



**Lemay-Yates
Associates
Inc.**

Mobile TV Technology Discussion

FINAL REPORT

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Executive Summary

This Report was developed by LEMAY-YATES ASSOCIATES INC. (LYA) on behalf of the Canadian Wireless Telecommunications Association (CWTA) to provide a technical description of how mobile TV services are being implemented in Canada. The objective of the Report is to address the question of use of the public Internet to access and deliver mobile TV signals in the context of CRTC Broadcasting Public Notice 2005- 82.

This Report was developed based on research conducted by LYA and with interviews with three mobile carriers (Bell Mobility, Rogers Wireless, and TELUS Mobility) and Idetic/MobiTV Inc., the solutions supplier to the three Canadian carriers.

The Report concludes that the mobile TV content provided by MobiTV to the customers of the three major Canadian mobile carriers is both accessed and delivered over the public Internet.

The digital video signals are compressed and formatted to fit the small screens of mobile handsets by MobiTV. The user requests and accesses the MobiTV servers over the public Internet to obtain access to the mobile TV content. The digitally encoded video frames are then sent in IP packets over the public Internet directly to the user's handset, using the mobile's carrier network for the "last leg". The mobile subscriber communicates directly with the MobiTV servers over the public Internet as is done in typical Internet client server applications. No additional hardware or software is required on the networks of the mobile carriers to offer the service. The mobile TV access and delivery processes are essentially the same as the video streaming technology that has been in use for many years over wireline Internet connections. Essentially, the role of the mobile carrier's



network in delivering mobile TV services is similar to the role played by an Internet Service Provider (ISP) network in a typical Internet application such as video streaming.

1. Introduction, objectives and approach

Mobile TV service was launched over the last few weeks by Bell Mobility, Rogers Wireless, and TELUS Mobility. All three carriers use the technology platform of MobiTV Inc., an independent service provider, which has developed the technology to enable mobile carriers to offer live streaming video channels, referred to as mobile TV.

LEMAY-YATES ASSOCIATES Inc. (LYA) has been commissioned by the Canadian Wireless Telecommunications Association (CWTA) to develop a report describing the technology used to offer mobile TV services in Canada. This Report is to be submitted to the Canadian Radio-Television and Telecommunications Commission (CRTC) in response to Broadcasting Public Notice 2005-82. The key question of interest in this Report regards the use of the public Internet to access and deliver mobile TV services to determine if these services fall under the New Media Exemption Order, CRTC Public Notice 1999-197, December 17, 1999.

LYA conducted its own research, reviewed the information already submitted to CRTC and conducted interviews with all three mobile carriers and Idetic/MobiTV Inc. to finalize this Report. Additional information on LYA and on our expertise in mobile broadcasting applications is presented at the end of this Report.



This Report is organised as follows:

- Section 2 sets the stage and provides an overview of how mobile multimedia applications have been evolving over the last few years starting with simple text messaging to image and video messaging, pictures, ringtones and video clips and finally to mobile TV. This illustrates how mobile Internet access has been a key enabler for many mobile multimedia applications with the latest implementation being mobile TV.
- Section 3 provides a description of the implementation of mobile TV and discusses the key technology aspects of the service. It also highlights how mobile TV services are being promoted to end users in Canada.
- Section 4 draws conclusions as to the access and delivery of the mobile TV services via the Internet and other interesting characteristics associated with these services.



2. Setting the stage: Mobile Multimedia Overview

Current penetration of mobile subscribers in Canada currently exceeds 15 million subscribers out of a population close to 32 million. Mobile phone service can definitely be characterised as mass market. More than 1.5 million subscribers were added in 2004. Similar increases should be expected in 2005 and for the next few years as mobile penetration in Canada continues to increase in line with the trends experienced in other countries.

Mobile data applications, ranging from text messaging or Short Message Service (SMS) to ringtones, video clips, etc. have been rapidly increasing in Canada over the last few years, similar to the experience of other countries. Mobile data applications integrating image and video are often referred to as Multimedia Messaging Services or MMS.

The following table highlights the evolution of mobile data services in Canada from SMS to mobile TV focusing on consumer applications. Consumer applications are estimated to represent more than 50% of all mobile data revenues in Canada in 2005.



