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# The eMBMS Puzzle: A Look at the Challenges

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# The eMBMS Puzzle: A Look at the Challenges

Evolved Multimedia Broadcast and Multicast Services (eMBMS) is a mobile wireless technology capable of broadcasting multimedia content over a 4G / LTE spectrum[1]. It is similar to terrestrial or satellite television broadcast in some ways. The difference is that a subscriber need not be restricted to one place to view the broadcast. Additionally, the subscriber has several more choices of content that go beyond traditional television broadcast (e.g. YouTube). However, eMBMS can transmit data in multicast (one sender to multiple receivers) as well as unicast (dedicated channel between sender and receiver) mode while continuing to offer traditional voice and data services. In multicast mode, the network bandwidth consumption is not dependent on the number of users. Given these capabilities, eMBMS should have been making headlines as the lead challenger to traditional television broadcast. But as of now, this isn't the case, suggesting there are challenges before eMBMS can become a real contender for multimedia supremacy. This PoV discusses the challenges hindering large scale eMBMS adoption.

# Deployment Challenges for eMBMS

The technical challenges for eMBMS start with cell planning and capacity to achieving Quality of Service (QoS).

## 1. Cell Planning

**Location:** eMBMS deployments need careful analysis to determine the impact on multimedia delivery as a result of interference from other signals. The location and nature of the MBMS Coordination Entity (MCE)[1] can change network topology. For example, if located within eNB (Evolved Node B[2]), it would limit the MBSFN (multicast-broadcast single frequency network) area to the cells of the eNB. All the cells in this area would have to be highly synchronized in order to ensure the broadcast signal is delivered to all users / devices in an identical manner.

**Coverage:** Indoor coverage in dense urban areas would require small cells to be used for broadcast with macro cells for unicast. This means networks will no longer be homogenous. The difference in the transmission power of the small and macro cells results in users / devices not necessarily connecting to the cell with the lowest path loss. Technically, this means dealing with holes in macro coverage.

**Dynamic Mode:** The network would have to dynamically analyze consumption patterns to switch between broadcast and unicast modes. When the audience for a piece of content is large but geographically concentrated, the broadcast mode is appropriate; when the audience is narrow, sparse or distributed, the unicast mode is appropriate; and when the demand is "clustered", multicast is the right alternative. Predicting and determining the right mix is crucial to optimizing network resources and bandwidth.

**Network Configuration:** The goal for network operators is to reduce the Bit Error Rate (BER)[3] and optimize reception quality. This is dependent on three key attributes which must be kept in mind when implementing eMBMS:

- Cell Power where parameters such as serving cell and neighbor cell, cell selection / re-selection criteria, configuration of offset or hysteresis, handover configuration, DRX configuration etc. play a crucial role and must be configured keeping in mind the eMBMS use case
- Longer Cyclic Prefix (33 us) with a reduced sub carrier spacing to cater to a larger cell radius
- Grouping of cells under MBSFN Service Area, MBSFN Synchronization Area and MSFN Area

## 2. Capacity

**Spectrum Utilization:** Arriving at the right bandwidth allocation for broadcast as a percentage of unicast is a major challenge. Spectrum, a scarce and expensive resource, is the key factor here. eMBMS utilizes part of this spectrum, with every eMBMS cell having broadcast and unicast capabilities. A minimum 40% of the spectrum is always allocated for unicast. The balance between broadcast and unicast is the key to maintain the QoS and for effective utilization of resources. While the broadcast mode optimizes bandwidth usage, enough should be provisioned for unicast services to maintain voice and data QoS.

## 3. Quality of Service

The challenge is to provide consumers with speedy and reliable data in addition to high quality video services. Video is extremely sensitive to latency, resulting in irksome buffering and jittery rendering with degradation in service becoming immediately apparent to the user. The dynamic allocation of bandwidth to broadcast / multicast therefore plays a crucial role in maintaining QoS.

QoS in the mobile world is not easy to maintain. Service interruptions are frequent. And with eMBMS, there can be brief interruptions when users switch channels from one live broadcast (news) to another (sport) or to a subscription-based unicast stream[4]. The solutions to the problem vary, depending on the vendor.

# Business Challenges for eMBMS

The business challenge is to create a revenue model with the right cost, content and price proposition that is superior to existing broadcast channels.

## 1. Use Cases:

Each market is driven by different demographics, cultures and needs. These uniquely determine the provider's strategy, market and relationship with content owners, regulators, ad agencies and broadcaster. In other words, service providers cannot have a single strategy across the entire landscape.

## 2. Business Ecosystem:

Mobile broadcast is not new. In the past it has failed. This is because revenue models were not innovative enough to create a win-win for the entire eco-system of providers, content owners, venue owners, advertisers and enterprises (for M2M scenarios). This challenge needs to be overcome.

### 3. Revenue Model:

Finding the right balance between new revenue streams vs. the existing data and voice driven revenue approach is tricky. It means finding a balance between broadcast and unicast for optimal bandwidth utilization. Broadcast is a channel of additional revenue while traditional voice and data services drive growth. Nothing in the eMBMS adoption strategy should upset this equation. Therefore, designing services around eMBMS with the right partners can hold the answer to success. Creating and sustaining demand for data-intensive applications and rich media content at profitable price points should be the goal. Services required by large number of customers – such as Firmware Over the Air– make an excellent example of monetization strategy through broadcast mode.

### 4. Regulations:

This is a complex area that must be negotiated between various stakeholders for copyright, broadcast rights, licensing and providers for establishing broadcast frameworks and licenses around frequency / spectrum. Regulations differ between geographies, raising different barriers to agreements / standards and legal negotiations.

## Beyond the Challenges

The relentless trend of rising multimedia consumption on mobile devices is going to continue. eMBMS is in a position to efficiently address the multimedia demands of consumers. Technical and business challenges exist, but they are not intractable. What are the resources, skills, partnerships and investments required to resolve them and stay ahead of the curve? Not looking for answers to these questions is a recipe to go out of business. On the other hand, finding the answers quickly is surely a fine way to take the lead and stand out in the industry. Our final paper in this three part series "The eMBMS Puzzle: The gateway to success" provides an interesting perspective on the multiple factors essential for the success of technology.

# References


1. MCE is a node that schedules radio resources and manages eMBMS services

2. eNodeB or eNB is the hardware that connects networks with handsets

3. BER is the parameter that determines the end-to-end performance of data transmission, from transmitters to receivers

4. For those keen on a technical explanation, control signalling and user plane data packet are distributed from the EPC to E-UTRAN through different interfaces. Service interruption perceived by the user is caused by different factors: E-UTRAN, CN and Application

# About the Author

**Vishnu Vardhan Kandan** is a Senior Architect in Modem & Wireless Communication Systems at Wipro.

Vishnu comes with over 17 years of experience in the wireless industry. He has worked across the entire software development lifecycle of cellular modem in 2G & LTE roll-outs as well as in M2M communication.

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