Local and Ultra Local Content in Broadcast Mobile TV

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ABSTRACT

Broadcast Mobile TV is meant to be one of the next 'killer application' for Mobile operators and content providers.

After in depth research, consulting groups announce that MobileTV Broadcast will create successful services in the coming years.
Broadcast MobileTV is already covered by different standard and has been launched using them all (DVB-H, T-DMB, FLO).
These deployments and trails are using existing national services (main popular channels). User feedbacks analyze shows that there is a real need for local contents like regional channels. Ultra local content, like specific mall/area live services or stadium dedicated content has been pointed out as a logical development.

The aim of this paper is to identify the different type of Mobile TV contents (National, Local and Ultra local), in order to check whether Local Mobile TV Services is feasible looking at possible business models and technical aspects.

Indeed, Ultra local content means that there are many contents to be handled at once, hence the way they are managed must be different than National and Local one whether be it on the business or on the technical side.

MOBILE TV

Mobile TV already exists. Most of the time, the actual Mobile TV is defined, managed and controlled by Mobile Network Operator. (MNO). These MNO use their cellular network to deliver the video content. To do that, they create their own content bouquet including Live and download (VOD) content. With this actual Mobile TV business model, this is the MNO who is fully in charge of the Mobile TV service: content selection (and creation for some of them), content delivery, associated business model and end user management (billing). Since one unique and centralized actor operates, Mobile TV services are quite easy to put in place and quite fast to deploy (re-use of existing cellular network). However Video service offer uses a network and handsets which have not be design to achieve that kind of performance originally.

It ensures these main following inconvenient:

- limitation of the cellular network in terms of simultaneous supported end users and in terms of supported bandwidth per video channel
- non suitable handsets which do not offer a satisfying experience: poor video quality due to non adapted screen size and resolution, high battery consumption.

BROADCAST MOBILE TV INTRODUCTION

TV Broadcast is not new. It started in the analogue format and switched to digital approximately 12 years ago. Broadcast technology is very well adapted to unlimited number of end users. Associated to digitalization, it offers the capability to deliver many different services per used frequency.
Hence solutions and standards have been defined to offer capability to use this broadcast technology to deliver TV contents to mobile devices.
For now, multiple standards are available and have already been deployed (trial and commercial offers). The most famous ones are:

- DVB-H (Digital Videao Broadcasting – Handle)
- FLO (Forward Link Only)
- T-DMB (Terrestrial Digital Media Broadcasting)
- CMMB (Chinese Mobile Multimedia Broadcasting - under finalization)
- …

BROADCAST MOBILE TV: EXISTING END USER FEED BACK

Multiple Mobile TV Broadcast trials have been conducted and commercial Broadcast Mobile TV services have been deployed, bringing accurate technical results and end users' feedback.

There was no major technical discovery; Broadcast technology can fit all major Mobile TV requirements, offering a nice service quality and significant user experience. In that way that End Users declared they

were willing to pay a fixed month subscription fee.
The average day watching time appeared to be around 16 minutes.

The surprise came while analyzing the day usage: Mobile TV content had been watched at home, for as much as half of its overall watching time.

The last major feedback is about content in itself: Most of the time, consumers watched best-adapted content like short news, sport and entertainment content. On top, consumers were requesting local TV content. Local and dedicated content were the two main user requests.

MOBILE TV CONTENT CONSTRAINTS

The biggest part of Mobile TV content comes from existing contents which are, most of the time, created by National live content providers for a large audience using usual TV sets (SD resolution).

The first step to take to get dedicated Mobile TV content is to adapt the existing screen size and resolution, as well as events' duration: dedicated Mobile TV content must have clear and easy to see scene (not to many details), and program duration must be reduced.
The second step is to create specific Mobile TV content, content which are made and designed for Mobile TV users only.
Content adaptation and related cost must be handled by one single actor of the Mobile TV ecosystem; it could be the content provider but also a MNO which takes the opportunity to get involved in the video content creation.

