While some pricing models are better suited for broadcast mobile TV, others are better applicable for the cellular version. Most of the pricing models are already applied for services either in the mobile or the TV world. For example, the subscription model is used by Pay-TV channel Premiere for its program packages such as ‘PREMIERE START’ (Premiere, 2005). Also, in the 2.5G network environment operators have charged on the volume of transferred data when surfing on the operator’s portal or the Internet (Credit Suisse First Boston, 2005, p. 35).

Figure 11 shows an overview of the pricing models applicable to mobile TV, which will be discussed in the following section.

Figure 11:
Overview of Pricing Models for Mobile TV



Source: own illustration

6.2.1.1. Pay per View (Time/Volume/Event Based)

The idea behind pay per view is that when a customer consumes information he pays only for what he views or downloads (Arnold, 2000, p. 18). This payment form is available in the TV world as a special form of Pay-TV where the user pays only for what he has actually viewed on TV (SevenOne Media, n.d.). For mobile TV this means that the user only gets charged for the actual usage of the mobile TV service either based on the time he views a TV-program, the data-volume being transferred during a TV-session or a single event, such as a football-match that is watched or a news-clip that is downloaded.

Paying for the mobile TV usage by consumed time is convenient for occasional users and certainly appealing to first time users to try the service without needing to subscribe and pay a monthly fee. Although daily and intensive use of the service could quickly cost a pretty penny, if the operator does not offer staggered prices. For example, for its *Live-TV* service Swisscom mobile charges € 1 for one hour, € 2.60 per day and € 10.40 per month (Swisscom mobile, n.d.).[19] Vodafone Germany offers its mobile TV service currently free of charge for customers of its special UMTS packages, but they will soon be charging up to € 3 per hour for the standard mobile TV channels from 1st January 2006 onwards (Vodafone, 2005b, p. 3). Assuming a price per hour of € 2, which is in line with both service offerings above, a customer using the mobile TV service for one hour each day, would have to pay € 60 per month. This is much more than the € 5 to € 20 that research from VTT showed that most consumers were willing to pay for unlimited TV access (Södergard, 2003, p.182).

Volume-based pricing only makes sense for a cellular service since the data traffic generated in a broadcast network is – due to its nature as a point-to-

[19] Converted from Swiss Franc to Euro with 1 Swiss Franc = 0,64939 €, then rounded

multipoint connection – irrelevant in terms of service usage. Nevertheless, this pricing method is not very convenient for customers as they are not able to immediately estimate the price for their TV consumption since they do not know the data used by one minute of mobile TV. Even if they did, it would be difficult to calculate the exact cost. Analysts from The Yankee Group think that "charging users for browsing the operator portal and downloading content is confusing and illogical" and that these charges should be removed (Hatton, 2005, p. 4). These charges are often paid on top of the price for content.

Event based pricing would be favored by people only interested in special events such as the soccer World Championship. The offering of TV-content built around a special theme or the latest news is also seen as an event.

T-Mobile charges a news service called 'RTL aktuell mobil' after this pricing model with € 0.69 per video-clip (T-Mobile, 2005) and Vodafone in the United Kingdom offers a mini mobile TV-series complementing the popular '24' TV series which costs € 0.73 per episode or € 8.82 for all twenty-four mobile episodes (Vodafone, 2005c).[20]

6.2.1.2. Subscription

By entering a subscription, users have to pay upfront for access to a certain service or content, mainly on a monthly basis (Arnold, 2000, p. 17). Most Pay-TV offers today sell their services for a monthly subscription fee, which often includes a package of channels, but also allows access to additional TV content via pay per view. The subscription model is already adopted by some mobile operators for their mobile TV offerings. For example, wireless carrier Sprint in the USA offers a broad range of over 25 cable TV channels available with its MobiTV service over the cellular network and charges a monthly € 7.79[21] subscription fee for unlimited access (mobitv.com, 2005b).

Pay-TV channels such as Premiere in Germany or BSkyB in the United Kingdom offer different bundles of their TV-content for different prices. Premiere offers a low-priced basic starter package, a movie package, a sports package, one called 'Premiere Super' and a high-priced complete package, where the latter two bundles include the first three packages (Premiere, 2005).

Bundling is a special form of offering *different versions* of a product. Two or more distinct products are assorted in a package and offered at a single price, which is usually less than the sum of the component prices. Bundling is a profitable and attractive way of offering e.g. two products to customers who were only willing to pay a smaller incremental price for the second product compared to the stand-alone price. As different customers value the distinct products differently, they are willing to spend a different amount of money on the products.

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[20] Prices from Vodafone UK converted from British Pound to Euro with 1 £ = 1,46936 €, then rounded

[21] converted from US Dollar to Euro with 1 $ = 0,77991 €

Since *differential pricing* is not applicable in most cases and products need to be sold with flat prices, one can only charge as much as the most reluctant buyer is willing to pay. Bundling can reduce consumers' *dispersion in their willingness to pay*, and a company can significantly increase the value it extracts from its customers. Bundling will always reduce consumers' dispersion as long as their values are not perfectly positively correlated. (Shapiro & Varian, 1999, pp. 73-76)

Premiere offers Premiere Start for € 5 per month and Premiere Film and Premiere Sport each for € 23 per month and a bundle of those three products called Premiere Super for € 33 per month. Now one can imagine that many people interested in movies are not so interested in sports and therefore have a different willingness to pay for the distinct products.

Table 3:
Willingness to Pay for Pay-TV Packages

	Premiere Start	Premiere Film	Premiere Sport
Person A	€ 5	€ 23	€ 5
Person B	€ 5	€ 5	€ 23

Source: own illustration based on Shapiro & Varian, 1999, p. 75

Table 3 illustrates two persons' willingness to pay for three different Pay-TV products. If Premiere wanted both persons to buy each package they had to price them all at € 5, resulting in total profits of € 30. Premiere would be better off if it priced Premiere Film and Premiere Sport at € 23 each, which would generate revenues of € 56 from both persons. Premiere could also decide to offer all three products as a bundle conservatively pricing it as the sum of the willingnesses to pay for the single products. In this case, both persons would be willing to pay € 33 for the Premiere Super bundle generating overall revenues of € 66 for Premiere.

TV bundles shall persuade the cautious user to purchase a good-value, low-cost package that creates a unique selling proposition. The lowest-priced bundle must be appealing without including any of the top content.

6.2.1.3. One Time Fee

A one time fee can be either a direct fee that is payable to the service provider when accessing a new service for the first time or it can be an indirect fee hidden in the price for new hardware and thus sometimes invisible for the customer. The one time fee could also come in the form of an additional activation fee similar to an admission fee which often becomes due when joining a club as a new member.

TiVo Inc. in the United States – a type of digital personal video recorder – offers its service to its customers either by charging a monthly fee of about € 10 or by charging a one time fee of € 233 that covers service access during the lifetime of the product (tivo.com, n.d.).[22]

For accessing the digital terrestrial TV in Germany broadcast over the DVB-T network, users need a specially equipped TV or they have to buy a special receiver that gives them timely unlimited access to the available TV channels (digitalfernsehen.de n.d.). This is actually not an indirect one time fee as the fee is for the hardware alone and not used to finance the network and the available TV channels are either financed by public fees or advertisements.

On the one hand, mobile TV service providers could charge a direct one time fee which would include lifetime access to their mobile TV service. In the case of broadcast mobile TV, where specially equipped handsets are needed for reception of the service, those phones could be sold with a price premium for the TV usage. This one time fee could, similar to TiVo, be tied to the lifetime of the product.

Price plans of mobile operators in Germany with postpaid contracts, often running for 24 months, would allow customers to buy a new subsidized phone after that time. This opportunity is taken by most subscribers, since mobile phones develop rapidly and are quickly out-dated and the daily and often intense usage lets mobile phones wear off quite fast. (M. Haase / Ericsson, personal communication, May 19, 2005)

This offers the service provider, e.g. the mobile operator, the opportunity to sell a new mobile TV enabled phone to the user and charge the one time fee again. Thereby, the provider does not run the risk of having many customers that use the service nearly ‘endlessly’. Since an average period of service usage can be estimated due to the anticipated average life of the handset, the premium price can be better calculated than in the case when the service is not bound to the product lifetime.

Charging users only a one time fee is not very probable because mobile phone companies like to have constant revenue flows from their subscribers to increase their monthly ARPU.

6.2.1.4. Financed through Advertisements – Mobile ‘Free-TV’

The private Free-TV channels, and to a small extent also the public TV channels, are financed through advertisements. This financing model has been in use for many years and has proved itself in the TV world. Why not establish a

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22 TiVo is a service that automatically finds and records the viewer’s favoured TV entertainment, and also helps to find related programming the user might like to see. But the service also requires special hardware, the TiVo box, the lowest-priced available for € 156. (tivo.com, n.d.) All prices are converted from US Dollar to Euro with 1 $ = 0,77961 €, then rounded.

mobile Free-TV that is free of charge for users and purely financed by advertisements or sponsoring?

It makes less sense to integrate ads when just rebroadcasting the available TV-channels, as most channels available on cable or satellite already contain advertisements. There wouldn't be space for additional ads without reformatting the content. As for the current situation, the revenues of these ads go completely to the TV broadcasters and the question is if they are willing to share those revenues in proportion to the mobile TV viewers with any third parties. As long as the TV broadcasters do not occupy the relevant steps in the value chain for broadcast mobile TV, they would have to share revenues at least with the datacast service provider and broadcast network operator or pay them a fee for their service provision (see chapter 5). When using the cellular network for distribution of existing channels, the mobile operator will want to have an opportunity to participate in the advertising revenues. All current offers from mobile operators that re-distribute existing TV channels such as MobiTV from Sprint, TIM's mobile TV or 3 Austria's service, charge for the usage either by subscription or by pay per view, as they do not participate in the advertising revenues. Advertisers might also be willing to pay the service providers for the additional viewers generated by mobile TV, especially if they obtain information about the viewers and can use a channel for interaction (visiongain, 2004, p. 161).

