Guidelines for a Conditional Access System That Would Serve the Success of ATSC-M/H Market

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Abstract

Mobile Digital TV (MDTV) has already been in use for several years in different regions of the world. In some parts of the world it is very successful, while elsewhere in the world mobile digital TV has been extremely unsuccessful. The reasons for the success or failure of MDTV services are not related to the broadcasting technology in use, but are typically due to commercial and business issues such as: proper spectrum allocation; effective service coverage; appropriate content; and simple – or complex – Conditional Access (CA) schemes. In each case where MDTV failed, these parameters were not properly handled. In all cases where MDTV has flourished, these parameters were fitted to the satisfaction and comfort of end users.

This paper builds on the accumulated experience of 6 years of MDTV failure and success stories, and focuses specifically on showing how the Conditional Access System (CAS) greatly influences the success or failure of the MDTV project.

On one hand, a highly secured CAS encourages premium content providers to offer their content over the MDTV service, thereby increasing the popularity of the service. On the other hand, complicated usage and implementation of CAS causes dissatisfaction among both the terminal makers and the end users, and eventually kills the MDTV service.

The purpose of the paper is to utilize this historical perspective in order to best derive guidelines for a CAS that would protect the content owners, serve the broadcasters' commercial needs, while at the same time secure the success of the impending ATSC-M/H launch in the USA.

1 A Six-year Perspective on MDTV

Siano is a leading provider of mobile DTV receiver chips globally. Founded in 2004, Siano was the first chip maker to provide multi-standard receivers. The product offering includes solutions for most MDTV standards: DVB-T, DVB-H, ISDB-T, T-DMB and CMMB. Siano holds large market shares in the CMMB, DVB-T/H, and ISDB-T (South America) markets.

Siano has been intensively involved in the standardization processes of CMMB and DVB-H, and was actively involved in the successful launch of CMMB in China, and what is considered the failed launch of DVB-H in Western Europe. In both cases Siano took part in the discussions, debates and implementations across the MDTV ecosystem regarding CAS.

This paper is written from this perspective – a vast experience with the factors that influence how successful or unsuccessful an MDTV launch can be.

2 Learning From the Short History

2.1 The Failure of DVB-H

Technical comparisons have shown that DVB-H does not fall short of T-DMB, CMMB and ISDB-T. T-DMB and ISDB-T have been deployed as free-to-air services (making the comparison to DVB-H somewhat unfair), but both DVB-H and CMMB are pay-TV services.

So, why has DVB-H failed, while CMMB succeeded?

- In some countries in Europe, especially in the UK, no sufficient spectrum was ever allocated for DVB-H.
- In other countries, such as France and Germany, the regulator failed to provide the leading mobile operators with a simple, readily applicable license to offer broadcast DTV services in conjunction with their voice and broadband services.

Nevertheless, even in those places where these hurdles were overcome – such as Italy, Austria, and Switzerland – DVB-H still failed. Why?

An unclear and chaotic CAS implementation played a major role.

Let us examine the DVB-H deployment in Italy, which started in the late summer of 2006. Two different DVB-H services were operated in Italy at that time. One was operated by the mobile operator "3" (H3G). The highlight of this service was live broadcast of soccer games from Italy's top league, Seria A.

The second network was built and operated by Mediaset, Italy's largest TV service provider, and was offered to mobile end users through two mobile operators, TIM and Vodafone. The content was Mediaset's regular channels, which were also available on home TVs, for free.

Both DVB-H services used a CAS called Open Security Framework (OSF), which was earlier recommended by the DVB-H committee. As the name attests, OSF enables flexibility in choosing the actual Conditional Access method and provider. Eventually, each mobile operator ended up using a slightly different CAS. CAS integration at the terminal level is a complicated task, which increases the terminal development cycle significantly. This lack of uniformity of DVB-H CAS, which meant different development efforts for each of the operators, made many device makers hesitate and stall their programs developing DVB-H phones, resulting in a very poor device offering to the end users.

