Mobile TV: Technology Developments and Trials

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Delivery Technologies and Business Models for Mobile Television Services
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Mobile TV: A bit of History
T-DMB System
T-DMB Broadcasting

Source: KBS
Mobile Experience is always Exciting

KBS real time TV

KBS Mobile VOD

KBS Mobile Web Site

Mobile Game

Source: KBS, 2005
KBS Mobile

Interactivity

Response

Audience Participation

TV Simulation

Quiz show

Drama

Entertainment show

Multimedia & 3D game

Source: KBS
1-Seg System
1-Seg Concept

**ISDB-T<sub>SB</sub> Transmission**

- **Single-segment**
  - Audio, Data
  - Transmission spectra: 430kHz

- **Triple-segment**
  - Audio, Data, Multi-channel audio
  - Transmission spectra: 1.3MHz

**ISDB-T (full band; television) Transmission**

- **13-segment**
  - One-Seg, HDTV
  - Transmission spectrum: 5.6MHz

- **Partial reception**
  - Digital radio receiver
  - One-Seg receiver
  - Vehicular receiver
  - Stationary receiver
DVB-H System
DVB-H: “Layered” Concept

- DVB family system
- Time slicing - battery saving in receivers
- MPE-FEC - protection at DATA link level
- 4K - network planning flexibility (large SFNs)
- DVB-H delivery in DVB-T multiplexes

Source: DVB
DVB-H IP Multicast

- DVB-H Transmitters
- Multicast IP
- Mobile TV Terminal
- BSC
- SMSC
- SGSN
- GGSN
- Internet
- Service System
- E-Commerce
- IPE Manager
- Stream Encoder
- DVB-H Transmitters
- Content Sources

Source: Nokia
DVB-H Receiver

Nokia 7710*

* Prototype 2005

Source: Nokia
MediaFLO System
MediaFLO Mobile M-M

Mobile solution (2007)

- FLO technology used high power MDS
- Good coverage from single high power transmitter
- OFDM, QPSK / 16 QAM, SFN
- In USA, spectrum allocated 700MHz, L-Band
- Files, multimedia via IP datacasting
- 15-20 video channels (350 kbps), 10 audio streams, 11.8 Mbps in 6 MHz
MediaFLO Services

An Integrated Service Strategy
Tightly integrate Operator’s Multimedia Assets with FLO delivered Base Programming
ATSC Mobile
ATSC 2.0 Mobile

Retrofitting

- DTV broadcast towers retrofitted to deliver mobile TV signal
- Local, full-motion digital TV on multiple mobile devices
- “In-band”, mobile TV as part of ATSC services DTT in 6 MHz channel
ATSC Mobile

https://www.nab.org/mobiletv/learnMore.asp
DVB-T2 Lite System
DVB-T2 Lite: Future Extension Frames

Allows a future system as “FEF” in T2 time slots

- No restrictions in content in FEF
- May use DVB-T2 Lite (mobile, specified subset of DVB-T2)
Fixed, Mobile Services
ISDB-T_{MM} System
NOTTV Service Layout

- **nottv1**: Main channel (Mainly live program will be delivered)
  - 24 hr.

- **nottv NEWS**: 24 hr. news program
  - 24 hr.

- **nottv2**: Sub channel (Additional program will be delivered)
  - 20 hr.

- **Storage type Service**: 

- **High-quality Real Time service**: 

- **13 segments**

- **Digital Contents** (Magazine, Newspaper, Games, Applications, etc.)
  - ●Video/Audio

Source: NOTTV
Receivers

AQUOS PHONE ZETA SH-01F
ARROWS NX F-01F
Xperia™ Z1 SO-01F
GALAXY Note 3 SC-01F
GALAXY J SO-02F
SH-01F DRAGON QUEST
ARROWS Tab F-02F

Source: NOTTV
DTMB
TV System
DTMB System

System Overview

• Supports mobile digital broadcasting
• Bit-rate: 4.813 to 32.486 Mbps
• Time, frequency domain data-processing
• Low-Density Parity Check (LDPC) encoding
• Time Domain Synchronization - OFDM
Main Issues with Mobile TV
Why Mobile Broadcasting did not Fly?

