Mobile TV: Opportunities and Challenges

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One of the most talked about new services today is mobile TV. Mobile TV marries two of the most successful services available on the planet today, mobile communications and TV viewing, which many consider a recipe for certain success. We will describe the background of these services, and also explain why ISVs will be playing a central part in the future of mobile TV offerings.

Ultra Mobile PCs (UMPC), Mobile Internet Devices (MID) and laptops are perfect devices for media consumption on the go, in which mobile TV is one important part. The large screen and strong processing power provide excellent picture quality to the end user even when the bit rate is low. These devices will also influence how the end user consumes on-the-go media services, opening up new business opportunities for both service providers and ISVs.

1 Purpose and Scope

This paper gives an overview of the digital TV market from a service provider and ISV perspective. We will look the different technologies and players, as well as the business models. We will also discuss the use of UMPCs, MIDs and laptops as client devices for mobile TV.

For a more technical paper about Broadcast Mobile TV, please see “Mobile DTV guidelines”

2 Introduction

Mobile TV is creating inroads to our life several different ways, making it one of the most talked about new services today. Marrying two of the most successful services available on the planet today, mobile communications and TV viewing, many consider mobile TV a recipe for certain success. Trials conducted, as well as early service introductions, show that the surrounding hype seems to be living up to its expectations.

We will focus on broadcast TV, mainly DVB-H, and to a lesser extent unicast TV, and we’ll also talk about alternatives. The main reason for this is that broadcast TV has to form the backbone for a true mass-market mobile TV service, due to simple capacity reasons. Broadcast TV alone is, however, not enough as personalized content plays an increasingly important role in TV today.
In this paper we use the word mobile TV for any video content being played back on a mobile device.

3 Alternative Service Models for Mobile TV

There are many ways of getting video content to your mobile terminal. Today early adopters are using different alternatives, some even starting to come into mainstream usage. Much of the focus in this document will be on broadcast mobile TV as mentioned above, but because this is only one way to fulfill the end-user need for mobile content, some major alternatives are also included. All these alternatives will coexist, and hopefully be used in parallel by service providers creating a broader mobile TV service offering.

- **Broadcast mobile TV.** Broadcasting the mobile TV is the only way to handle large volumes of subscribers. If mobile TV is going to reach the mass market, broadcasting most likely has to form the base of the offering. There are several standards, and DVB-H currently has the largest support from the industry and is predicted to be the dominant technology in many areas.

- **Synch and go.** Taking your own content with you on a client that has been synched at home is the model MP3 players use today. This has recently been expanded to include portable video players as well, by using a standard file copy or with an application delivered with your client device. Today this can be done according to a standard, DLNA, which may simplify this usage model.

  One of the challenges of this model is to overcome the DRM issues. The original content may come from bought material or recorded TV. If this content is protected by DRM, there has to be a way to convert it to a format handled by the mobile player.

  The simple route here is to “sync and go” free-to-air TV which is not protected. The mobile terminal could initiate the recording of the TV shows, which would be synched later.

  IMS could be used in the long term to enhance this usage model by for example allowing remote sync-and-go functionality.

- **Place shifting (stream from home).** Slingbox*, Sony Location free TV*, Pinnacle PCTV To Go* and other similar products/software/services have made it possible to stream live TV or local content from home to anywhere in the world, including to mobile users. However the bandwidth requirements for mobile TV require “all-you-can-eat” services, which are becoming more common for WiFi and 3G networks. Streaming from home often turns the service provider into a pure bit pipe, something they want to avoid. Some service providers have, however, embraced this concept,
providing the home box as part of the subscription and including traffic from the box with the subscription. The discussion about DRM and format conversion is as valid in this case as in the sync-and-go model.

- **Stream content over 3G or WiMAX.** Many service providers distribute TV over existing networks. This works well at the start of the service, but it will not scale to a mass market. Technology developments, such as MBMS in the case of 3G, will improve the performance of these networks, but probably not to the extent that it will render broadcast networks unnecessary. Today’s services are often of poor quality, but have in many cases managed to bring ARPU up for existing users, as well as attract new, high ARPU users. Streaming unicast will be an important complement to broadcast networks because some users do not see mainstream TV as the most important TV media, as the recent success of YouTube has shown. Some argue that broadcast TV will not be a successful mobile service, because users want short clips that they have chosen themselves for mobile consumption. The most probable scenario is that a streaming point-to-point service will complement broadcast TV in a very effective way.