Newly developed channels for the mobile could indeed be financed following this proven advertising-based model from the ordinary Free-TV. Specific TV formats for the mobile reception with the attribute of short duration of only few minutes will not be suited for commercial breaks lasting many minutes. However they would be well-suited to sponsoring using an interstitial image or teaser of the sponsoring brand; it could be shown at the beginning and at the end of the program and optionally include further interactive elements.

A model suggested by Nokia would have users pay less for their data services when they allow advertisements to be displayed on their mobile phone (visiongain, 2004, p. 162). This model could also be applied for mobile TV, perhaps combined with a monthly subscription. It would then give price-sensitive users the opportunity to save on the monthly fee by accepting advertisements.

6.2.2. The Pricing Model Best Suited to Mobile TV

The right pricing approach which also gives users a choice of various payment options will be crucial for the success of mobile TV (visiongain, 2004, pp. 160-162).

The advent of cable television already brought two revenue models that coexist on many TV screens at home: The free-content model financed by ads and the paid-for ad-free channels (Winder, 2001, p. 23).

Strategy Analytics believes that the price level for mobile TV should not exceed the monthly spending for comparable alternative media such as cable / satellite TV subscriptions or broadband Internet access and they are convinced that cus-

tomers will not be willing to spend more than € 20 per month for a mobile only service (Strategy Analytics, 2005, p. 13).

There is not only *one* pricing model that is best suited for mobile TV in general. First of all it is important to differentiate between the delivery networks used for the mobile TV service. Offering a cellular mobile TV service for a monthly subscription fee only makes sense for users if the data traffic is also included in the fee. Again, this could get costly for the operator and lead to network overloads if subscribers make intense use of the mobile TV service (see the problem of high data traffic discussed later in section 7.4.).

When launching their 3G networks, South Korean operators promoted them with low-priced mobile TV and video services which included unlimited usage. This led to network congestion problems as well as unprofitable revenue levels. The consequence was that operators removed the unlimited tariffs and increased the price per Mbyte of video traffic by applying a combination of volume-based pricing and content charges. (Heath, Brydon, Pow, 2004, pp. 11, 14, 15)

For cellular TV services, a pay-per-view pricing scheme based on volume or event seems to be most qualified. Mobile operators can best exploit 3G technology by offering short, premium-priced TV and video clips and charging users per clip and per Mbyte (Heath et al., 2004, p. 19). The volume based pricing is of course less convenient for the customer, as the incurring costs are difficult to estimate.

The Yankee Group advises Vodafone to adopt a cable TV-style model for the delivery of its video content with monthly subscriptions for basic and premium content bundles and additional pay-per-view content (Hatton, 2005, p. 4). Since it currently offers the services over their UMTS network, this would again bring up the above mentioned disadvantages for the operator.

For broadcast mobile TV, there is a broader range of applicable revenue models as implications such as network congestion and price per Mbyte are irrelevant for broadcast networks. Visiongain believes that mobile TV “charges could either be fixed or tied to usage”, and suggests that “service providers could experiment until the acceptable balance is found between cost and level of service” (visiongain, 2004, p. 161).

In Japan and Korea, mobile operators have adopted a cable TV charging paradigm for their mobile TV services with monthly subscription fees for the access of tiered bundles of channels. Additional premium content is also made available on a pay per view basis. This lead could probably be followed by most operators worldwide. (Strategy Analytics, 2005, p. 16)

A further potential pricing model could consist of offering a mix of free e.g. financed by ads and paid-for premium TV channels. Moreover there is always the ability to generate additional revenues by offering paid content such as logos, music and ringtones that is linked to the specific TV program. (visiongain, 2004, p. 161)

7. Economic Implications of Mobile TV for the Value Chain Members with Focus on Mobile Operators and TV Broadcasters

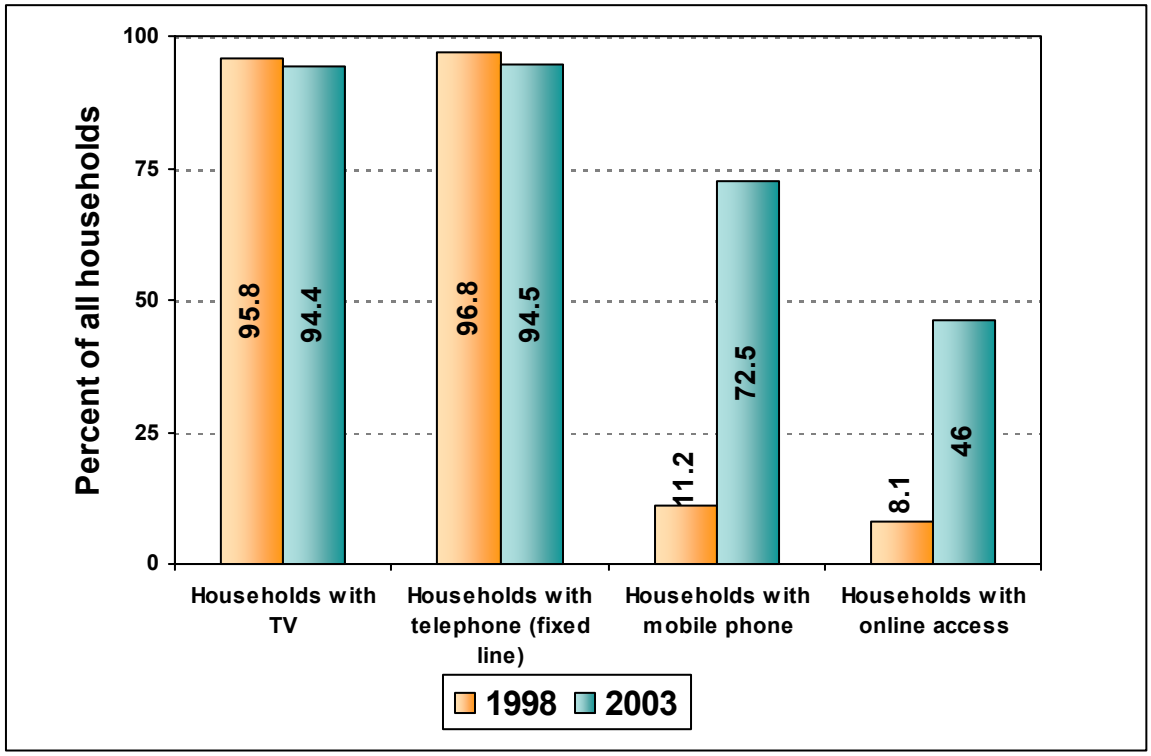
The following chapter will give an overview of the present and future market potential of mobile TV and analyze the economic implications for mobile operators and TV broadcasters arising from the introduction of mobile TV services.

7.1. Present and Future Market Potential for Mobile TV

Since the first cellular mobile TV services have just been introduced to the market by some operators in Germany e.g. Vodafone with its mobile TV offering (Vodafone, 2005a) and mobile broadcasting solutions for the mass market are not expected to launch prior to 2007 in Western Europe (Betti, 2004a, p. 2) almost no past data exists for the German market. There are other countries, especially South Korea and Japan but also the United States, in which TV services have been available for quite some time now and the figures on user uptake can be used to estimate the overall market potential of mobile TV and show a trend for Germany. One has to keep in mind that these are different markets in other cultural environments that can develop differently compared to Western European markets in particular when regarding the Asian market. South Korean operator SK Telecom for example acquired one million users for its mobile TV service in the first nine month since its launch and MobiTV[23] in the United States, which was only available to customers of operator Sprint for quite a long time, already attracted several hundred thousand users (Barrabee, 2005, p. 2).

[23] MobiTV is offered by Idetic and is currently available from US-operators Sprint, Cingular and Midwest Wireless (mobitv.com, 2005a).

Figure 12:
Penetration of German Households with TV, Telephones and Online Access



Source: own illustration based on Statistisches Bundesamt Deutschland, 2004a, 2004b