Table 1- Chronology for consumer mobile data services in Canada

<u>Application</u>	<u>Time of launch in Canada</u>
Short Message Service or SMS	1996/1997 (launch of PCS service)
Launch of mobile Internet access	2000/2001 by all carriers
SMS Interactive TV (voting)	Third quarter 2001
Launch of ringtones services: <ul style="list-style-type: none">• Monophonic ringtones• Polyphonic ringtones• True Tones (MP3 quality)	Second quarter 2002 November 2002 May 2005
Camera phones and picture messaging	Fourth quarter 2003
Launch of video clips and video messaging	Fourth quarter 2004
Launch of mobile TV services	August 2005

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Mobile Internet access was launched in 2000 by Canadian mobile carriers. While initially focused on business applications, mobile Internet access has since become a key enabler for a variety of new services offered to mobile subscribers. Since the launch of mobile Internet access, mobile Internet browsers have been incorporated in most mobile handsets offered by Canadian carriers today to support the use of MMS and other Internet applications. In conjunction with the enhancements to the capabilities of handsets (digital cameras, video recording and multimedia messaging, MP3 capabilities), these developments have spurred new applications leveraging multimedia capabilities such as image messaging, games, ringtones and video clips.



As an example, the Table below highlights how the Internet is being used to access and download ringtones on a mobile phone¹. This process is similar to using the Internet browser on one's PC to access a web site, and then downloading a file or document.

Table 2 - Example of the use of Internet in mobile ringtones applications

PLUS, you can now send and receive ring tunes as gifts!* It's easy, here's how:

Launch your phone's mobile Internet browser by clicking on the link within the text message or:

- Motorola phones: press the "Browser" soft key.
- Nokia phones: press and hold "0."
- Other phones: find the browser/Internet option in the menu settings

Select "GET MUSIC&TONES" from the main page, click on "GIFTING"

Select "SEND A GIFT" or "REDEEM A GIFT"

Follow the prompts

Mobile Internet access has been a mainstay offering of Canadian carriers for a number of years and now underpins a myriad of new services offerings including the download of wallpapers and ringtones as well as multimedia messaging.

Mobile multimedia applications and mobile public Internet access are thus closely intertwined and mobile TV is the latest offering of Internet-based mobile multimedia applications as discussed in Section 3.

¹ The information is found on Rogers web site.



3. Detailed Implementation of Mobile TV in Canada

Mobile TV is the latest innovation in the realm of mobile data consumer applications. Technology issues challenging mobile TV services are numerous and the most important ones are briefly explained below.

- The transmission bandwidth available on mobile networks is in the tens or hundreds of kilobits per second, much lower than broadcast quality video signals and even much lower than the already compressed megabits per second digital signals being carried for digital specialty channels. This implies that a very high rate of compression is required and that the number of frames per second sent to the handset will be much lower than what is the case for traditional broadcast or cable TV signals.
- The small size of the screen on mobile handsets (e.g. a few centimeters) and the variations in the size of screens found in the pool of handsets currently on the market have a significant impact on image quality and on the type of images that can provide enjoyable viewing.
- Mobile TV also faces a number of other technology challenges to bring a quality signal to its viewers, among which we note the following:
 - The image resolution of the mobile screen expressed in terms of pixels, which is much lower than what is found on a typical NTSC signal.
 - The number of colours supported and the sound quality on mobile handsets, which also impact the mobile TV user experience.
 - The impact of high bandwidth usage as required for video applications on the battery life of the handset.

In addition to purely technology issues, the activity of watching live TV on a small mobile phone brings into question which type of programming is more compelling and



interesting for users. Is it news, comedy clips, fashion catwalk video clips, music videos, full-length movies, or short mobile episodes of popular TV shows specifically developed for mobile phones? As this is an emerging market worldwide, no clear answer to this question has yet been established in any country's experience and certainly not in Canada where services are just now being launched.

3.1. Detailed description of the mobile TV implementation with MobiTV technology

The three Canadian carriers have selected the same solutions partner for deployment of their mobile television, MobiTV Inc.. The ReachTV technology platform developed by MobiTV Inc (previously known as Idetic Inc.) is being provided. As deployed in Canada, MobiTV's service platform consists of a number of key elements:

- Signing agreements with content providers and TV channels to obtain permission to access and redistribute their signals.
- Compression of the video channels offered. Compression of the video signals is done in two steps. The first step consists of compressing the original video signal received into a higher bit rate MPEG signal. The second step is to transcode the signals into lower bit rate streams compatible with today's mobile handsets. MPEG² and M-JPEG³ are being used today for the video portion of the signal.
- The compression ratio required is of the order of 100:1. Compression ratios will also vary according to the type of programming. For example, it will be higher for news and lower for action movie signals. The resulting signal operates in the range of 12

² MPEG: Motion Pictures Expert Group that has developed a suite of standards (MPEG 1, 2, 4) for digital encoding of video signals.