Wireless technologies use many frequencies: due to the high number of live video contents, it is hard to get available frequencies for a new service. That is why this is necessary to share one single frequency (ie the bandwidth) between all contents: National and Local. There is even more to it, since it may not be possible to broadcast all services at once, providers need to make a selection among them.
Content selection, content adaptation, content creation are the key factors to get a great Mobile TV service quality.

The business model related to the content access brings also some constraints on the services management side. When content is free to air (free to access), the service is quite easy to deploy. When content is not free (post paid or pre-paid, pay per month/week/days or pay per event), it implies content protection and user management. Content protection means content scrambling; it is generally done at the content compression stage and is linked to user management. User management implies to get a centralized user database with user right definition, attribution and content access policies but also a centralized billing system.
Paid contents require centralize content management.

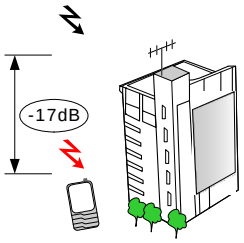
Another feedback from trial and commercial deployment indicates that users consider Mobile TV services as an extension of their usual TV. He/she would like to have the same experience as in front of his/her TV set: an easy way to access content and an easy way to switch from one content to another.
We generally attribute this ability to the handset and more precisely to its user interface, i.e. the handset capacity to give easy access to the content. The handset must also be aware of all available contents/services and make it easily available. That is what the content declaration, which is generally include in the Electronic Service Guide, does. This ESG is broadcasted in parallel of the video content.
Because we could not imagine that users need to make a specific and manual procedure to see all available contents in each region he will visit, content availability must appear automatically when users first enter a new content coverage area.

MOBILE TV DEVICES CONSTRAINTS

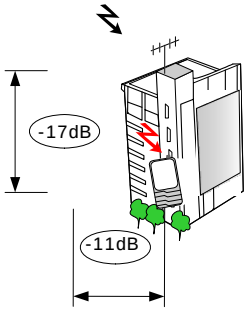
Mobile devices are quite small and light. Associated screen sizes are proportional. It means dedicated screen resolution which, in the case of Mobile TV, must be adapted. QVGA screen resolution is now largely used and could be considered as a standard resolution. In terms of video display, the screen size must not be too small.

However, using a large screen size consumes a lot of energy. Autonomy is indeed another constraint brought by mobile handset. Energy is consumed by the screen, content processing/decoding and content reception (RF and front end part).
Broadcast Mobile TV technologies have taken into account these constraints by adapting content delivery for example. DVB-H Time Slicing is one of these solutions. Time Slicing consists of time division (like TDMA) where the handset receives all content at once, during only 10% of the content total duration meaning receiving the content burst by burst. Such a solution is well adapted when all contents are managed simultaneously from one central point.

The last Mobile handset constraints is related to signal reception. Wireless broadcast technologies have been initially designed for outdoor reception using dedicated antennas (satellite dish, RF antenna). For classical UHF frequencies, the RF antenna is placed on a high point with a specific orientation to guarantee satisfying signal quality and reception. This is not the case for Mobile TV handsets which do not have any external antenna and which reception occurs at the 'ground' level. Studies demonstrated that there is 17 looses dB for the RF reception for Mobile TV handsets.



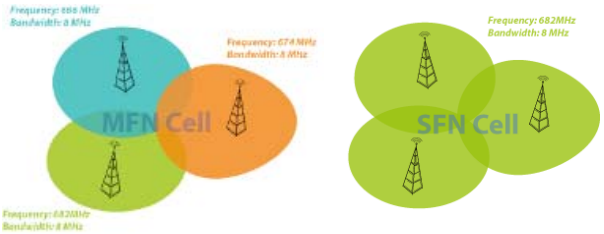
We discovered previously that half of the time consumers watch Mobile TV services at home, meaning indoor reception. And the other half of the time, the same feedback indicates that most of the time, reception was made inside a building. We can conclude that good indoor reception is a key factor for service adoption.
However, reception within a building is 11 dB less that outside the same building.