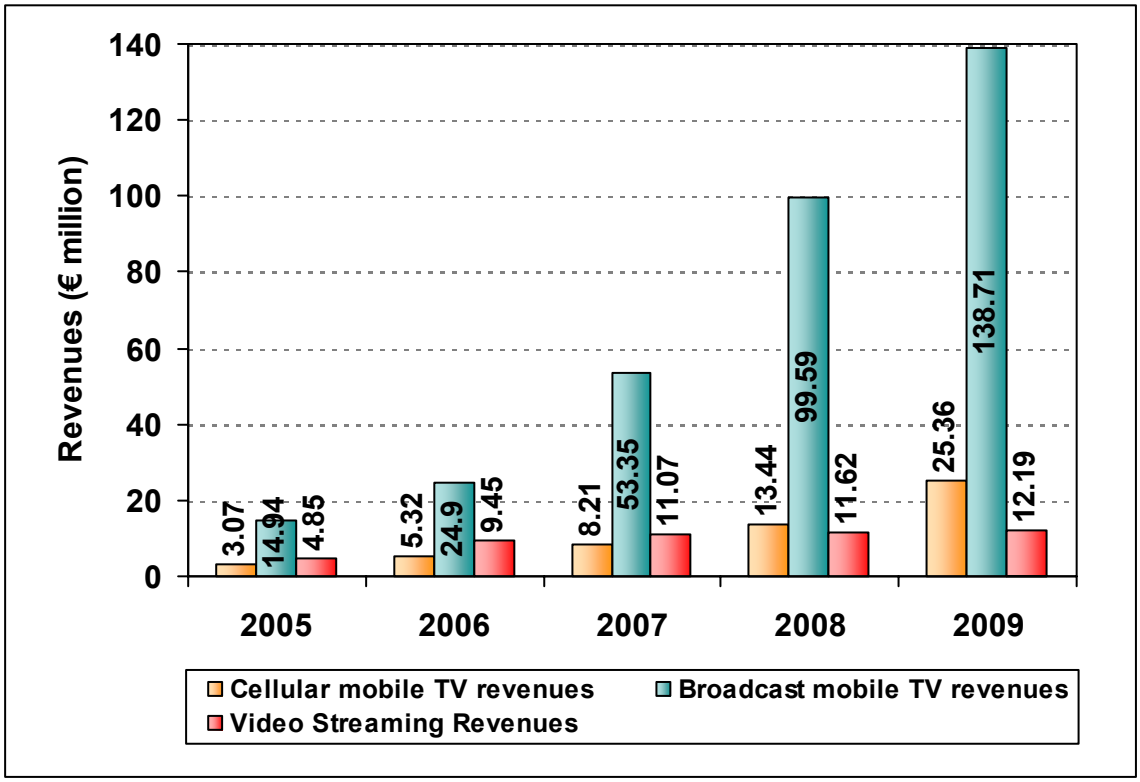
TV is a widespread medium in Germany. 34.5 million households with over 73 million people aged three years and above own at least one TV-set. These TV-households now approach 97% of all German households. (ARD, 2005) The massive take-up of wireless communication devices and services in the last years has affected people's lives, making them increasingly mobile (visiongain, 2004, pp. 20-21). For 2005 this will result in a mobile penetration rate of 80% (Forrester Research, 2004, p. 2) and in estimated revenues of € 20 billion generated through mobile telephone and data services in Germany by the end of the year (Ovum, 2005). The German television networks market is estimated to have a size of about € 14 billion in 2005. This figure consists of advertising revenues on broadcast and cable networks and public broadcast license fees. (PricewaterhouseCoopers, 2003, p. 32)

Households are equipped with ever more equipment of media and communication technology and many devices have integrated functionalities that were previously only available in separate devices. Some TVs for example are featuring PC functionality, PCs are able to receive TV and mobile phones and PDAs are evolving to portable multimedia devices. Mobile TV can be seen as the latest renaissance of convergence, which will result in the fusion of the familiar TV broadcast and the expanding mobile worlds with the ambition to offer the customer new, compelling services. (visiongain, 2004, pp. 20-21)

As one can see these two worlds are both inherent parts in most people's lives and both represent strong markets. Technology evolution and usage behavior make it not only possible but reasonable to leverage the converging worlds.

Figure 13 shows a forecast for the development of revenues in Germany generated by TV services over cellular and broadcast networks and for comparison the development of revenues from video streaming in the cellular environment. For assessing the potential of the German market the mobile TV revenues which are based on worldwide forecasts have been broken down under the assumption that the German share of the worldwide mobile TV revenues will be the same as the German share of the worldwide revenues from mobile services.

Figure 13:
Forecast of Mobile TV and Video Streaming Revenues in Germany, 2005–2009



Source: own illustration based upon visiongain, 2004, p.160, Strategy Analytics, 2004, p. 5, Credit Suisse First Boston, 2005, p. 49

The figures from Strategy Analytics for cellular mobile TV, which forecast worldwide revenues of € 553 million in 2009, are quite conservative. They believe that the willingness to pay will remain below the point at which services can be economically supported over cellular networks. (Strategy Analytics, 2004, p. 5)

But 3G technology enhancements such as HSDPA and MBMS will increase the total business potential. However, the evolution of the market for cellular TV will

probably be dependent on whether broadcast networks are built up and how fast the rollout takes place. The forecast from visiongain for broadcast mobile TV which underlies the German revenue forecast assumes that in 2009 worldwide revenues from mobile TV will reach about € 3 billion (visiongain, 2004, p. 160). Figures from Strategy Analytics give even a brighter outlook for broadcast mobile TV as they estimate 51 million users worldwide will generate revenues of € 5.1 billion in 2009 (Strategy Analytics, 2005, p. 15).[24]

On average TV viewers watched 210 minutes TV per day in 2004 (AGF/GfK Fernsehforschung, 2005). Assuming that the viewers owning a mobile phone would shift 10% of their daily TV consumption to the mobile channel by using mobile TV would result in about 10.5 hours of monthly mobile TV consumption.

7.2. Opportunities for Network Operators

Germany is one of the strongest and most attractive mobile telephone markets in Europe.[25]

Germany had about 64.3 million mobile subscribers in 2004, which implies a penetration rate of 79%.[26] It is estimated to grow to 83% in 2009 (Forrester Research, 2004, p. 2). 15% of the German population is under 15 years of age and 17% are older than 65 years (Deutsche Stiftung Weltbevölkerung, 2004, p. 10). In this part of the population the share of people using a mobile is considerably lower than in the rest of the population.[27] This means the mobile phone market is relatively saturated and it will become more and more difficult for mobile phone companies to grow and boost revenues just by acquiring new customers.[28]

Furthermore, mobile phone companies have heavily invested in building up their 3G networks. Ovum estimates that building up a 3G network in Germany costs around € 5 billion (Bieler, 2005, p. 10). Also, due to equipment and handset delays, many European operators had deferred their UMTS launches until late 2004 or 2005; in addition, early services such as video-telephony offered over these networks have only shown limited success (Brydon, Heath, Pow, 2003, p.

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24 All figures in this section are converted from US-Dollar to Euro with 1 $ = 0,77561 €

25 In the 4th quarter of 2004 revenues of € 22 billion were generated with mobile services in Germany (16% of European mobile revenues), the third highest in Europe after the UK (€ 23 billion) and Italy (€ 22,6 billion) (Merrill Lynch, 2005, p. 3).

26 Other sources, e.g. Merrill Lynch, show higher penetration rates (87,1% for the end of 2004), because not the number of customers, but the active SIM cards are counted. Subscribers owning multiple SIM cards (double subscriptions) inflate the penetration rate. (Merrill Lynch, 2005, pp. 12, 78)

27 This will of course change in the future, when the younger generations from today (which are accustomed to using mobile phones) will get beyond the age of 65.

28 For comparison: In 2004 emerging markets had an average subscriber growth rate of 41% compared to about 10% in Germany (Merrill Lynch, 2005, pp. 4, 78).

15). To amortize their expenditures operators now search for services that gain users' acceptance and make use of the higher speed and capacity of the 3G network.

Mobile TV is a service that can help to increase the average revenue per user (ARPU) and due to its high data volume is best suited for being offered on 3G networks. Secondly, attractive mobile services like mobile TV can improve loyalty and reduce churn.

7.2.1. ARPU Increase

In 2005 and beyond mobile operators will face many threats that can negatively affect their revenues. The first mobile virtual network operators (MVNOs)[29] such as Tchibo and easyMobile are entering the German market offering 'no-frills' telephony services at low prices. Bundled tariffs and special options as well as pricing pressure from MVNOs will have prices for voice minutes decreasing. In the future IP-telephony may also put pressure on mobile voice telephony pricing and revenues. Even fixed to mobile substitution won't be able to increase the voice ARPU, because it requires that the mobile premium[30] that one currently pays for voice calls drastically drops. (Bieler, 2005, pp. 1-6)

Despite the on-going growth in subscriber numbers, overall revenues are slowing down in the German market, especially for the two largest operators, Vodafone and T-Mobile (Bieler, 2005, pp. 1-6). This is partly to do with the battle for market share which has led to increased customer acquisition costs and higher costs for the subsidization of ever more feature-loaded and more expensive handsets (M. Haase / Ericsson, personal communication, May 19, 2005).

Revenues from value-added services and data services should be the core focus for operators in their endeavor to raise or at least keep the current level of the ARPU. Otherwise mobile phone services could become a commodity with users differentiating only on price.

Commoditization is a natural and inevitable process sooner or later occurring in every market. All companies come to a point – that is when their products over-

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29 A *MVNO* offers one or more mobile services without owning or operating a cellular network by partnering with a mobile network operator. For major brands the MVNO model presents a major opportunity to generate additional revenues, extend their brand and build broader awareness. Being an MVNO means much more than just reselling mobile voice; the end user expects the MVNO to provide value above and beyond that of the mobile service provider. This can be achieved by providing specialized exclusive content, branded mobile devices or cross-product bundles. (Portal, 2004, pp. 4, 5, 8)

Not every reseller of mobile services is an MVNO (which owns own structures such as a billing system or a fixed line network), more often they do just *branded reselling.* Examples: *Simyo (E-Plus), Payback 'Volkstarif' (Vodafone)*. (heise.de, 2005)

30 The mobile premium is the average cost per mobile voice minute above fixed-line costs (Bieler, 2005, p. 6).

shoot in terms of functionality and reliability customer demand in lower tiers – when they have to cope with commoditization (Christensen & Raynor, 2003, pp. 151-152).[31] When market needs on each attribute or dimension of a product have been fully satisfied by more than one available product, it becomes a commodity within a specific market segment (Christensen, 1997, pp. 169-171).

Simultaneously to the process of commoditization a reciprocal process of de-commoditization occurs at another stage of the value chain or next door in adjacent processes. These are the stages, which offer attractive profits, but companies much too often fail to move where the money will be in the future. Much too often companies rely on attribute-based core competency theory to make decisions, which they later regret. Whether or not something is a core competence is not the determining factor of a firm's ability to move to where the future profits reside. Competitiveness is far more about doing what customers value than just relying on one's own core competencies. (Christensen & Raynor, 2003, pp. 152, 158, 161, 162)

Voice telephony as the core product of mobile network operators is relatively commoditized. It is hardly possible to differentiate it, only marginally in terms of speech and network quality and service availability[32]. In this field phone operators compete mainly on price resulting in decreasing profit margins. Therefore operators must look at other stages of the value chain and for other close-by products, which are differentiable, give their subscribers added value and offer the ability to earn attractive profits. Various value added data services and special mobile content offer that ability. As long as not all operators offer mobile TV, this can be a service differentiator. Exclusive mobile TV content only available to customers of one specific operator will serve this function as well.