- **P2P TV sharing** A recently talked about development is P2P TV sharing services. This has not taken off in fixed networks, and its usage in mobile networks is still highly uncertain. A technical solution like this may be a perfect way to market to small, independent content providers as well as to advertisement-sponsored channels. With “all-you-can-eat” data services, this could take the market by storm. One of the first movers in this area is Joost.

All of these quite fundamentally different technical approaches fulfill the same user need: watching mobile video content. Anyone who manages to combine two or more of the above alternatives in a user-friendly manner will probably be in a good position for success.
4 UMPCs, MIDs and Laptops as Mobile TV Clients

From a client device perspective UMPCs, MIDs and laptops, with their open architecture, fit all of the distribution-models above. WiFi has already been built into all laptop with Intel® Centrino® processor technology, enabling many of the mobile TV models mentioned above. The first UMPCs and laptops with built-in DTV tuners and/or 3G connectivity are already available in the marketplace. For DTV tuners these devices currently support only DVB-T, but expect to have integrated DVB-H as well in the near future. DVB-T is the technology used to distribute digital TV to standard TVs in many countries, whereas DVB-H is an improved version of DVB-T focusing on handheld functionality. See section 0.

The open component architecture approach of the Intel® Mobile PC platform makes it easy to add DTV features to already existing devices as well. The aftermarket for DVB-T tuners has exploded during the last years, and there are many types of devices available.

3G connectivity is also available as an after-market option.

Because the UMPC screen, not to mention the laptop screen, is much larger than a traditional mobile TV screen, it gives a very good mobile TV experience.

With the powerful processor available in these classes of devices, picture enhancement technologies can be implemented that improve the picture quality. This is quite important as a normal mobile TV signal is intended for smaller screens. If the signal has a high enough quality, say 250 kbps H264 or more, the picture scales well up to at least 7-inch screens.

The large storage space also fits the mobile TV viewing experience well, providing an opportunity for functionality, such as time shifting, that is normally not available on phone devices. We will talk more about this later.
The possibility to install new programs and new codecs allows the device to support new services in a very flexible way. Among these are YouTube and Joost. Also new interactivity functions in a DVB-H service could easily be introduced.

## 5 Broadcast TV

If mobile TV is the mass market success it is predicted to become, broadcast TV probably needs to form the base, due to capacity reasons, for any decent offering. It is not technically possible for everybody in a WAN radio-cell, no matter if its 3G, HSDPA or WiMAX, to watch different content with decent quality. Also some of the big drivers for mobile TV are large sporting events like the World Cup or the Olympics. This kind of content fits a broadcast model perfectly, and the events are often used to announce DVB-H trials and service introductions. The 2006 World Cup in Germany is a perfect example because many such trials and services were announced during this time.

There are a number of standards today in mobile broadcast TV. DVB-H, T-DMB, DAB-IP and MediaFLO* are the most talked about. In addition, a number of smaller standards exist.

In EMEA, as well as in many other parts of the world, DVB-H is predicted to be the market leader. Below we will talk about DVB-H, but much of the information is applicable to the other broadcast standards as well.
5.1 DVB-H

DVB-H is a modified and improved version of the much used DVB-T standard. DVB-T is designed for digital TV broadcasts on standard or HD TV sets. DVB-H is improved for mobility reception. The two major changes are for battery life and extended (indoor) coverage.

- The DVB-H content is sent out in bursts with, for example, six seconds of video being sent to the terminal in much less than one second. After receiving this content, the receiver can power down until shortly before the next burst, allowing for an extended battery life.
- The protocol contains more error correction features, thus allowing a much weaker signal to be correctly received. This allows for indoor coverage if the broadcast network is correctly dimensioned.

DVB-H is an IP-based broadcast standard. Thus in the base standard no codecs or other services are defined. This opens up the market for a lot of exciting new services, but has also created some degree of fragmentation.

DVB-H can work over many different frequencies, such as UHF, L-band and S-band. UHF will be used in most cases; it allows for good coverage with not too many base stations and repeaters.

In 2006, Finland and Italy went live with DVB-H-based services. Many more are expected to go live during the second half of 2007 with the big push for services coinciding with the 2008 Olympics.

5.1.1 Codecs

In Europe H.264 (also known as MPEG-4 part 10 or AVC) is almost exclusively used for encoding the video. This codec offers two to three times the improvement over MPEG-2, which is used in most DVB-T services. H264 is being used in many other applications today, such as Blue-ray, HD-DVD and iTunes* Video among others. In the United States, Microsoft’s Windows Media* codec’s are used instead. Early trials of DVB-H have also used MPEG-2 as codec.