During 2007, the DVB-H committee tried to be more assertive about CAS, and strongly recommended a method called OMA-BCAST, but this was still left out of the "core" DVB-H specs, and a great degree of freedom was left for each specific network, discouraging large handset makers from investing in DVB-H products in general, and CAS integration in particular.

In Switzerland, the OMA-BCAST system was implemented as the CAS for DVB-H, but the system provider required device makers to pass its own proprietary compliancy tests, which again worked against the economy of scale, and made the investment into DVB-H terminals very expensive. The result, again, was lack of terminals, and total failure for the system.

The current status of DVB-H is Europe is miserable. In Italy, which has the most successful DVB-H network so far, after nearly 2 years of operation by two mobile broadcast networks and 3 commercial services, only a handful of handsets, data-cards and portable TV models

that support DVB-H are available. The overall accumulated number of handsets with mobile broadcasting capability sold since 2006 is below 1M. The number of active subscribers is publicly undisclosed (most likely due to the very low numbers).

In Switzerland, the DVB-H network covers 44% of the population and 28 channels are offered. The operators provide 3 handset models that support DVB-H. In January 2010, there were 3.000 subscribers to the DVB-H service, compared to 5.000 subscribers a year earlier. In April 2010, Swisscom announced it would be discontinuing its DVB-H service "because there are not enough DVB-H compatible devices to make the service a success."

In Austria, the service was launched in June 2008. As of the end of November 2008, about 53% of the population was covered with DVB-H signal. At the end of October 2008, about 10,000 subscribers were registered. Since then, there has been no increase of subscribers. The major drawback is the lack of attractive terminals. Most mobile operators do not actively market mobile broadcast TV service anymore.

In the Netherlands, in June 2008, KPN launched the services and there is 89% outdoor coverage and 73% indoor coverage of the DVB-H signal. The operators provide 3 handset models that support DVB-H. In November 2009, KPN reported about 40,000 users.

Had the DVB-H committee been more assertive in dictating a uniform CAS, and had it made this an integral part of the DVB-H technology itself, it would have been much more attractive for the large terminal makers to make the investment, and to develop multiple models supporting DVB-H.

2.2 The Success of CMMB

In China, on the other hand, the CMMB committee took a completely different approach. Under the management of SARFT, China's State Administration of Radio, Film and Television, and its execution arm CBC (China Broadcasting Corporation), the committee came up with a complete, uniform, compulsory CAS. The CMMB CAS is still flexible in that it enables several CAS server and client suppliers, and even different billing systems, but the core technology is one, and it is an integral part of CMMB. Two different CMMB services are offered in China.

a. CBC's system – This system is offered directly by CBC, which is responsible for the deployment. This is a one-way system – no return channel from the terminal to the server. Two CAS vendors support this system – NagraVision and Novel SuperTV.

b. China Mobile's system – This system is provided by China Mobile, the world's largest mobile operator, which has its own CAS, called MBBMS (Mobile Broadcasting Business Management System). MBBMS is based on a return channel from the terminal to the server, using the cellular network to authenticate the CMMB user.

Both systems require hardware means on the terminal side to store the "root-of-trust" information for the authentication process. This hardware can be a SmartCard, but for cost reasons most devices use a surface mount semiconductor chip ("SMD"), or even a piece of silicon integrated together with the CMMB receiver.

All of the above CAS systems and vendors eventually generate the same key that is used to decrypt the CMMB data. The only difference is the method that is used to generate this key.

After about one year of commercial deployment, the CMMB launch is considered a success, with already more than 10 million devices in the market and a fantastic growth rate.

Considering the fact that the CMMB network covers about 450M of the Chinese population, it reflects about a 2% penetration in the first year and an expected penetration of another 3% - 4% over the year ahead. This is in comparison to Italy with total penetration of about 1.5% after two years, and Switzerland, Austria and other European counties with 0% penetration of DVB-H.