Japan and South Korea appear to be the most advanced mobile communications markets especially regarding data capabilities and usage. Both markets have seen a rise of data revenues per user and the data ARPU is highest in their technologically most advanced networks with the highest bandwidth. (Anderson, 2005, pp. 4-5) *'June'* for example, a premium multimedia service also featuring mobile TV and video on demand, was launched by SK Telecom in November 2002 and by June 2004 it had attracted 2.78 million customers representing 51% of its overall 3G customer base. These June customers generate a substantially higher ARPU than other mobile subscribers. (Heath et al., 2004, p. 4) This market development cannot be transferred one-to-one to the German market – criteria such as culture, technology-acceptance and usage behavior that also impacts on data usage differ a lot between Western Europe and Japan or Korea. However the developments in these markets can be indicative of a similar trend for Germany and other countries.

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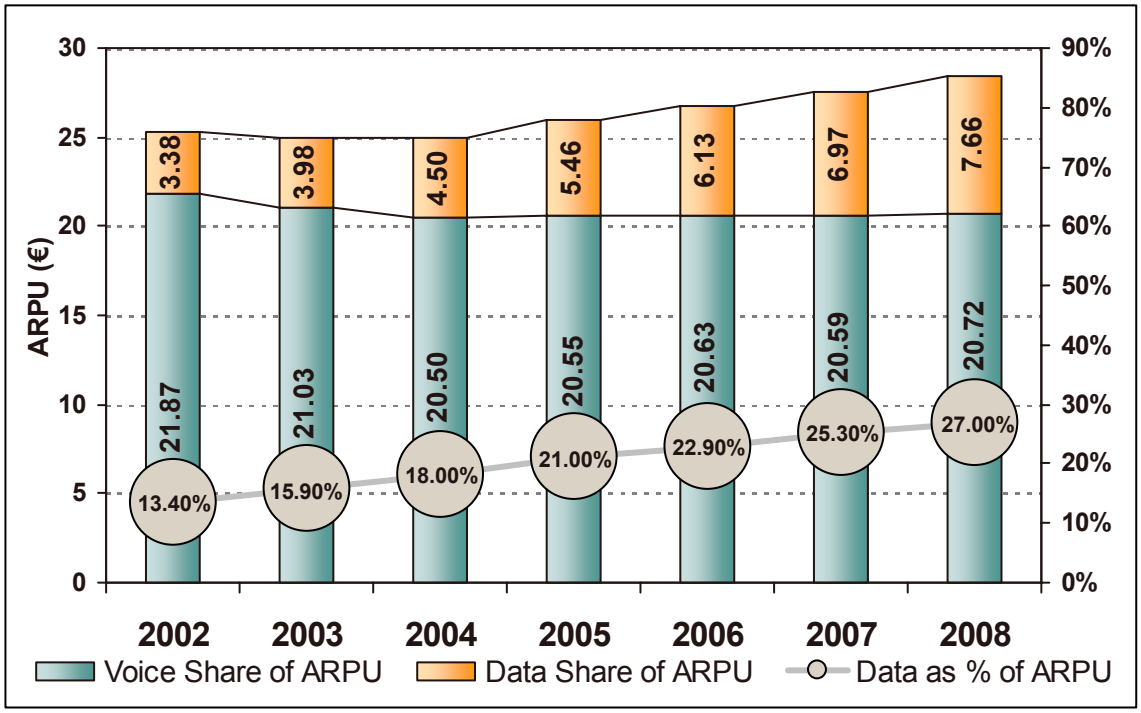
[31] For a detailed analysis of the processes of commoditization and de-commoditization see Christensen, Raynor, 2003, pp. 149-175.

[32] The speech quality and network availability can be different in the various mobile networks due to technology and deployment issues (M. Haase / Ericsson, personal communication, May 19, 2005).

Figure 14 shows the development of the monthly ARPU in Germany over the last three years and gives a forecast for the coming years. As one can see the overall ARPU is expected to grow from € 25,25 in 2002 to € 28,38 in 2008, but this growth is almost only caused by growing average data revenues per user (which will grow from € 3,38 in 2002 to € 7,66 in 2008), while the voice share of the ARPU remains nearly constant. The current ARPU split between voice (79%) and data (21%) service revenues is forecasted to shift into a 73% (voice) 27% (data) relation over the next three years (2008).

Figure 14:
ARPU Development in Germany



Source: own illustration based on Merrill Lynch, 2005, pp. 78-79, Credit Suisse First Boston, 2005, p. 38, Ovum, 2005

The data ARPU consists of the revenues from data services[33] and includes revenues from traffic, the operator's share of premium content revenues and any other transaction fees (Ovum, 2003, p. 2). In 2002, SMS revenues accounted for 96.7% of the total data revenues, but this figure will fall to 41.3% in 2008 (Credit Suisse First Boston, 2005, p. 38) and thus other non-messaging data services such as downloads, email, video streaming and also mobile TV will constitute a growing share of the data revenues.

[33] Data services are for example SMS and MMS messaging, games, phone personalization (ring tones, screensavers, logos) and various entertaining and informational content (Ovum, 2003, pp. 3-5).

According to Analysys Research, there are three highly plausible scenarios for the evolution of the wireless industry which hold major opportunities and threats. They are dependent on three drivers: the voice service mix, the data service mix and the technology mix. The three resulting scenarios are: 1) *Premium for Mobility*, 2) *Voice and Broadband Data Go Mobile* and 3) *Alternative Technologies Thrive*. (Brydon et al., 2003, pp. 14-21)

In the '*Premium for Mobility*' scenario, the wireless industry focuses on the success of data services that generate substantial per Mbyte and use relatively little network capacity. Such services include SMS text messaging and MMS picture messaging. Also significant price premiums for mobile voice telephony and Internet services are maintained over those of fixed networks. This scenario would be a continuation of the strategy that most operators worldwide currently pursue. Pre-requisite for this scenario to happen is a continued growth of high revenue per Mbyte services, as well as existent services such as SMS and MMS but also new interactive services need to gain popularity. (Brydon et al., 2003, pp. 24-29)

The second scenario called '*Voice and Broadband Data Go Mobile*' emphasizes revenue growth through high-volume, lower-margin services that consume substantial network capacity but bring only little revenue per Mbyte. Mobile voice telephony will be offered closer to fixed voice costs and broadband data services will be priced competing with DSL services. As a result, fixed-to-mobile substitution will occur and mobile usage and revenues will explode. The South Korean market leads the way offering aggressively low-priced multimedia services. The market leader SK Telecom had a lot of success with its attractive 3G multimedia service *'June'* which offered a wide range of services including music-on-demand, internet and TV broadcasting. The newly established 3G networks offer quality and cost advantages and bring enormous capacity benefits over GSM networks which will accelerate with the introduction of new technologies such as HSDPA and data compression in these networks. (Brydon et al., 2003, p. 13)

'*Alternative Technologies Thrive*' is the third scenario. The likelihood of this scenario will gain weight if operators fail to make progress with either traditional mobile or new 3G services. Moreover, further delays to UMTS-equipment and network roll-outs, failure of achieving customer base targets with 3G services and accelerated increase of WLAN hot-spots will contribute to increase the likelihood of this scenario. (Brydon et al., 2003, pp. 14-17)

All three scenarios are highly plausible and lead to a different evolution of the wireless industry. As operators are in the *driving seat* they should take actions early that let them capitalize on the opportunities available in each scenario. (Brydon et al., 2003, p. 64)

In Germany all four operators have already invested in licenses and infrastructure to build up their 3G networks. So their hands are forced to shape the future of the wireless industry in a way to help them amortize their 3G networks by

gaining customers and increasing ARPU. The second scenario is most likely to be the operator's desired outcome.

In conclusion, one can say that attractive, useful services and content, that really interest the end-user and also make use of the benefits of the new 3G networks, are needed to further boost data revenues and increase ARPU. As mentioned before early 3G services failed to attract consumers, so new ideas and concepts are needed. Surveys have shown that mobile TV seems to be a service consumers are interested in and also willing to pay for (see section 3.2.). It consumes substantial bandwidth and thereby needs the higher capacity offered by UMTS. However, UMTS it is not suited to support intensive use of TV services and future mass-market up-take will require other approaches and technologies (see section 4.3). Currently, as German 3G networks are only used by a few subscribers and have enough free capacity, they are qualified for delivering the first mobile TV services.

7.2.2. Increasing Customer Retention and Reducing Churn

In times of cut-throat competition actions and targets of customer retention are more important than winning new customers (Meffert & Schwetje, 1998, p. 1). Strong competition on the German mobile phone market along with declining prices for voice minutes and basic fees and commoditization of the core product, mobile voice telephony, mean that price is often the main criterion of operator selection. Since phone numbers are portable when changing the providers, it has become even easier to switch the operator.

The yearly churn rate is calculated by the number of subscribers per year who discontinue their use of the service divided by the average number of total yearly subscribers. The Churn rate is helpful for providing insight into the growth or decline of the subscriber base and into the average length of service usage (investorwords.com, 2005).

The mobile telecommunications industry is facing an average yearly customer churn rate of 14.4%, i.e. a mobile phone company loses 14.4% of its customers per year. Most of these customers will purchase a new mobile phone contract from another operator (Bieler, 2005, p. 3). With customer acquisition cost being five to ten times more expensive than retaining an existing customer, a reduction in churn rate has become more important than customer acquisition (Parekkat, Arun, 2003), especially in almost saturated markets.