Globally, Mobile TV handsets have 28dB less in the quality signal reception when compared to a classical RF broadcast reception.
We can easily conclude that signal transmission has to be efficient with deep density to comply with these constraints.

MOBILE TV COVERAGE CONSTRAINTS

According to the previous conclusion, a good coverage of Mobile TV services is a key to service success.
An existing solution to increase broadcast signal quality and signal density is to deploy multiple Single Frequency Network (SFN). Each area/region could be covered using one frequency which is broadcasted by multiple transmitters.

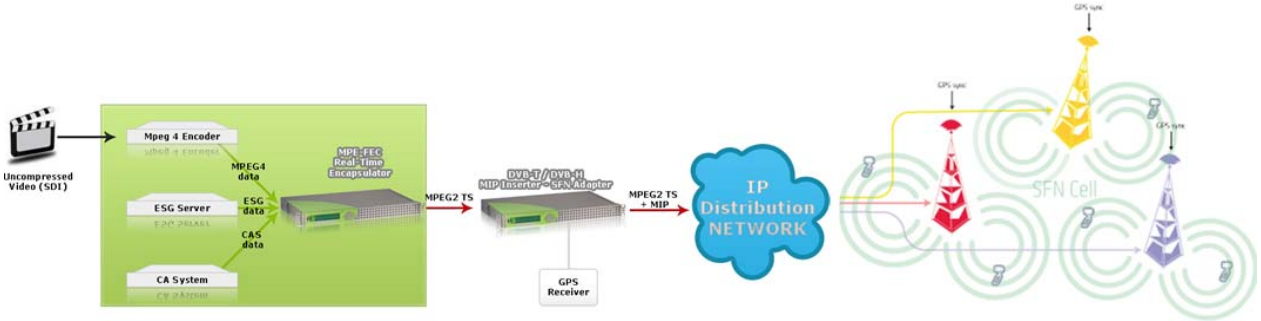


SFN also allow to guarantee reception in specific areas that one transmitter is not able to cover, like shadow area at the entrance of a building.

Transmitters belonging to the same SFN cell radiate the same RF symbols, over the same frequency, at the very same time, using the very same RF modulation. Any receiver located in the area covered by the SFN cell will receive signal from one transmitter, or another, without any difference. And moving from an area covered by one transmitter to another within the same SFN cell is transparent at the reception level.

Perfect synchronization between all transmitters within the SFN cell is feasible only by the use of a SFN adapter at the head end side.
SFN adapter is centrally located at Head End side to build a unique source that all transmitters will have to broadcast in a synchronized way.
Since SFN adapter and transmitters are not located at the same place, the only common timing reference available in the world is GPS satellites. This is why in SFN networks, SFN adapters and transmitters are connected to GPS receivers providing them with 1 PPS and 10MHz signals.

Needed to be inserted at the central head end or before delivering the stream to the transmitters, SFN synchronization implies a major constraint to content delivery and associated architectures.



MOBILE TV CONTENT DEFINITION

According to the previous section, we could easily distinguish two major kinds of contents: National content and Local content. Going more in detail and regarding specific areas where video content could be interesting to catch, another kind of content could be imagined: this is what we call "Ultra Local content".

Mobile TV National content definition

National content are associated to the most popular content which are broadcasted to the entire dedicated population. The associated coverage must be the largest. The content is based on:

- Generalist subjects,
- Dedicated popular thematic like sport, music, weathers forecast, …

Well know channels using National content are CNN, EuroSport, …

In Mobile TV context, due to limited number of channels, such channels are selected to avoid service overlapping or information redundancy.

User feedback and audience estimation provides this well known ratio: 80% of the population is watching 20% of the global content focusing on the most popular channels. That is why even if Mobile TV users were requested dedicated content, these content are the base of Mobile TV service.

Mobile TV Local content definition

The main characteristic of National content, which is broadcasting generalist programs, is also a drawback. Users request more "proximity" information.