5.1.2 CA and DRM

There are two major technologies to protect the service and content: CA and DRM.

CA protects the access to the service, but does not protect the content. Once on the device, DRM protects the content from being copied to other devices.

Initially the focus in DVB-H is on CA. Here there are two major camps: DVB-CBMS that comes from a traditional TV ecosystem background and OMA-bcast (broadcast), which is based on telecom standards from OMA. Both camps support both hardware and software methods, but there seems to be strong demand from service providers and content providers to use a hardware solution, while OEMs often strive for software-based solutions.
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<tr>
<th></th>
<th>DVB-CBMS</th>
<th>OMA Bcast</th>
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<tr>
<td><strong>Software based</strong></td>
<td>18crypt</td>
<td>OMA Bcast DRM</td>
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<tr>
<td><strong>SIM based</strong></td>
<td>Open Framework</td>
<td>OMA Bcast Smartcard</td>
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Two schemes from the different camps can in some cases be used in parallel if the service provider uses Simulcrypt.

DRM may be implemented later, but is not used initially. Many also believe CA and DRM will merge in the future so that only one protection mechanism is needed.

### 5.1.3 ESG

ESG is an important part of digital television and end users are getting used to having program information available on the TV. In its simplest form ESG provides information about which programs are currently playing as well as information of upcoming programs.

There are however a lot of additional features possible within the realm of ESG, the most important being payment of subscriptions and pay per view. Much of this more advanced functionality requires the user to have a backchannel to the server to allow for interaction.

Similar to the CA/DRM there are two major camps here. The DVB version is quite simple, while the OMA bcast based one is more complex, including much more functionality.

### 5.1.4 Interactivity

Interactivity is not being standardized currently, except the “simple” interactivity functionality provided in the ESG. A lot of potential exists for ISVs and service providers to work together to create new services. We have already seen examples of the audience participating in TV shows via their mobile phones. This may be simple voting, but they also may be participating in quiz shows, live gambling, multi-player gaming and much more. This functionally today is not within the bandwidth of TV, both communication and application wise.

Mobile TV would allow this to be taken to another level integrating the interactivity experience with the viewing even more.
5.1.5 VAS

In addition to the obvious broadcast TV service, a service provider can use DVB-H to distribute other services. This is possible because DVB-H is IP-based and any IP-based broadcast application can utilize the network.

Here are some examples that we have seen already, either in trials or just as ideas:

- Pushing podcasts to the client
- New software / software updates
- Broadcasting a detailed local map in every cell
- Massively Multiplayer Mobile games, maybe with video content
- Advertisements

Among the new services, distribution of podcasts is the most obvious. Podcasts are popular today and are expected to be even more so in the future. Distributing podcasts over a broadcast network should be very efficient. This way YouTube-like services could get an efficient mobile distribution method.

We will probably see a lot of creative use of the possibilities that large bandwidth to many users gives. ISVs will play an important role in coming up with ideas and implementing these ideas on both the client and server sides.

6 Players in the Mobile TV Market

6.1 Networks providers

In EMEA there is often only one large, often government owned, network provider for broadcast services in each country. These providers are in many cases expected to get the license rights for DVB-H.

In some cases the service provider also builds his own network. This is in many cases a waste of both spectrum and money because the same channel will be broadcasted by different service providers.

6.2 Service providers

Service providers are the entity that the customer interacts with and gets the bill from.

Traditional TV service providers have no prior experience in mobile services, so it’s the traditional mobile service providers that show interest in this area today.

In some cases the government decides which channels to broadcast, thus allowing very little differentiation between different providers in the same area. A service provider can differentiate two ways:
• Package the broadcast TV service with other mobility products, such as voice subscriptions.

• Package the broadcast TV service with other mobile TV services, as mentioned in section 0 or offer more advanced software features, as described in section 0.

Early service introductions have shown that the early adopters of mobile TV also use many other mobile services and generate a high ARPU. Thus, the first model fits well during the first phases of introducing mobile TV when only one or two service providers are active.

However as mobile TV becomes a mass market, more advanced and creative offerings will probably be necessary and the second model will become increasingly important, with the focus on ISVs and content providers to provide the differentiation to the service providers.

6.3 Content Providers

The content providers are companies that supply the content for the different services. This area has traditionally had only a few major players, but this is changing as more service provider start their own channels and generate user content on the Internet.