On that account mobile phone companies are searching for solutions to avoid subscribers terminating their service usage and migrating to competitors.

Mobile phone companies have to fulfill their subscriber's expectations and make sure that they are satisfied in every way. This will lead to customer loyalty and improved customer retention. As a result customer churn will be reduced. It has been proven in many empirical studies that high customer satisfaction positively affects customer loyalty (Rams, 2001, p. 152). Customer retention in the narrower sense can be defined as the intention of the customer to make follow-up

purchases at a specific vendor; they can be caused by contractual obligations or situational circumstances, i.e. they are not necessarily based on a voluntary basis (Diller, 1996, p. 82-83).

Customer loyalty reflects the attitude of a customer to the business connection with his vendor. It indicates the customer's voluntary disposition to continue the business connection caused by a positive evaluation of the vendor. This manifests itself in follow-up purchases, the extension of existing contracts or the recommendation of the service to third parties. (Rams, 2001, p. 35)

When analyzing customer retention, one has to differentiate between the two types of mobile subscribers, postpaid and prepaid customers.

Postpaid customers have a minimum term of their contract, which in Germany is generally 12 or 24 months; this is automatically extended if it is not cancelled ahead of time. Prepaid customers do not have any minimum contractual terms; their contract ends if they have failed to reload their credit within a certain period. Two controversial conclusions follow for the correlation of customer retention and minimum term of the contract: On the one hand, prepaid customers can be attributed a higher customer retention because they have not acted on the possibility of canceling their contract although it is possible at any time. On the other hand, customer retention can be higher with postpaid customers that are still in the minimum term of the contract and thus not able to cancel the business connection. A contractual fixation does not lead to higher customer loyalty. (Rams, 2001, pp. 132, 162, 163) However, it could be seen as 'forced loyalty' and helps to retain the customer at least until the end of the contract period.

As mentioned in 7.4.1 the product mobile voice telephony is relatively commoditized and largely homogenous. Thus barriers to switching vendors (except when forced by contractual commitments) are very low. Prior to November 1st 2002, though mobile phone numbers were not portable when switching vendors. This can be considered an effective barrier to switching (Rams, 2001, p. 165). However, since that date, customers have had the possibility to keep their number including the prefix when they change their mobile phone company (Gneiting, n.d.). Therefore the price, terms and conditions have now become the centre point of customer satisfaction and present the main focus when comparing different operators (Rams, 2001, p. 173).

When comparing different service offerings of operators, one must differentiate between three product categories. At first there are *must have* services such as voice telephony, SMS, MMS, and WAP, which every operator must have included in its service offering due to their high popularity. Secondly, some services are *nice to have*, e.g. news alerts, interactive maps or dating services, which some operators have in their product portfolio. The third category consists of service *differentiators*, which are the most important ones in terms of customer retention. These exclusive (and value-adding) characteristics and services of a mobile network operator can be a barrier to switching because they would lead to a loss of these services for the customer if he changed the pro-

vider (Rams, 2001, p. 38). Mobile TV can be such a service differentiator, if there is only one national operator offering it or if it features exclusive channels and content. *TV for the mobile* services can generally be seen as differentiators since they are usually offered exclusively by one operator, e.g. the 'RTL aktuell' service offered exclusively by T-Mobile in Germany.

7.3. Opportunities for TV Broadcasters

TV broadcasters in the highly competitive German TV market are always in search for new opportunities to generate additional revenues. This applies primarily to the so-called 'Free-TV' stations, which finance themselves mainly through advertisements. They are therefore strongly dependent on these advertising revenues, which in turn are dependent on the highly cyclical spending of the advertising industry. When the economy stagnates, the advertising industry spends less on advertisements.

Additionally, TV broadcasters compete against other media for advertisement expenditures. Some media, such as the Internet, offer advertisers interactivity and the possibility to measure the success of their campaigns.

The competition for market share between the two main 'Free TV' players RTL Group and ProSiebenSat1 as well as many new emerging category channels, which will further increase with the digitalization of the TV, will lead to decreasing market shares for the existing players and also to lower advertising revenues.

Broadcasters have to be convinced of the opportunities which mobile TV offers to them and of the possibility of earning money in this area (visiongain, 2004, p. 93).

The following section will show the main opportunities mobile TV can offer to TV broadcasters.

7.3.1. Mobile TV as an Additional Source of Income

Many private TV broadcasters already earn additional money on top of their core revenues generated by advertising with products or services such as merchandising, TV-shopping, SMS-voting and web-portals.

Through multiplication of transmission capacity and convergence of media, the digitalization of TV allows for an immense increase in channels and other TV-like service offerings (Heinrich, 1999, p. 71).

In an international comparison with the US and the United Kingdom, the German market has far less category channels. The category channels have established themselves in the German 'Free-TV' and 'Pay-TV' market and still have huge growth potential. The number of available channels is expected to continually rise and as a result the major channels such as RTL and SAT 1 will lose

market shares to the category channels. This will lead to decreasing revenues from advertising for a single channel.

If the available program offering rises to a greater extent than the demand from recipients, then the average usage of the average program – also called average usage quota – will continually decrease. The average usage quota is calculated by taking the average time for TV consumption per time unit measured in time units and divided by the TV program offering per time unit measured in time units. The average usage quota is an indicator for the viewer splitting and can also be seen as the fictitious market share of one hour of TV program when assuming an equal usage of all programs. (Heinrich, 1999, pp. 459-460)

The average program usage has decreased from about 3% in 1982 to 0.69% in 1996 (Heinrich, 1999, p. 460). This data is nearly ten years old and at that point in time, a large number of channels in existence today were not yet in the market. TV was not even on its way to being digitalized. The average program usage has most likely declined much further since 1996 and this trend is expected continue in the near future. Of course these are only average values applying to the average of all programs. There are of course still some programs and content, which have high viewer levels as they interest the masses. The World Cup soccer game Germany-USA in 1998 e.g. had 24.37 million viewers and a market share of 70.1% (Heinrich, 1999, p. 460).

The massive increase in the supply of programming content is partly supported by an increase of the demand for advertising time, but the revenues from advertising did not increase at the same magnitude as the program offering. This led to decreasing revenues per programming hour and with that to an increasing revenue splitting (Heinrich, 1999, pp. 460-461).

Deloitte predicts for 2005 that the traditional business model for broadcast television, with the idea of one-to-many broadcasting and revenues mainly generated from advertising, will likely be replaced by a more segmented, user-centric approach. Recent years have brought about a significant number of new media formats and channels leading to a multitude of small and ever decreasing audiences. (Deloitte, 2005, p. 4)

Mobile TV can help to broaden the reach of the channel or a specific program. The mobile phone is a permanent companion in most people's lives. So it is possible to reach them with a special program or advertisement, even when they are not in front of a TV screen. For specific programs that are suited for being viewed on a handheld and while 'on-the-go', this will lead to a greater share of viewers. Such advertisements can reach more potential customers and therefore broadcasters are able to raise their prices per minute of advertising in the specific programming environment. The mobile channel is furthermore predestined for offering category channels for specific target groups, which allows companies to employ more targeted advertising. Especially when the UMTS network is used for distribution of the content, a broad range of content can be stored on servers made available to consumers on demand. The interactive element of the mobile channel also allows for many new forms of advertising

built around specialized mobile TV content which will be discussed in section 7.5.2.

Next to advertising, subscription-fees are also a major form of revenue generation for mobile TV (visiongain, 2004, p. 33). Consumers pine for more programs and more choice in a variety of formats with the ability to consume it wherever and whenever they want; and they are willing to pay for it (Deloitte, 2005, p. 4). TV broadcasters can offer customers specialized mobile content for a monthly subscription fee, whereby they would be less dependent on advertising revenues.

Furthermore, TV broadcasters have the chance of earning money with additional mobile services integrated into the mobile TV experience. Many TV broadcasters already generate additional revenues from SMS-based services such as voting, chatting or the download of ringtones and have even built complete shows around these services, e.g. MTV with 'Videoclash' in Germany (visiongain, 2002, pp. 47-52). These services can be more seamlessly integrated into interactive mobile-TV programs, because users would not need to switch the medium to interact with the program by sending an SMS – they could just be asked to press a button on their mobile phone.

7.3.2. New Forms of Advertising and Cross Media Marketing and Distribution

A representative survey among 2009 households in the United States found that there is a big difference in TV usage between Internet users and people that do not use the Internet. Internet users watched about 4.6 hours of television less per week than non-users and 22.7% of online users spent part of their weekly TV viewing time TV while at the same time surfing on the web. (Lebo, 2004, pp. 46, 54, 103) The younger generation having grown up in an 'always-on world' has even a filter mechanism which enables them to do many things such as listening to music, working with the PC and watching TV simultaneously, but only focusing on the input they want to. This ability to block out anything unwanted makes it hard to reach them with conventional TV advertising spots. (Rose, 2004)

There are some developments which make brands move away from broadcast TV as the anchor medium and look for advertising means beyond the 30-second TV spot. TV broadcast networks do not deliver the mass audiences needed by big brands anymore, other leisure activities (including other media) compete with TV viewing. The effectiveness of TV ads is declining driven by new technologies such as personal digital video recorders (that allow people to easily skip the commercial breaks). Especially for reaching the younger 18-to-34 year old consumers, a more direct entertainment-and-branding experience is needed. Savvy advertisers are starting to react to this trend: In 2003 Coca Cola already cut its TV advertising spending by 10%. (Rose, 2004)

The mobile phone as an interactive and widely used medium offers new and different forms of advertising, which can especially help to reach the younger

audience. Mobile marketing campaigns include services such as quizzes, opt-in alerts, contests, sweepstakes, trivia games, polling, voting, treasure hunts and customized ringtones (Gibler, 2004, p. 3). Procter & Gamble carried out a mobile campaign in the UK for its Head & Shoulders product that allowed consumers to download a mobile multi-player game whereas the multiplayer aspect of the game and a scoring list enables the brand to extend its relationship with consumers. The game was promoted through TV advertisements and encouraged viewers to download the game for free by sending an SMS to a specific number. A potential benefit of mobile marketing is the viral marketing effect when users forward desirable messages to friends (Gibler, 2004, p. 3). However, this effect can also be reversed, and the forwarding of undesirable messages can have a negative impact.