These contents are focusing on a specific region, on a specific town or part of a state, generally associated to regional channels.

Most of the time, this content is created close to the place where they are broadcasted, i.e. inside these associated regions.

Some example are 4NBC for New York dedicated channel and TvBreiz for dedicated French Brittany region.

Due to the high number of specific areas, the number of such kind of content could be high but is also limited by the fact that the public is not big enough to enable concurrence.

According to the associated business model, this kind of contents and channels could be managed as National one.

Mobile TV Ultra Local content definition

More and more people are looking for "proximity" information related to where they are. These kinds of information, focusing on a specific area, are only available inside this specific area and could be of no importance outside. Most typical example is stadium dedicated content; this could be content related to the stadium event and events outside the stadium but of the same interest, and content you are able to receive only inside the stadium. Imagine that you are going to see a football match, immediately inside the stadium you have the possibility to watch video content that summaries the previous results of the teams, that displays the last goals, and that offers you the possibility to watch the other games which are played simultaneously in another stadium. This is Ultra Local content. And you could find such kind of content in many different areas like malls (shopping information), museums, public areas, theme parks, …

The number of such kind on contents and channels created for and inside specific areas, could be very high. This content has also the particularity to be available to everybody, independent from the National Mobile TV subscribing, whatever the receiver device is.

According to these facts, high number of content and independent content provider, such kind of content could not be managed as National or Local one and must have their own delivery mechanism. But this Ultra Local content must be easily accessible from end user point of view; the Mobile TV device must be able to display automatically the available Ultra Local content and services without specific user action (like channel scanning). Ultra local content referencing in National broadcast delivery is one of a key problematic.

MOBILE TV – NATIONAL AND LOCAL CONTENT MANAGEMENT

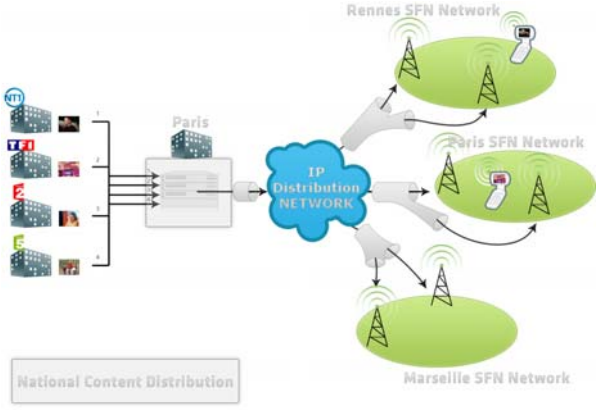
Mobile TV management could be summarized in:

- Making aggregation of all contents
- Making content repurposing
- Delivering content to all transmitter sites
- Complying with Mobile TV constraints

National and Local services management (and delivery) can be done using centralized or distributed architecture. National services are generally managed from a central head end (Centralized architecture) when Local services could be managed from regional points (Distributed architecture) or from a central point (Centralized architecture)

According to broadcast network characteristics (distribution network, SFN / MFN, …) each of these two content management has benefits and limitations.

National services management: centralized architecture

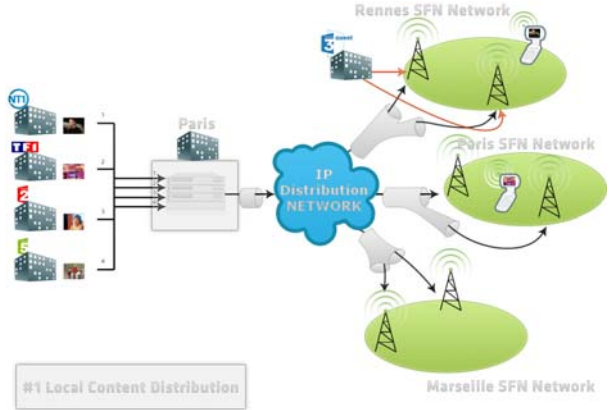


Centralized architecture implies that all contents are managed from a central point: receiving all content feeds and managing all of them simultaneously.
Main advantage is that it is the easiest way to manage Electronic Service Guide (ensuring the declaration and referencing of all contents) and one of the best way to control Users content access and billing, achieving a secure CAS deployment. This architecture also offers the easiest and more powerful capability to optimize the bandwidth allocation using Statistical coding for example. And off course, this is the most efficient way to guarantee the full compliance with Mobile TV constraints.