Market issues

- Mobile phone manufacturers reluctant to include chip
  - Cost factor
  - Battery drain
  - Time sharing with calls

- B’caster + Telco joint ventures are rare
  - B’casters offered low revenues
  - Japan: Example of successful joint venture
Mobile did not Fly

Business issues

• B’casters did not develop a viable business model
  – Sat-mobile b’casting services closed down
  – FTA mobile b’casting services do not generate enough revenue

• Telco offer video services
  – Easy to access
  – Paid services
  – But network congestion limits access
Mobile did not Fly

Technical issues

• Mobile broadcasting needs different approach
  – HPHT network unable to meet coverage needs
  – Cellular approach is required to ensure mobile, indoor coverage
  – Capital intensive
  – Most b’casters experimented with HPHT
  – Or combined mobile with DTT
Developments in Mobile Multimedia
ATSC 3.0 (Proposed)
ATSC 3.0 System

New system: Possible FoB System?

- ATSC developing a new standard with advanced performance
- New functionalities
- To maximize point-to-mp broadcasting attribute
- Provide robust mobile services to un-tethered devices
ATSC 3.0 System...2

Features in ATSC 3.0

• Internet Protocol based
• Core technologies with broad international acceptance, global interoperability
• Robust delivery to multiple platforms
• Will accommodate future improvements
• Not backward compatible
ATSC 3.0

Broadcasting becomes part of Internet
ATSC 3.0

OFDM with variable-rate LDPC

Source: ATSC
ATSC 3.0

Better pictures, sound, more services

- Allows UHD and /or HD multicast
- Super-4k – HEVC (18 – 30 Mbps)
- Super-HD – HEVC (8 – 12 Mbps)
- HD – HEVC (3 – 8 Mbps)
- SD – HEVC (1 – 2 Mbps)
- Immersive Audio
ATSC 3.0

HDR, Internet experience, personalized

Source: ATSC
LTE Mobile Offload
LTE Mobile (LMO) in Broadcast

- Technology also known as “Tower Overlay”
- Shifts content payload from cellular Low Power Low Tower (LPLT) networks to large coverage High Power High Tower (HPHT) networks
- Created at Technical University of Braunschweig
• **Key system functionalities of DVB-T2, LTE-A used to realize LMO**
  - DVB-T2: Future Extension Frames (FEF)
  - LTE-A: Carrier Aggregation (CA)

• **LTE-A formatted content inserted into broadcast DVB-T2 multiplex using FEF**

• **LTE in-band signaling (via mobile network) instructs LTE receiver**
  - to receive, decode at broadcast frequency being used
Integration of LTE P-MP carrier into DVB-T2 FEF
LTE Mobile in Broadcast ...

- Will reduce congestion in wireless broadband use in UHF spectrum

- Telcos may partner with broadcasters:
  - Offer fixed services in one channel
  - LMO mobile services in another channel
eMBMS
eMBMS: How it Works

• An add-on to LTE-Unicast, shares LTE technology
  – Same capacity achieving FEC code
  – Supports SFN operation
  – Extended cycling prefix (GI) up to 33 μs
  – Allows anonymous free-to-air reception without Sim card
  – Shares carrier bandwidth flexibly with unicast services (60% for eMBMS)

• Not optimum for covering large areas
eMBMS ..2

- eMBMS enables unicast, broadcast service blending
- eMBMS major advantage
  - Same content can be received by many users simultaneously
- Bandwidth consumption independent of number of users
  - Depends on number of simultaneous channels ‘broadcast’
To maximize bandwidth, eMBMS utilizes three concepts:

- **Time** - eMBMS activation triggers allocation of radio resources on “as-needed” basis
- **Location** - eMBMS can be activated for small geographical locations
- **Resource allocation** - up to 50% for eMBMS transmission
Unicast, Broadcast Service Blending

Mobile Coverage

Source: Fraunhofer
eMBMS: Complementary Service

- Possible scenario: complementary service types
- HPHT serving high-capacity content
- eMBMS cover indoor, mobile environments
- Rooftop reception provided by HPHT
- Back-haul by HPHT transmitter
Impact of eMBMS

Potential impact on mobile broadcasting

• eMBMs will make inroads in point-mp (broadcast) video networks
• Now keen interest from mobile operators
• Service dynamics support live streaming, file-delivery, M2M connectivity, control
• P-to-MP architecture (eMBMS) is part of 3GPP
• Several pilots, trials
Recent Trials
DVB-T2 Lite Trials
Danish T2-Lite Trial

DVB-T2-Lite (2010) UHF

• First phase of the trial: Broadcast from single 100 M high antenna, 600W ERP in Copenhagen

• Mobile TV channels same as those available on DTT UHF channel 35

• T2 Lite as a subset of DVB-T2
Danish T2-Lite Trial ..2

DVB-T2-Lite (2011) VHF

- Trial deploys T2-Lite video, audio content to mobile devices in VHF Band III
- Used 1.7MHz VHF Channel 9D in Greater Copenhagen region
- Included T2-Lite TV and radio channels
- Carried up to 16 PLPs