By offering mobile TV services, broadcasters have access to these new forms of advertising and can expand their service offering to the companies that do advertising business. These are always interested in new forms of advertising, which better reach their target groups and are effective enough to be remembered by consumers.

According to a survey in Europe in May 2004 among 250 mobile subscribers, 30 operators and 25 advertising agencies by Empower Interactive, a supplier of mobile data infrastructure products, 84% of European mobile subscribers would be willing to receive SMS promotional offers on their phones. Fifty percent of the respondents even embraced the idea, provided that the promoted products are appropriately targeted towards their individual preferences and 39% said they would welcome messages from companies in which they had expressed interest. Only 16% of the users questioned were not willing to accept mobile promotions from any company.

Admittedly the prospects for mobile advertising are not that bright after all. A survey by Intelliseek and Forrester Research in the United States showed that text-based advertisements on mobile phones ranked very poorly, near the bottom of consumer's trusted forms of advertising. A survey by mobile marketing firm Enpocket in 2002 in the UK, where short message texting is far more common than in the United States, revealed that 57% of subscribers who had not even been in contact with a marketing SMS found it annoying.

With a procedure called *opt-in*, it is guaranteed that only users wanting to take part in mobile campaigns will receive messages with advertisements. Since many users are annoyed by receiving un-requested SMS with pure advertisements, the intelligent combination of quality content and a tight advertising message exhibits a surprisingly high user acceptance and a very high advertising effectiveness. Mobile TV can offer the appealing and high quality content around which the mobile advertising campaign can be designed.

Although mobile marketing instruments can be deployed exclusively, in most cases classical and new media enhance and fortify each other. Mobile marketing should be embedded in the media mix of the overall marketing strategy of the respective company.

Here mobile TV can unify the classical and the new medium in itself by enabling the combination of the classical TV spot with interactive elements from the mobile channel in one viewing device.

Most consumers dislike commercials that interrupt a movie on TV, but nearly 90% of TV viewers, also including those having a Pay-TV subscription, would accept sponsoring (Paukens & Schümchen, 2000, pp. 7, 39). Sponsoring would be an ideal form of advertising since it would not make sense to offer long lasting advertisements when taking into account the short duration of specialized mobile TV programs and the viewing habit of users (see section 3.1.3.). A sponsoring at the end of a mobile TV program could for example be combined with a link leading to a contest or the download of a game and in this way making use of the interactive possibilities of the mobile channel.

As an example, in 2004 cosmetic brand Yves Rocher launched a mobile coupon campaign in France, which was supported by point-of-sale, poster and flyer advertising. Such campaigns could also be combined with mobile TV and would allow to conveniently store a mobile coupon received during a sponsoring or advertisement of mobile TV directly in the handset for later use.

Besides the mobile channel becoming more and more important for brands in their cross media marketing campaigns, it offers the opportunity for TV broadcasters to reuse and redistribute existing content again over this new channel.

Multiple usage of content is reasonable, since media products are often characterized by high costs for producing the first copy, in contrast to marginal costs for every following copy and distribution to the customer (Schumann & Hess, 2002, p. 74). Here the concept of *windowing* is of great relevance, which aims to distribute a complete product (e.g. a movie) over different distribution channels at different points in time (Zerdick, 2001, pp. 70-71).

The multiple usage and revenue generation over different distribution channels, the *profit-windows*, is possible because of the non-rivalry in the consumption of content and the marginal variable costs of media production. In the single profit-windows a different willingness to pay of the recipients (due to differing preferences regarding the timeliness of the media product) is exploited. For media companies, which are integrated along the value chain, profit-windows are one of the most important concepts for the optimal realization of revenue potentials. (Schumann & Hess, 2002, pp. 74-75)

7.3.3. Positive Effect of Mobile TV on TV Advertising Prices

To communicate an advertising message, a company can use different advertising media to spread the advertising messages to the target audience (Meffert, 1998, p. 692).

The media differ in a variety of attributes such as price, reach, image and possibilities for interaction. The TV is a medium with a rather passive reception of the offered information, which gets even more transient through the problem of ”zapping” i.e. the switching of channels during advert breaks. The impact of the

advertisements on the viewer is quite superficial requiring numerous repetitions (Terlutter et al., 2003, p. 160).

Another limiting factor for an advertising message is the tradeoff between richness and reach. A basic law applies to information embedded in physical modes of delivery: It can rarely be rich and at the same time have a great reach. Reach measures the number of people receiving the information. Richness is defined by three aspects of the information itself, the customizability, the interactivity and the available bandwidth for transmission. For example, a company has the ability to embed its marketing message in a TV ad, a piece of customized direct mail or a personal sales pitch. In the above order, the alternatives increase in richness but diminish in reach. Communicating information to large audiences generally requires compromises in bandwidth, customization and interactivity. (Evans & Wurster, 1997, pp. 73-74)

The bandwidth of a UMTS or DVB-H network is relatively high (see section 4.1). Interactivity is possible in the cellular network and cost-effective mass-customizability could be achieved by combining intelligent software solutions along with surveyed or monitored user preferences. These attributes and the ability to broadcast mobile TV to a mass-audience make it a medium that can be relatively rich while also reaching many people.

Accordingly, targeting advertisements accurately on television is not possible because the audience can not be segmented by demographics or product interest. Similarly to Internet TV, this is possible with cellular mobile TV or the broadcasted version when personal information from the mobile subscriber is available and the cellular network is used as a feedback path.

By establishing broadcast mobile TV, the number of digital broadcasting receivers would increase with every handset sold that includes such a receiver. Assuming interest and usage of the TV service by mobile subscribers, this will generate more users for a TV program. People would either be additional new viewers, or would have missed the show without mobile TV, as they were unable to be in front of their home television set.

Advertisers should be willing to pay for the additional viewers, particularly if they receive valuable information about potential customers and if they can use the cellular feedback channel for interaction (visiongain, 2004, p. 161). This will result in additional revenues for the TV broadcasters which can be reflected in increased prices for one minute of advertising during a specific TV program.

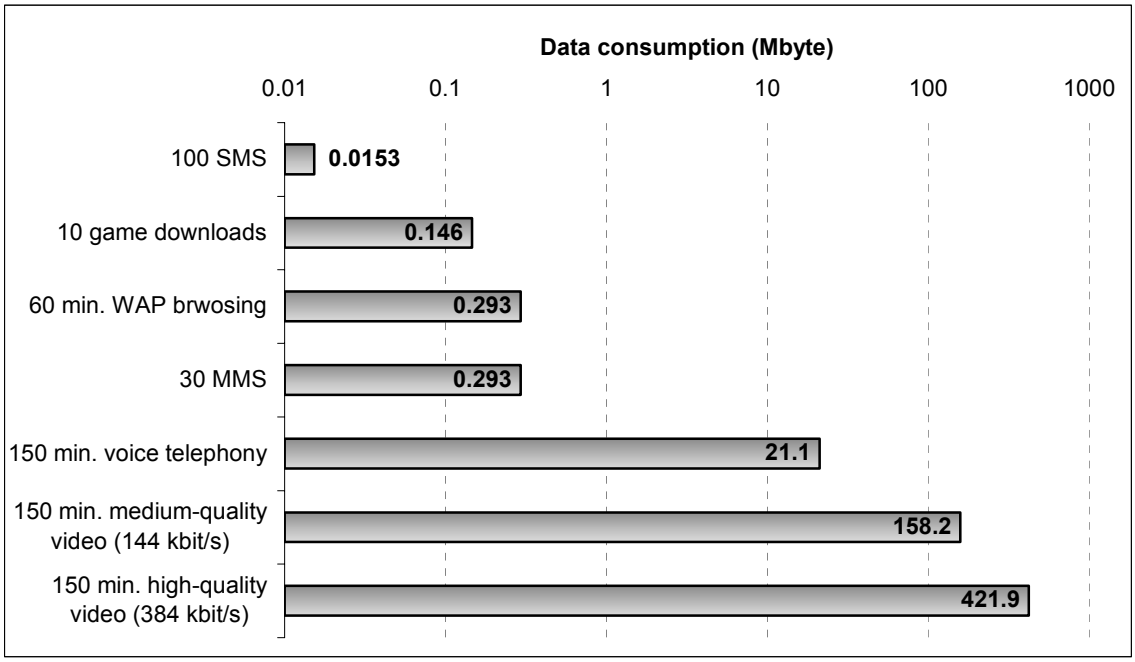
7.4. The Problem of High Data Traffic and the Resulting Low Revenue per Mbyte

Delivering full-video or digital TV to a mobile phone at an adequate quality absorbs a substantial amount of bandwidth compared to other mobile services.

A two-hour movie for example would generate over 300 Mbyte of data traffic and network operators would have to charge at least € 300 for a unicast cellular delivery to achieve similar margins per Mbyte to voice telephony. (visiongain,

2004, p. 169) Admittedly, no user would be willing to spend any amount of money in that order of magnitude.

Figure 15:
Data Consumption of Typical Mobile Data Services



Source: Heath et al., 2004, p. 11

Thus the operator has to price cellular TV and video services on low revenue per Mbyte basis, but the pricing still has to be high enough to guarantee service profitability for the operator. It has to provide a service mix that generates suitably more average revenues per Mbyte than the accrued average costs per Mbyte for the service delivery. Using UMTS infrastructure, operators should strive for earning average revenues per Mbyte above € 0.4. Regarding the costs of popular and high quality content, this figure should most likely be closer to € 0.8 or even higher. (Heath et al., 2004, p. 12) As table 4 shows, other mobile services generate substantially higher revenues per Mbyte than TV and video services. Although short, premium-priced TV and video clips can achieve margins per Mbyte similar to voice telephony.