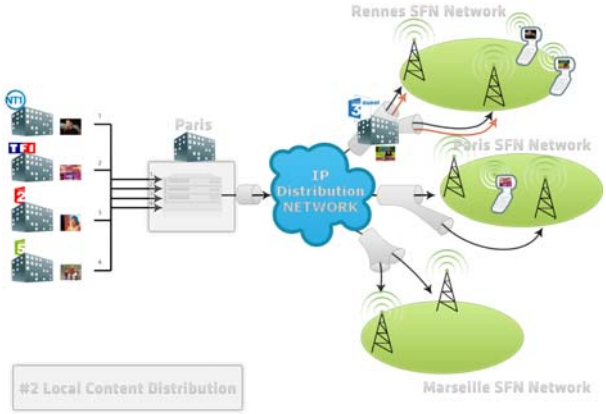
Local services management: distributed architecture

There are two ways to make Local content distributed architecture.

Distributed architecture #1 is the most distributed one; Local content, which is created in one dedicated local area, is inserted at the last point of the distribution network: the transmitter site.



Distributed architecture #2 is characterized by the fact that local content in inserted at one point, just before the local area global content distribution.

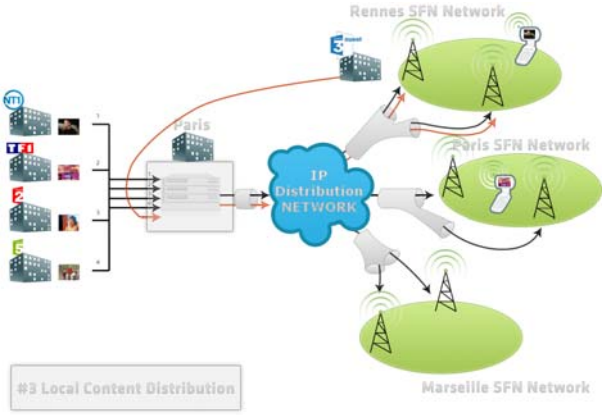


Distributed architecture #1 is not quite valid due the fact that is almost impossible to preserve SFN. Trying to make such architecture could impact the overall area transmission making lots of perturbation. Also, considering the needs of one “specialized and complex box” which makes local content reception and insertion at each transmitter site, the cost of deployment for such architecture is very high.
Architecture #2 complies with SFN constraint and do not implies any specific box at any transmitter site. But it implies to have a dedicated distributed network for each region. For example, for money reason, it is not reasonable to have one satellite distribution per local area. Cable network is quite mandatory between each transmitter site considering this architecture.

These two architectures enable each region to be quite independent and each regional content provider to manage directly its equipments, its content, its advertising, its program grid, …
However, one main issue is that user management and CAS deployment are made difficult since there are generally centralized.

Sharing the same frequency (mux) for National and Local content, both architectures imply a modification of already created National multiplex, the insertion of Local content and the modification of the ESG. These cases are not the best ones to guarantee the best quality of services, and would require a more complex supervising and monitoring system.