The key factors that have made the Conditional Access concept in China successful are:

a. One large CMMB network supports all the different CA methods and providers. It means that every CMMB terminal that supports one of the CA methods of one of the CA providers, can receive the CMMB content everywhere across China.

b. Every purchased CMMB terminal already includes the entire hardware and software package required for CAS. The end user does not need to further add a card, or install software, or anything else. In fact, earlier trials in China showed that, when the end user has to purchase a CAS SmartCard after the purchasing time, or even just make a phone call to authenticate the terminal – the user typically did not do it!

c. The CA system and providers were decided upon, and implemented at an early stage. Because the CAS system is standard, CAS enabled CMMB can be viewed anywhere in China where CMMB is broadcast. Moreover, CBC has also forced a simple mechanism for “roaming” – a user with a CMMB device can receive both national and local channels, no mater where he/she purchased the device.

Today, Chinese consumers can purchase CMMB handsets from China Mobile, or purchase other electronic devices in consumer electronics stores. They don’t need to install any hardware or software in order to watch TV. Then they can fly 4 hours to another city in China, thousands miles from their home, and still use their device to watch TV, without any action from their side.

Simplicity wins.

3 4ATSC-M/H Success or Failure May Depend on How Conditional Access is Defined and Implemented

Consumers’ expectations regarding watching TV content on mobile devices are completely different than watching content on a stationary TV. Consumers are very experienced with mobile terminals and have a mature and established set of expectations and usage habits. Thus in order for ATSC-M/H to be successful, the customer’s experience with mobile TV should meet these expectations. A mobile TV terminal is not a “portable TV set-top box”, but rather a mobile device with a TV feature.

Furthermore, in order for ATSC-M/H to flourish, it is also essential to harness the large mobile phone makers to make multiple models supporting ATSC-M/H. These makers, such as Apple, Google, HTC, LG, Motorola, Nokia, RIM, Samsung, Sony-Ericsson, and others would be reluctant to add the ATSC-M/H feature unless they are certain that the usage

concept is very simple, and that the implementation is uniform for all service providers, allowing them to benefit from the economy of scale.

3.1 Seamless, Nationwide Service is Key to Success

A basic expectation from a cell phone is that once the end user is engaged with certain service provider, the service would be supported at minimum nationwide, if not globally. End

users would expect the same from a mobile TV service on their device – even if the terminal is purchased and usually used in San Francisco, it must automatically operate also in Denver and Austin, etc., with no further actions needed from the end user side.

This is somewhat unusual for TV broadcasters, given the regional nature of TV services in the US. In the US, each regional broadcaster would offer its own content locally, and would expect to be able to monitor its own ratings, not to mention offer local pay-TV services when the time comes. Thus, the broadcaster would tend to implement a local CAS. As indicated above, that would cause a problem for mobile users.

The problem can be solved if some of the ATSC-M/H content in every region would be accessible seamlessly for any ATSC-M/H user, regardless of where this user initially engaged with a broadcaster, or purchased his/her terminal. This means that there is no need for any additional hardware or software for reception of at least some of the channels. In other words, if a Los Angeles based ATSC-M/H user, who is engaged with a local LA broadcaster arrives at New York, she would have automatic access on her phone to at least some content, with no further action from her side.

Requiring specific hardware for just mere reception will be unacceptable and impractical for end users. No end user will go through the hassle of purchasing and installing a new, “local” SmartCard in the city where she arrives for a day (or a week, for that matter).

Again, recall that mobile phone users are used to using the same SIM card nationwide, and in fact even worldwide, for cellular connection. This should not change for the TV feature.

In order to enable nationwide ATSC-M/H reception with the same hardware and software, making the ATSC-M/H service popular, it is imperative to make an a-priori decision on CAS that would support that. The best would be if this model were implemented as part of the ATSC-M/H standard itself.

3.2 Hardware vs. Software: CAS Considerations

There are two concepts for Conditional Access support on the terminal side. The first is via software means. The CA method already defined as part of the ATSC-M/H standard falls into this category. The advantage of this method is its design simplicity and lower cost. Its disadvantage is that its level of security can be somewhat compromised.

The second approach requires dedicated hardware to locally store the cryptographic “root-of-trust” data. There are several options for implementing such hardware, but the concept is similar for all of them. Usually, a hardware solution presents better security.