The challenge is to offer valuable mobile TV services that are affordable to the consumer while they are still profitable for the operator (visiongain, 2004, p. 169). The best balance of affordability for the consumer and profitability for the operator can be achieved with short TV clips ideally lasting less than three minutes (Heath et al., 2004, p. 14).

Table 4:
Revenue per Mbyte for Different Mobile Services

Service	Typical operator revenue	Data consumption (Mbyte)	Revenue per Mbyte
SMS message	€ 0,12	0,00015	€ 755,46
Games download	€ 2,31	0,0147	€ 157,55
MMS message	€ 0,38	0,00977	€ 39,35
1-minute WAP browsing	€ 0,04	0,00488	€ 7,84
1-minute voice telephony (peak time)	€ 0,19	0,141	€ 1,37
1-minute voice telephony (off peak)	€ 0,06	0,141	€ 0,44
3-minute low-quality video / TV clip (72 kbit/s)	€ 1,54	1,62	€ 0,95
3-minute medium-quality video / TV clip (120 kbit/s)	€ 1,54	2,637	€ 0,58
3-mintue high-quality video / TV clip (384 kbit/s) e.g. music video	€ 2,31	8,438	€ 0,28
30-mintue medium-quality TV program (120 kbit/s) e.g. soap opera	€ 3,84	26,37	€ 0,15
90-mintue high-quality movie (384 kbit/s)	€ 7,69	253,1	€ 0,03

Source: Heath et al., 2004, p. 13; own calculation

Moreover, the bandwidth of cellular networks is limited, even if 3G offers significant improvements regarding bandwidth, capacity and cost per Mbyte over 2G networks (visiongain, 2004, p. 169). As cellular networks are designed for one-to-one communications, only the implementation of MBMS (see section 4.1), will solve the problems of network clogging and high data traffic (costs) in the cellular environment. Despite those enhancements, non-broadcast wireless access systems such as wide-area UMTS networks will only be suited to support a low to medium level of mobile TV penetration (The Shosteck Group, 2005, p. 44).

Another important point regarding mobile TV services is the fact that today, the method of charging is separate for data traffic and content. Generally when browsing with the handset through the operator portal or surfing on the web, costs are incurred based on the transferred data traffic. When consuming premium content such as viewing or downloading a video, additional charges apply raised by the supplier of the content. Many operators do not charge consumers for traffic when they download premium content, especially TV-content from their own portal or they offer them at least a monthly data flat rate for using their portal. (Hatton, 2005, p. 4) These traffic costs are not directly apparent when using a specific service and can be substantial for mobile TV services, which generate enormous amounts of data traffic. If these fees are charged for mobile TV they would make the service too expensive and hence unattractive to the consumer. If content providers / aggregators or other third parties offer mobile TV services outside the operator's portal on their own portals and if there are no

special agreements with the operator, then mobile subscribers get charged for incurring traffic by their operator. This makes it difficult for third parties to offer mobile TV on their own portal and they are strongly dependent on the operator and its willingness to cooperate. The operator, in turn, may want to keep the traffic charges for third parties to make their own mobile TV services more affordable and attractive to consumers.

The high data traffic costs generated by mobile TV are only problematic when delivering the service as a point-to-point connection over current 2.5G and 3G cellular networks.

7.5. Does a First-Mover Advantage for Mobile Network Operators or TV Broadcasters Exist?

Some management concepts such as the “first mover advantage” are so appealing to managers that they automatically assume them to be valid. Despite the cautionary lesson of the fate of many followers, such as the dot-coms, many managers are still convinced that being first in a new market or product category, even in the absence of network effects, will earn them almost insuperable competitive advantages. (Suarez, Lanzolla, 2005, p. 121)

Two established categories of theoretical-analytical approaches exist trying to explain those often long-lasting first-mover advantages. The first economic theory uses the barriers-to-entry concept and a company’s utility function to explain first-mover advantages. A barrier-to-entry represents the additional costs that a non-pioneering company has to bear for competing effectively in the new market relative to the first entrant. Numerous entry barriers are believed to positively affect first movers. They include, but are not limited to: scale effects, experience effects, reputational effects, technological leadership, preemption of scarce resources and buyer switching costs. (Kerin, Peterson, & Varadarajan, 1992, pp. 33-35)

The second approach is based on the behavioral perspective and explains how consumers are likely to respond to pioneering brands and later entrant brands. For example, it is easier for a first mover to convince and acquire customers, especially early adopters of a new product or brand. For the later entrants, the customers left are often less predisposed and more difficult to convince, as the first mover has already skimmed the early adopters. As consumption is a learning experience, consumers’ learning about brands and developing preferences is important for achieving a first-mover advantage. Comparing the follow-on brands with the pioneer brand may lead to a disadvantage, if the early entrant is regarded as ideal by the customers. In addition the first mover has the ability to influence on the customer’s valuation of a product to its benefit. However the behavioral view ignores that later entrants might have the resources and capabilities to attract customers – those of the first mover and those newly entering the market – by offering a product of superior value and also by being able to better position their brands because of the experience they gained about con-

sumer preferences as a result of the first mover's incorrect positioning. (Kerin, Peterson, & Varadarajan, 1992, pp. 33-35)

The extent of the pioneering advantages usually depends on a firm's capabilities, the competitors and changes in the environment (Lieberman & Montgomery, 1998, p. 21). Suarez and Lanzolla identified two environmental factors which are normally beyond the control of any single company but that eminently influence the success of first movers', namely the pace of the technology development of the product in question and the pace at which the respective market for that product is expanding. Further on they distinguish between short-lived first-mover advantages and durable ones which positively affect the firm's market share or profitability over a longer period. (Suarez & Lanzolla, 2005, p. 122)

The question now is if being first in the market with mobile TV services will offer mobile network operators or TV broadcasters any significant competitive advantages. In chapter 2 the two different concepts, *TV on the Mobile* and *TV for the Mobile*, were introduced. In the short to medium term mobile operators are probably offering a mix of both mobile TV concepts (such as Vodafone's current mobile TV offering) over their cellular networks, employing MBMS when available. For the deployment and operation of broadcast networks various value chain players including TV broadcasters and network operators seem possible (see section 5.1.6.). In the beginning especially TV broadcasters might find it attractive to just rebroadcast their existing programs, since producing *TV for the mobile* formats require additional investments. For the first mover analysis, rather than differentiating between the two different concepts, it is more advisable to distinguish between the delivery technologies, i.e. if mobile TV is offered over a cellular or broadcasting network.

Barriers to entry are barely existent for the mobile TV over cellular networks service. The focus of the analysis of first-mover-advantages in this cellular-network-based value chain is on operators since TV broadcasters do not have any control over the delivery network and it is more difficult for them to establish their own mobile TV services on their portals in this environment (see chapter 5). They will more likely position themselves as content aggregators and participate as supplier of programs and content. Every operator can offer these services over its mobile network, so it is not possible to preempt late movers to any scarce assets, perhaps apart from any exclusive content which an operator has contracted to. The information economy to which mobile operators and TV broadcasters belong to is driven by economies of networks compared to the supply-side economies of scale that drove the old industrial economy (Shapiro & Varian, 1999, pp. 173, 179). Thus economies of scale do not apply for mobile TV. Also the underlying technology is mature and standardized and future advancements will likely be standardized too, therefore technology leadership is hardly possible. However, companies, which first deploy a new technology, will have cost advantages or the ability to offer TV services with better quality. Operators which will first deploy enhancements such as HSDPA to their UMTS networks can offer mobile TV services at lower costs and, if wanted, also with better picture quality than competitors. Similar to differing speech quality in cur-

rent GSM networks, the overall quality of the TV experience could differ depending on the provider and the quality of its network. Time advantages will prevail as time allows better implementation of new technology and ironing out technical problems in the network infrastructure.

Positive network externalities enhance the value of a product and entail positive feedback, for example buying a fax machine allows communicating with others, thereby enhancing its value with every new user (Shapiro & Varian, 1999, pp. 183, 184). A large *network* of mobile TV users brings no advantages for the mobile TV consumer. Accordingly, positive network externalities do not exist for mobile TV. *Switching costs*, which arise when consumers switch to a new product or technology that is incompatible with the one they used before (Shapiro & Varian, 1999, p. 11), will not exist for mobile TV services since networks, video coding and TV transmission in the cellular environment are based on technology standards. Thus changing the provider will allow customers to use their current handset for receiving mobile TV – they do neither need to spend money for buying a new mobile phone nor are they forced to learn new operating functionalities. Although working on the provision of mobile TV services will gain mobile operators and TV broadcasters valuable experience effects (Betti, 2004a, p. 7), which can represent a barrier-to-entry.

Many of the above analysis of entry barriers can also be applied in a similar way to delivering mobile TV over broadcast networks. There is one major difference that can present a barrier to entry: The resource allocation of the frequency spectrum. The frequency spectrum for a broadcast network such as DVB-H is limited (see section 4.1) and if a single operator or TV broadcaster acquires the necessary license to operate such a network nationwide, it can preempt other companies from using that scarce resource. Even if there are frequencies still available for other transmission technologies (e.g. DMB), it is more than questionable, if many different broadcast networks will coexist, taking into account the high investment costs and the needed handset support from vendors. It is unlikely that multiple receivers for different broadcast technologies will be integrated into the same mobile phone. One broadcast technology will probably establish as a standard – currently DVB-H is the favored technology in Europe.