³ M-JPEG: Motion- JPEG (Joint Photographic Experts Group) which compresses picture files so that they are smaller and quicker to download.



Kb/s to 20 Kb/s as supplied to Canadian operators. Bandwidth requirements are thus of the order of 6-9 Mbytes per hour per user.

- Formatting of the mobile video channels. It should be noted that a different format is required for every type of handset on which the MobiTV service is being offered to be able to accommodate the differences in screen sizes and resolution. Each channel in each format requires a different signal feed which will be refreshed at a different rate depending on the bandwidth available and handsets. This could range from 1 or less than 1 frame per second to approximately 6 frames per second, depending on the handset. There is no interleaving as in traditional broadcasting.
- Supply of the applet⁴ or software to be downloaded to each subscriber handset. The downloaded Java applet is 42.4 KB in size (42.8 KB for the French version). The Java applet is essentially a proprietary media player designed for a wireless network.
- Management of the client server relationship between each MobiTV end user and the MobiTV servers providing the signal feed. This includes the processing of requests from end-users to access channels and the delivery of requested service to the handset.

MobiTV obtains the broadcast channels directly from a satellite reception dish. Broadcast signals are received in the same way as a local cable TV affiliate would. Content for TV channels comprised of video clips are being obtained via file transfers over the Internet.

From the satellite reception, the signals are then transported via local high capacity digital transport links to a MobiTV server farm, in this case located in Reston, Va., for digital encoding, compression and formatting to fit every type of mobile phone screen on which the service is being offered.

⁴ An applet is a program written in the JavaTM programming language that can be included in an HTML page, much in the same way an image is included. When one uses a Java technology-enabled browser to view a page that contains an applet, the applet's code is transferred and executed by the browser's Java Virtual Machine (JVM).



For each mobile video channel offered, a different or unique signal feed is thus required for each type of phone. This approach is sometimes referred to as unicasting and is fairly different from traditional broadcasting where the same signal is sent to every user.

In Canada, the MobiTV service is being introduced on seven different handsets (3 for Bell Mobility, 3 for Rogers Wireless and 1 for TELUS Mobility). The number of pixels available on mobile phone screens supporting mobile TV in Canada ranges from 120 by 144 pixels at the low end to 176 by 220 pixels at the high end. This compares to a typical NTSC broadcast screen size of 640 by 480 pixels.

In the case of video clips, MobiTV has its own jukebox technology. The jukebox technology is used for managing and mixing the different video clips received and thus creating playlists of the video clip files. Windows Media Player has included a jukebox technology for a number of years. A similar technology is being used to organise and sort playlists in MP3 music players.

The MobiTV server farm in Reston, Va. is interconnected to the public Internet via a high-speed digital link. Each unique digitally encoded video stream travels from the MobiTV server farm to the Internet gateway of the mobile carrier over the public Internet as IP packets. As such, the signal is provided on a 'best efforts' quality level and there is no quality of service (QoS) assurance provided, similar to other public Internet applications. From the mobile carriers' Internet gateway, the signal is routed by the mobile carrier on its mobile network to the appropriate tower and antenna where the signal is transmitted wirelessly for the last mile for reception on the end-user handset. Note that all Internet users make use of some last mile technology as part of their Internet service. In this regard, the use of the wireless network for the last mile is conceptually



the same as the use of twisted pair networks, coaxial cable networks or WiFi networks for connection of personal computers to the Internet