Local services management: centralized architecture



This latest Local content management architecture enables the management of Local content like National one, including full compliance with Mobile TV constraints, a nice possibility of bandwidth allocation optimization (Stat Mux) and the simplest way to manage the ESG and CAS. Centralized ESG also guarantees a full description and referencing of all contents. And this architecture allows an easy way to handle multiple Mobile Network Operators for same content and service.
On the other hand, this architecture has the disadvantage to consume more distribution network bandwidth as all content (National + Local) are broadcasted for the central point to all regional points and transmitters. As for Distributed architecture #1, this architecture requires a dedicated product in front of all transmitters. Product which has to make the Local content selection according to the area where it is located.
A way to solve these technical issues is to optimize the centralized head end by putting the maximum of 'intelligence' at this point. For example, there is no need for extra Forward Error Correction on the national distribution network; also, SFN synchronization is be done for all regions simultaneously, ESG is computed simultaneously for all regions as well as all require 'references tables'. This permits to guarantee all Mobile TV constraints from a central point, to verify it easily, as well as deploying Transmitter front end products which are less 'intelligent' (require less processing power) having an as lower as possible price for this equipment.

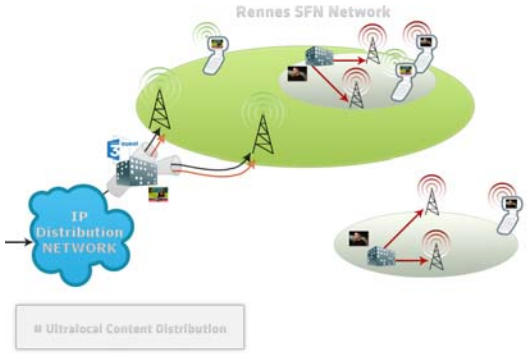
In term of Business model, this architecture does not allow Local content provider to be independent. Local services could be monopolized by one Operator meaning that Local service will not have the possibility to be received by all users.

MOBILE TV – ULTRA LOCAL CONTENT MANAGEMENT

Ultra Local content delivery brings some other issues. Due to its potential high number, global management could be difficult and specific distribution could be complex. As explained before, Ultra Local content must be independent from the Mobil Network Operator. That is why this content could not:

- share the 'main' frequency/network/mux which is linked to an operator.
- be transported by a Mobile Operator network.

Consequence is that Ultra Local content and associated provider must have the possibility to deliver/broadcast their content independently from existing contents/services. This could be done only by using a specific frequency and/or using another technology. It could be feasible that National and Local contents are broadcasted using technology A and Ultra Local content using technology A or technology B.



When technologies are different, the problematic is at the receiver level: having the capability to receive content from multiple ways using multiple technologies / standards on potential different frequencies bands.
For global content delivery, the problematic is at the referencing level. We could not imagine end users having to manually 'scan and search' for new content each time he will enter on a specific area; even if there is panels which indicate that dedicated content is available in this area. We have to find a way to reference content which is not available everywhere and is different on each area. It's another point that forces to not have a centralized management of the Ultra Local content

Such architecture implies that Mobile TV service providers will not be able to validate all the delivered content to its end users and must accept end user terminal to display other services than its selected offer.
In the same philosophy, Ultra Local content could be protected by Conditional Access and ultra local user management system must be available to provide the

users' rights to access to it. For example, entering in a stadium will only allow stadium spectators to watch the dedicated content; in this case, scratch card could be used to provide access code; the CAS must support it and Mobile handset too.

Now, Ultra Local content services could be envisaged. Technical aspects must be clarified and must be found to allow a nice user experience:

- content broadcasting on separate frequency and / or using a different technology
- content referencing in a global way for an easy access
- content protection with 'universal' CAS mechanism (no proprietary solution)
- end user management for content access located to specific area.

CONCLUSION

Mobile TV users request Local content. However, Broadcast Mobile TV technologies bring constraints to services deployment that could enter in conflict with this local content delivery. National and Local services deployment and management can be achieved with special features to comply with Broadcast Mobile TV constraints using centralized architecture or 'special' distributed architecture.

Ultra local contents must be independent from other contents/services; it implies that Ultra local contents must have their own deployment architecture. And independent architecture goes with the problematic to have easy access to this content and content protection.

When FM radios were deployed, it permits to have lot of independent and ultra local audio services. An ideal situation could be to have the same feasibility for video content. Nevertheless, now, Broadcast technologies do not offer the same flexibility; and business model for video are more complex. Adding some advance features to existing one could achieve, in the future, this goal.