If different broadcast networks should coexist, each requiring a specially equipped handset for reception, customers that want to make use of another mobile TV service (using another network) could face switching costs (for the necessary new handset).

7.6. Mobile TV – a Disruptive Technology?

Clayton M. Christensen first wrote about ‘disruptive technology’ in 1993 and defined it as a technology-driven innovation introducing a new kind of product or service which initially performs worse regarding the needs and values of mainstream customers and that creates entirely new markets and business models (Christensen, Johnson, & Rigby, 2002, pp. 22, 23, Christensen & Knight, 2001, p. 10). A disruptive innovation is often driven by small, emerging companies and

contrasts a sustaining innovation which brings forth products or services that satisfy the demand of existing customers in established markets by gradually improving product design or features through moving upwards the s-shaped technology curve (Christensen & Knight, 2001, pp. 10-11). These sustaining innovations are favored by the incumbents and help them earn higher margins by selling improved products to their most valuable customers (Christensen, Johnson, & Rigby, 2002, p. 23). Disruptive innovations do not address the requirements that most-demanding consumers have for the next generation of an existing product (Christensen & Overdorf, 2000, p. 72). Failing in this respect and offering only low margins, incumbents are not interested in those kinds of innovations. They appeal to customer segments that are not attractive for incumbents and entrants have a walkover here to acquire customers. (Christensen, Johnson, & Rigby 2002, p. 24 & Christensen & Knight 2001, p. 11)

A good example of a disruptive technology is the introduction of voice-over-IP-telephony also known as Internet-telephony. Phone calls conducted over the Internet using special telephones offer high quality and are indistinguishable from ordinary circuit-switched phone calls. The business model of charging for time on long-distance calls will be obsolete and new flat fee pricing models will emerge. (Christensen & Knight 2001, p. 13)

Examining the disruptiveness of mobile TV we have to differentiate between the service itself, which generates the customer experience, and the technology behind it, which is used for the delivery of the service and that differs depending on the network used for distribution.

Does mobile TV represent a disruptive innovation as a new service? Mobile TV does not open up completely new markets and it does not necessarily require new business models neither for mobile phone companies nor broadcasters. For mobile network operators it would be a new service offering in their portfolio for their existing customers. Broadcasters would have the ability to extend the reach of their program through a new distribution channel but would target mostly existing customers. It is targeted at the existing mass market and intended to fulfill customer's needs. Both players are incumbent companies in their particular market (TV versus mobile telecommunications market) although they also enter the market of the respective other player when offering mobile TV and become 'new entrants' in this market. The extent to which one player will enter the market of the other one is dependent on various factors such as the configuration of the value chain, the technology used and on whether both parties cooperate and jointly offer the service or not. The only disruptive element which mobile TV entails when distributed over existing cellular networks is the massive traffic load that it generates making volume-based pricing commonly used for data services unattractive and obsolete. This erodes the current business model applied to data services and will lead to event-based or flat fee pricing models which can lead to heavy usage of mobile TV services resulting in a capacity overload of the cellular network.

Considering the above mentioned relevant criteria one must conclude that mobile TV as a new service is not a disruptive but a sustaining innovation.

Now we examine the question whether the technology of delivering the mobile TV experience is disruptive. As described in section 4.1 there are mainly two ways of delivering mobile TV: over a cellular or over a broadcasting network. Cellular networks do not represent an innovation – their technology has existed for many years. UMTS is a relatively new technology but it builds on the existing network structure and the same services including telephony are possible over UMTS networks. So it represents a sustaining technology.

IP datacasting technology such as DVB-H that underlies broadcasting networks appears different. These networks are optimized for one-to-many (see section 4.1) distribution and represent a completely new way of distributing content compared to the cellular radio environment (Betti, 2004a, p. 7). This can negatively affect mobile operators' business opportunities in many ways. Mobile operators had formerly identified broadcast-quality video services as a key application for their new UMTS-networks. Including a television tuner in a mobile phone and thereby enabling users to receive broadcasted TV would supersede the high bandwidth cellular network for receiving such content and thus eliminate one of the most persuasive reasons for upgrading to 3G technology (visiongain, 2004, pp. 168-169). Furthermore, who would want to download videoclips from the operator's mobile portal and get charged for them on a per unit basis, if broadcasted TV-content was available for a monthly flat fee or even for free[34] with the possibility to not only watch a small goal scene but the whole match? The key question is how mobile TV will be positioned next to other mobile services most notably mobile video. Visiongain admits that mobile TV will eat away consumers' expenditures on video-content but they believe it is also possible that mobile TV could help stimulate video usage. (visiongain, 2004, pp. 168, 171)[35]

The scenario gets even worse for operators if a broadcasting technology that lacks a return channel such as DVB-T is used for transmission and appropriate receivers are integrated into mobile phones. Then operators can not control the mobile TV consumption of their subscribers and are unable to participate in this business thus not earning any revenues from it. If broadcasters or any other third party owned and operated the broadcasting network, mobile operators would only benefit from return-channel traffic generated by interactive programs (Betti, 2004a, pp. 7,8,12 & visiongain, 2004, p. 142).

It becomes evident that the concept of disruptive technology is a theory of relativity that does not affect all involved players and all instances in the same way (Christensen & Knight, 2001, p. 11). The IP datacasting (DVB-H) technology has the potential to become disruptive for mobile operators. But at the same time it is a sustaining technology for TV broadcasters that helps them broaden the reach of their program.

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[34] e.g. when it is purely financed through advertisements like the German 'Free-TV'

[35] Users that have watched a match live via broadcast might want to download clips of it for future usage or for sending them to friends (visiongain, 2004, p. 171).

In conclusion, we believe, that in the terms of Christensen's definition mobile TV as a service is not a disruptive innovation but when a broadcasting technology is used for service delivery it can be disruptive for mobile operators.

8. Conclusion and Outlook

High penetration rates of mobile phone and TV usage and high average TV consumption alongside with the mobility of the society and established user behaviors make a converging of the TV and mobile worlds not only feasible but reasonable. Evidence from other countries such as South Korea already shows strong usage of mobile TV services.

Market potential for mobile TV is large – experts estimate that broadcast mobile TV will generate worldwide revenues of up to € 5.1 billion in 2009. They are much more conservative with their forecast of € 553 million generated by cellular mobile TV services. However, appliance of MBMS-technology in the cellular networks and further enhancements in the future are very likely to increase this business potential. For Germany this means overall revenues from mobile TV of about € 165 million in 2009. Next to those 'premium revenues' generated by user fees, a further revenue potential exists in the form of advertising revenues from the mobile channel.

Regulatory obstacles are relatively minor and only relevant for mobile TV over broadcast networks (above all: spectrum allocation). Technological obstacles are not very significant regarding the actual cellular mobile TV services, as most modern handsets support the necessary features for mobile TV reception. Only for broadcast mobile TV, the availability and costs of special mobile phones is crucial and may hinder service uptake. Display capabilities (needed for a high quality TV experience) are continually evolving and battery issues will be ironed out in the near future.

End-user expectations are especially important for the acceptance of mobile services and it is advisable to evaluate user acceptance prior to the introduction of mobile TV services. In the past many new mobile services (e.g. MMS, WAP and video telephony) initially did not show the desired success, as operators believed a new technology alone would give enough added value to consumers.

Consumer interest is high – many user surveys and trials across Europe already proved the concept of mobile TV. Most participants embraced the idea and were also willing to pay € 5 to € 20 monthly for mobile TV. As most critical acceptance criteria for mobile TV can be regarded: the quality and scope of available TV content, the picture quality, the interface design and the right pricing. To support service uptake, a mixture of subscription fees and pay per view pricing, giving users a choice of various payment options, should be applied.

Mobile TV offers many opportunities for mobile operators as well as TV broadcasters. German operators have heavily invested in UMTS licenses and network infrastructure and thus they are searching for broadband and multimedia services which help them recoup their investments and increase the ARPU. Mobile TV can also help them to reduce churning of subscribers. For broadcasters mobile TV has a positive effect on advertising prices, it offers the ability to generate additional revenues and it can contribute to broaden the service portfolio by offering new forms of advertising. However, the operator might also

want to profit from mobile advertising revenues. The appropriate business models that benefit both players still need to be developed.

Just broadcasting traditional TV-programs will probably not show the desired success due to the special requirements and limitations of the mobile channel. 'TV *for* the mobile' with services designed specifically for mobile reception is needed to deliver added value in the long term.

It has been elucidated that the unicast delivery of mobile TV over existing cellular networks which is currently employed by most operators is not suited for intensive mass-market service usage and not economical - at least not without compromising on quality which would again negatively affect user acceptance. The feasible alternatives for establishing mass-market mobile TV are the establishment of broadcast networks (e.g. DVB-H) or the introduction of MBMS-technology in cellular networks.

As first-mover advantages are relatively minor, companies should not make huge investments, e.g. for building up broadcast networks, right now, but leverage the available networks and options for mobile TV delivery.

MBMS is likely to emerge as operators' preferred choice for delivering broadcast services over the next years, since the necessary investments are relatively low. Furthermore by using MBMS operators will be well-positioned to lead the way towards the mass market for mobile TV, since they use their own GSM and 3G networks and stay in full control of the end user relationship. Future developments of network technologies, video codecs and handsets will allow an even superior mobile TV experience.

Right now, as services are just being introduced to the German market, operators can use their cellular networks for mobile TV delivery to gain first experiences and to estimate usage behavior and uptake. Vodafone already uses this approach, offering a broad portfolio of mobile TV channels in its UMTS packages, which can be used free of charge until the end of this year.

Mobile TV which allows to watch TV *anywhere and anytime* has the potential to gain popularity in the next years similar to the success of the Sony Walkman personal stereos in the 1980s, which were promoted alike by the concept of 'enjoying music anywhere and anytime'.

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