Note that for “non-connected” terminals, such as a portable navigation device, a hardware solution is almost a must, since usually there is no way to authenticate the device “on line” – no return channel. This doesn’t necessarily mean that for software CA, the terminal should be “always connected”; it just means that software CA terminals shall be connected to the network (or server, etc.) “once in a while”, for a short time.

Based on our experience, we recommend having two layers of CA to be supported by ATSC-M/H terminals:

a. Software CA – the one that has already been standardized by the ATSC-M/H committee. This would provide the first level of security. We recommend that all ATSC-M/H providers would support the software CAS for at least their encrypted free-to-air services. This would allow a breed of low cost terminals that can access basic contents anywhere in the USA.

b. Hardware CA – This would provide a second level of security. We recommend that a terminal equipped with hardware CAS will be able to receive the entire content, from all broadcasters – pending the commercial engagement with each local broadcaster. Thus in order to receive premium content that is not supported by the software CA, there will be an option for hardware authentication. Hardware CA will be required also for reception of the entire content by "non-connected" devices.

Since different CA providers need different hardware, it is crucial for the ATSC-M/H committee to select specific CA providers and standardize the hardware. We recommend two form factors for the hardware CA, both equally compatible with the hardware CA:

a. External microSD card

b. Embedded chip

The cost of such hardware CA solution should – and can - be below $1 for high volumes. Integration effort of such hardware into devices is actually surprisingly smaller than the integration effort of Software CA. In case of embedded chip, the CA chip could be connected to the ATSC-M/H receiver and controlled by it. In this case the entire CA management is transparent to the host processor and there is no CA related integration effort by the device. More than that, the CA hardware can be also packaged together with the ATSC-M/H receiver and enable very small and cost effective complete solution for ATSC-M/H reception and ATSC-M/H CA.

4 Summary

ATSC-M/H is considered the "next best hope" of reviving the TV broadcasting industry in the US, and bringing new prosperity to the broadcast TV market

Without careful planning and exact implementation of some key elements the ATSC-M/H project runs the risk of following in the footsteps of historical failures like DVB-H in Europe.

- Coverage must be very good, enabling watching TV in locations such as university/school campuses, shopping malls, coffee shops, etc., as well as mobile locations such as cars, trains, buses, etc.
- The content has to be sufficiently attractive; live sports and live news are the main ingredients. The basic TV services need to be available throughout the entire U.S. to all ATSC M/H users, to capture the interest of a wide range of consumers.
- There has to be a wide, rich offering of terminals available for the end users, especially those terminals that are otherwise popular (i.e., no special terminals for MDTV only).

Once these basic criteria are met, the most critical aspect that will dictate the destiny of ATSC-M/H is how CA is defined and implemented. Giving too much "freedom" for implementation and letting each broadcaster define its own CAS might cause chaos, resulting in questionable commitments of the ecosystem such as large terminals makers and the mobile operators.

While not compromising on security, the implementation of the CAS must be extremely simple and straightforward both for the terminal makers and the end users. ATSC-M/H devices must be operative nationwide, and no special action must be demanded from the end user when "roaming" from one region (and broadcaster) to another.

Very low cost terminals will allow nationwide access to basic content, using software CAS. More secured terminals would use hardware CAS, and would allow access to every channel, premium or not, per the proper engagement with the local service provider, engagement which will be implemented smoothly via a simple application on the fly.

About the Author

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Mr. Klein joined Siano in May 2007 and served as the CMMB program manager, responsible for the development of Siano's first CMMB chip. In August 2008 Mr. Klein became the Director of the CMMB product line; responsible for Siano's CMMB related marketing activities. He assumed his current position in January 2010.

From 2003 to 2007 Mr. Klein held key engineering positions in Metalink – a fabless semiconductor company which developed chips for xDSL and for 802.11n. As part of his responsibilities, he served as principle architect of Metalink.

From 2000 to 2003 Mr. Klein served as a Chief architect and project manager in Tiaris – a fabless start-up company.

From 1997 to 2000 Mr. Klein held key engineering positions in Zoran – a fabless semiconductor company. As part of his responsibilities, he served as a manager of architecture and algorithms development team.

From 1993 to 1997 Mr. Klein served as a VLSI developer in Motorola Semiconductors.

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