Source: http://www.connectedtv.eu
India: DVB-T2 Lite Trial

DVB-T2-Lite trials in India

- Classical broadcasting transmission infrastructure - HPHT
- Reception on mobile phones
- Use of dongles

Source: Prasar Bharati
India: Field Measurements

Delhi

Source: Prasar Bharati
India: Field Measurements ..2

Chennai

Source: Prasar Bharati
LMO Trials
LMO Trial

Trial in Paris

• The LTE Megacell Overlay model proven to work using current DVB-T2 system
• Possibility for incorporation into other advanced systems (e.g. ATSC 3.0)
• Partners: GatesAir, T U of Braunschweig, TDF, RAI, IRT, some others
eMBMS Trials
Qualcomm LTE Broadcast Demo at CES

At CES 2013

• High-quality live and non-real-time media services over LTE broadcast (eMBMS) enabled networks.

• With Verizon, Ericsson
Ericsson LTE Broadcast Tests

In Poland 2014

• With Polkomtel, streaming 2014 World Volleyball Championship to 300 selected guests in Warsaw

• Devices received several video feeds
  – sports match replay
  – sporting network news
  – horse racing coverage
  – large files using the single LTE Broadcast channel
Verizon-Ericsson at Indy

**In US 2014**

- United States’ first LTE Multicast (emBMS) over commercial 4G LTE network
- Live video from trackside, in-car cameras and real-time information
- LTE Multicast in ultra-dense user environment showcases ideal deployment scenario

Source: Verizon
eMBMS trial in Netherlands

Amsterdam

• KPN-Ericsson trial first live LTE broadcast in Amsterdam Arena football stadium
• Objective: Deliver high quality video to large groups of people
• Qualcomm, Samsung, IBM joined video delivery in mobile networks
AT&T Demo in Dallas

US 2014

- College football in Stadium
- 85000 spectators at the game
- 4G network broadcast simultaneously to multiple users on mobile devices, 6.4 TB
- Capturing, sharing in real-time scenes with compatible devices
- Viewers see game from many camera angles
- Catch replays
Huawei, Vodafone in Kiel:
eLTE, eMBMS

Germany 2014

• Kieler Woche international sailing event
• 4G-based broadband integrates voice, video and data
• Distributed base stations set-up across race course (sea) for live footage captured by smart phones
• Audience got close-ups, not otherwise possible
Telestra starts LTE Broadcast Channels

Australia May 2015

• Telstra started enabling permanent LTE Broadcast channels at key venues, major events
• Initially for testing, customer access on compatible devices
• eMBMS trials by Telstra show 3 or 4 video (and data) channels can be streamed with HEVC
• Uses 10 % of 20MHz carrier to cover all users
Ericsson-Singtel Pilot LTE Broadcast

Singapore June 2015

- The first end-to-end LTE Broadcast (eMBMS) trial in Singapore uses commercial network
- SEA Games: Live broadcasts of sporting event
- eMBMS, HEVC, MPEG DASH enabled efficient, high quality media services over LTE
Ericsson-Singtel Pilot LTE Broadcast- eMBMS

- Enhanced end-user experience by highest-quality video content, guaranteed delivery (no buffering)
- Served mobile devices in dense areas where unicast cannot cope

Source: Ericsson
Other Use Cases

Other use cases that can create new business opportunities

• TV terminals inside elevators, waiting halls, airports, bus stops for location-based media services

• Content delivery to automobile screens, software updates

• Digital signage for periodic media updates

• Emergency alerts, news, updates

• Displays in stadiums for in-venue media services
Finally

• eMBMS will enable commercial deployment of entertainment services over LTE for mass market
• Allow operators to drive new revenue streams
• Partner content owners can meet demands for exceptional video experience
• Efficiently utilize available LTE spectrum, network resources
## My Introduction

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<tr>
<th>Role and Position</th>
<th>Duration</th>
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<tr>
<td>Former Director Technology, Asia-Pacific Broadcasting Union (20 years)</td>
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<tr>
<td>General Manager, Telecommunication Consultants India</td>
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<tr>
<td>Senior Director Engineering, Doordarshan India, Public TV broadcaster (23 years)</td>
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<tr>
<td>Prof. of TV Operations, Film and TV Institute of India</td>
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<td>Former Vice-Chair, World Broadcasting Unions-TC, Steering Board Member, DRM, World DMB Forum</td>
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<tr>
<td>Senior Expert ITU: RASCOM, DTV, DR, EWS Editorial Board, IJDTV</td>
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<tr>
<td>Advisor Tech &amp; International Relations, CEO, Prasar Bharati, India</td>
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THANK YOU
FOR YOUR ATTENTION