There is also room for new creative players, as mobile consumption of video and television evolves away from how TV is watched today. Shorter programs, made especially for mobile consumption, may prove very popular, regardless of whether they are available over DVB-H, on YouTube-type services or via video podcasts.

As an example CBS has formed a special division, CBS Mobile, to produce and format content for mobile TV. One new type of content is mobisodes, which are becoming available for some popular TV series. These are often initiated in new business relationships that are not typical in the world of television. For example Warner Brothers Television and the CW Network announced a partnership with Sprint to launch a new, short form animated mobile series spun off from the CW’s primetime hit Smallville.

6.4 OEMs

OEMs build the mobile TV devices. For free-to-air services and web-based free services they are often bundling their hardware with software solutions, which allow the customer to enjoy mobile TV out of the box.
6.5 Business models

There are many potential business models for mobile TV. The complexity of the service with so many actors allows for an almost infinite number of possible models.

Just outlining a number of possible scenarios:

- Content providers (Canal+, Sky...) bundling mobility devices with content subscriptions. This is similar to what TV providers do today with Set-Top-Boxes for satellite services.

- Mobile service providers (Vodafone, T-Mobile...) using mobile TV to differentiate their current mobile service offering. Mobile TV will in this case often be bundled with voice call, data services and other services.

- ISVs doing deals with content providers. The ISVs distribute the content owned by content providers, such as Joost or YouTube. (In the latter case, however, the end user provides the content.)

- Network providers and traditional TV service providers today only distribute television via satellite or terrestrial network. Some have indicated that they are interested in establish themselves in the mobile arena and see mobile TV as a good opportunity for doing this.

One important question is whether non-connected devices should be allowed. A non-connected device does not have a backchannel to the network, raising additional design considerations that must focus on how to achieve interactivity and processes for distributing subscription information to the device. This will affect the CA and DRM scheme used.
7 Independent Software Vendors

As mentioned earlier ISVs will play an important role in enabling a full mobile TV experience. There are a range of opportunities for the ISVs, both from a technical perspective and from a business model perspective. Standards, business models, type of content and implementations are moving targets in a digital TV market that is still developing. If we look at the matrix created between potential technical solutions and business models, there is room for many initiatives and solutions.

From the business model perspective, here are some possibilities:

- Selling directly to the end consumer
- Being bundled with add-on-hardware, such as a USB TV dongle
- Being preinstalled on UMPCs and laptops
- Being bundled with a service provider’s offering
- Bundling with a content provider and offering a service directly to the end user

From a technical perspective there is a lot of differentiation potential among mobile TV ISVs. Below are some possible ways ISVs can differentiate. Of course more will come from creative ISVs.

7.1 Implementation alternatives

The DVB-H market is very fragmented and partnerships are vital to develop fully functional software stacks that work in many service provider networks. As mentioned in section 5, a single ISV can probably not solve all DRM, EPG and other baseline functionality.

Also, DRM, ESG and interactivity are not defined in standards and have several alternatives. Service providers are free to make choices.

Interactivity is one area that needs more exploration and is open for creative solutions where the operator can differentiate their service. In many European countries differentiation is very important because there will be only one network provider for broadcast services, broadcasting the same channels on behalf of all service providers.

7.2 Picture enhancements / codecs
As bandwidth is one of the scarcest resources in a mobile environment, the quality of the codec will be key. H.264/AVC seems to be poised to become the de facto standard in mobile TV in the coming years. Because most devices intended for mobile TV have small screens, and because quantity is often preferred over quality, most mobile TV streams will be of low bandwidth. The 3GPP standards define up to 384 kbps video streams, so higher quality content for DVB-H will probably not exist in the semi-near future. These streams are often optimized for smaller screens and the frame rate might be lower than in normal cases, opening up possibilities for video enhancement features on the UMPC, which has a larger screen and more processing power to play with. Video enhancement features can really change the user experience on the client side. For unicast streams, however, higher quality video is possible. Video enhancement features is however as applicable in this case.

### 7.3 PIP

For DVB-H, the TV signal is sent in bursts to allow the radio receiver to turn itself off. Alternatively, the receiver can of course listen to another channel transmitting on the same frequency, allowing two or more channels to be received at the same time. With the UMPC’s larger screen, two pictures can easily be displayed, providing PiP functionality. Or, in the extreme case, the large screen of a UMPC would allow a sports enthusiast to follow two events simultaneously, still having better picture quality than your standard mobile TV receiver. Similar solutions can integrate different types of mobile TV services allowing the end user to watch a podcast while at the same time keeping an eye at the live broadcast of a football game.