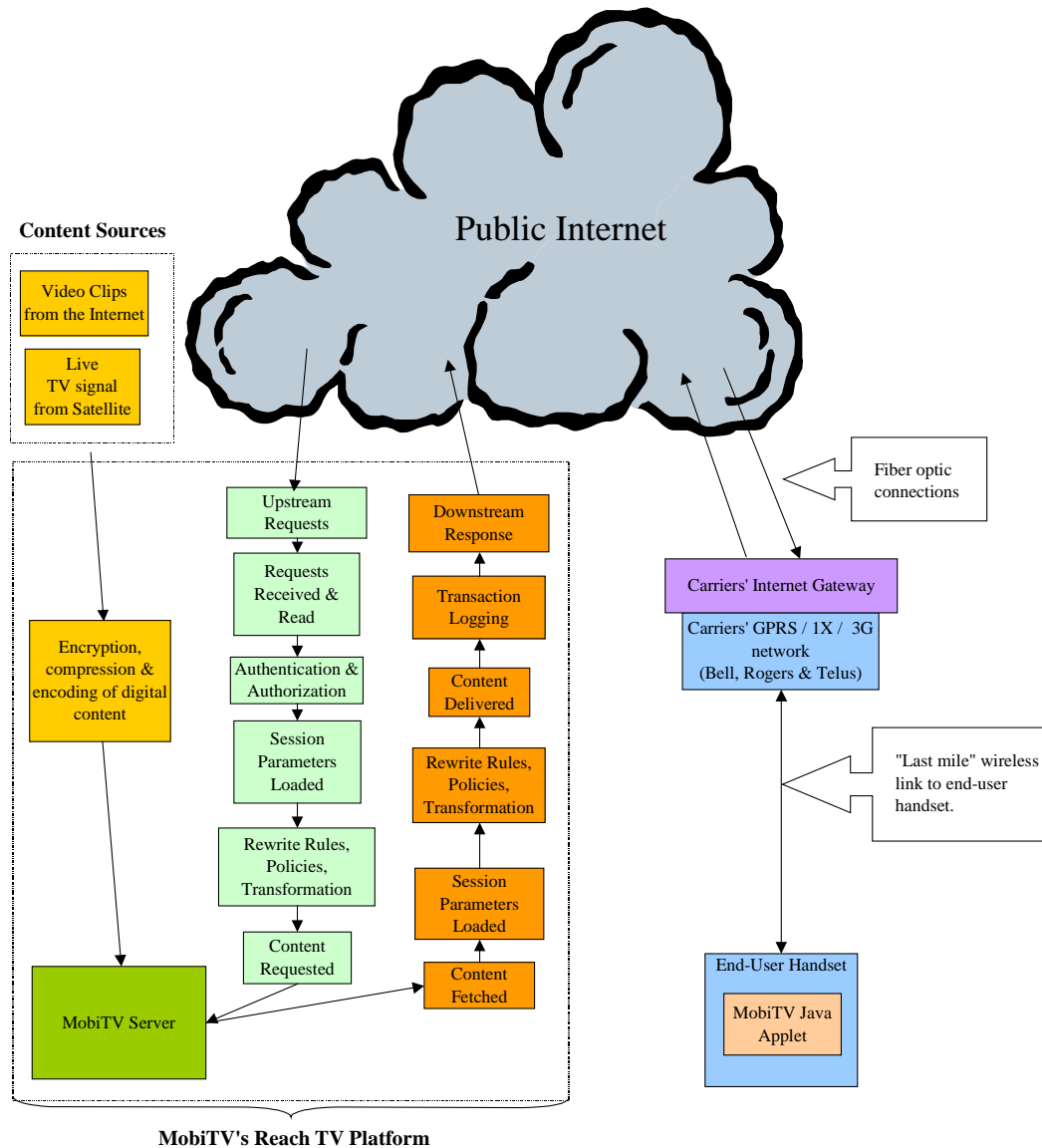
The mobile subscriber communicates directly with the MobiTV servers over the public Internet as is done in typical Internet client server applications. No additional hardware or software is required on the networks of the mobile carriers to offer the service. The mobile TV access and delivery processes are essentially the same as the video streaming technology that has been in use for many years over wireline Internet connections.

There is an inherent delay or latency of approximately 1-minute between the live broadcast signal and the mobile TV signal being received by the end user.

Figure 1 highlights the functions performed by the MobiTV Reach TV Platform managing the upstream request from the end user to the MobiTV server and the downstream response from the server to the end user.



Figure 1 – Implementation of Mobile TV in Canada using MobiTV technology



Source information: LYA, interviews and Idetic/MobiTV web site



Table 3 describes the detailed steps required when an end user wants to start watching a mobile TV channel. All transaction processes and signal transmission use the public Internet as well as standard Internet protocols to be completed.

Table 3 – Steps for a MobiTV client to get access to a mobile TV channel

Step 1: Launch Browser Application
Step 2: Start-up of MobiTV applet by selecting the MobiTV client application on the end-user handset
Step 3: The MobiTV end-user application makes a client request to the MobiTV server. The request is made via http, the common protocol for requesting pages over the public Internet network.
Step 4: The MobiTV server sends a query to the mobile carrier to authenticate the end-user handset. The MobiTV server caches (or stores) the authentication for subsequent requests.
Step 5: The MobiTV server authenticates the client request with its unique account identifier and the account status information from the MobiTV database.
Step 6: Once the client is fully authorized to watch MobiTV, MobiTV utilizes the TCP/IP protocol to deliver the service from its servers to the end user handset across the public Internet network and the last mile wireless portion provided by the mobile carrier.