### 7.4 PVR

Another differentiator is that a UMPC has much more storage space than other mobile TV devices and can act as a PVR. Both program recording and time shifting is of course possible with a PVR.

Another use could be to add the possibility of receiving two channels simultaneously, recording one and viewing one, or even recording several channels at once.
7.5 Convergence device

As we mentioned earlier there are several ways of getting video content to your terminal, such as broadcasting, 3G streaming, synch and go, and place shifting. To the end user these are only slightly different ways of getting video content to their device, and a service provider daring to offer two or more of these services in one software suite will stand on a very good base with a differentiating offer towards competition. Many of may seem cannibalizing from the service provider’s point of view, so it will be interesting to see if any service providers are willing to take this step.

7.6 Other areas

We mentioned earlier that interactivity is an area where there are big possibilities for ISVs to exploit new ideas. Another area that may influence digital TV is IMS. IMS plays a central role as a service-enabling technology and mobile TV can very well be one of these services. In its simplest form IMS allows for a standardized form of interactivity, very similar to MSN messenger, Skype* and similar applications. More uses are possible, however. Potential use cases may include:

- Order a pay-per-view football game and join a voice chat group around the game.
- See a trailer for the latest movie and order a ticket to the local cinema.
• Get a message of a new YouTube video and have a voice chat with the friend that sent the link while watching the clip.

• Accept a remote movie rental request from your child sitting at home, after viewing a trailer.

Another scenario is use in the car. A special mobile TV application for automotive use could have quite a few special functions, especially if the UMPC is connected to the car’s internal network. The user might control the volume in the loudspeakers of the car, use the wheel controls to control the UMPCs and stream the picture to built-in rear seat screens. Additional possibilities include voice control and integrated navigation features.

8 Summary

Mobile TV will arrive and change the way we watch TV today. The only question is in which form. The safest bet is that a broadcast technology will form the base, being complemented with other solution(s) to personalize the content.

The UMPC, MID and laptop are good client devices for mobile TV, offering both service providers and end users with the best possible flexibility and user experience.

ISVs have a multitude of opportunities in this area, both from a technology perspective, providing new software solutions, and from a business model perspective, as the market continues to evolve.

9 Additional Resources

ISVs that are considering how best to integrate the needs of the UMPC platform into their offerings will benefit from the following resources:

Intel® Software Network Mobile Developer Community is a hub for developer information related to all things mobile, including technical documentation, software development tools, technical discussion forums, knowledge bases, and blogs, For more information, please visit: http://www.intel.com/software/mobile.

For software development on the ultra mobile platform, Intel Software Network offers technical resources at:

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Appendix: Acronyms and Abbreviations

3G  Third generation Mobile Network (allows mobile wideband access)
ARPU  Advanced Revenue Per User
AVC  Advanced Video Coding. Also known as H264
CA  Conditional Access: Protects access to content, but not to the content itself.
DLNA  Digital Living Network Alliance
DRM  Digital Rights Management. Protects the content.
DTV  Digital TV
DVB  Digital Video Broadcast.
DVB-T  DVB-Terrestrial
DVB-H  DVB-Handheld
DVB-S  DVB-Satellite
EMEA  Europe and Middle East
ESG  Electronic Service Guide
H264  Highly-efficient decoder for video content
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>HD</td>
<td>High Definition</td>
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<tr>
<td>HSDPA</td>
<td>High Speed Data Packet Access (improved 3G, allowing broadband access)</td>
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<tr>
<td>IMS IP</td>
<td>Multimedia Subsystem</td>
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<tr>
<td>ISV</td>
<td>Independent Software Vendors</td>
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<tr>
<td>MBMS</td>
<td>Multimedia Broadcast Multimedia Service Broadcast implemented over 3G</td>
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<td>MID</td>
<td>Mobile Internet Device, in essence a less powerful Linux-based UMPC intended for the consumer segment</td>
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<tr>
<td>MPEG</td>
<td>Moving Pictures Expert Group</td>
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<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
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<tr>
<td>OMA</td>
<td>Open Mobile Alliance</td>
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<tr>
<td>P2P</td>
<td>Peer to peer (server-less communication)</td>
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<tr>
<td>PiP</td>
<td>Picture in Picture</td>
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<tr>
<td>PVR</td>
<td>Personal Video Recorder</td>
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<tr>
<td>VAS</td>
<td>Value Added Services</td>
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<tr>
<td>WAN</td>
<td>Wide Area Network</td>
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<td>UMPC</td>
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