It is important to highlight that no hardware or software is required to be added to the mobile carrier's network to support MobiTV's application. There are also no dedicated links or circuits set up between any mobile carrier and MobiTV or between the end-user and MobiTV. The mobile carrier's network provides the last mile transport of the MobiTV signal on its wireless infrastructure acting as an Internet Service Provider (ISP) to enable its clients to access web pages and video streams.



3.2. Mobile TV service as launched in August 2005

Rogers Wireless, Bell Mobility and TELUS Mobility all launched mobile TV services in August 2005. The following describes key features of the services offered focusing on pricing options.

Canadian carriers offer similar pricing plans for mobile TV. These plans either are provided on a package basis (access and usage) or include one element for basic access to the service and a second element for the data usage on the Internet. This is highlighted in Table 6. In the case of Bell Mobility, the \$5 per month for unlimited viewing is the identical option any subscriber can buy for unlimited mobile data applications.

Table 4- Pricing plans for Mobile TV in Canada

- Bell Mobility: \$10 per month + \$5 per month for unlimited data plan, suggested by Bell, providing unlimited viewing.
- Rogers Wireless: \$9 per month for access to Mobile TV services and \$16 per month for unlimited viewing
- TELUS Mobility: \$15 per month for unlimited viewing.



4. Key findings

The key findings from our research and analysis are summarized below:

- The implementation of Mobile TV service is similar among the three largest mobile carriers in Canada. Rogers, Bell and Telus have selected the same solutions partner, MobiTV Inc. and its Reach TV service platform.
- Mobile TV services use the same streaming video technology that have been in place for years to deliver video content over the public Internet. The public Internet network is being used to access and deliver video content channels specially compressed and formatted to fit the screens of mobile handsets.
- Mobile TV services are being offered as a client server application running on the public Internet. Therefore, as demonstrated, each individual subscriber accesses the mobile video channels using the Internet for live broadcasts or other applications via an IP address and using standard TCP/IP internet protocol to reach the MobiTV server after having downloaded the Java applet supporting the application on his handset.
- Each end user communicates directly with the MobiTV server as part of MobiTV's client server platform.
- There is no hardware or software added to mobile networks to enable mobile TV applications and the Mobile TV Internet applications run independently of the mobile networks. The network of each mobile carrier provides the wireless last mile transmission to reach the end user handset.
- For each video signal offered, a different signal feed must be provided for each type of handset supported by the different carriers to accommodate the different screen sizes and resolution.



- The structure of the pricing plans and price points offered by Canadian carriers are similar to those offered for mobile data/ Internet applications.
- Bandwidth requirements for mobile TV services are per user and not shared between users, in opposition to traditional broadcasting.
- There is latency or a delay of approximately 1-minute between the live TV and mobile broadcasts.
- The mobile TV signal is very different in quality from the traditional broadcast signal and hence the end user's experience of watching TV on a very small screen is also very different. Market demand for this service remains to be proven.

In conclusion, the mobile TV services currently offered by Canadian mobile carriers using the MobiTV technology provide video content accessed and delivered over the public Internet in a manner similar to streaming videos on a PC. Essentially, the role of the mobile carrier's network is similar to the role played by an Internet Service Provider's (ISP's) network in a typical Internet application such as video streaming.



5. Experience of LYA in mobile broadcasting

LYA, founded in 1993, is a leading independent management consultancy providing services to the communications industry on telecommunications and broadcasting matters.

LYA has been active in mobile communications for 10 years. We bring in-depth expertise and experience in mobile networks. LYA has developed numerous analyses and business plans that included detailed technology discussions and implementation of mobile networks to provide services ranging from voice, SMS and MMS including mobile Internet access. LYA has experience and expertise relating to all mobile technologies deployed in Canada including GSM, CDMA, GPRS, EDGE and 1XRTT. LYA has also been very active in consulting mandates pertaining to mobile multimedia applications for a number of years.

Since 2003, LYA has been offering a monthly monitoring and impact assessment bulletin on mobile broadcasting applications, which covers the full range of applications and technologies from SMS to mobile TV. This Bulletin covers worldwide developments in mobile broadcasting. Additional information on this Bulletin is available on LYA's web site.

LYA has developed a number of independent expert reports submitted to CRTC and other public consultations, such as Industry Canada. A number of Reports are available on our web site at www.lya.com. Both Ms. Lemay and Mr. Yates have been expert witnesses at CRTC hearings and in other judiciary proceedings or consultations. Ms. Lemay and Mr. Yates are often called upon for industry conferences or commentaries in the media, notably on Report in Business TV.