Mobile TV: Technology Developments and Trials

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NBTC/ITU Asia-Pacific Regional Seminar

Delivery Technologies and Business Models for Mobile Television Services

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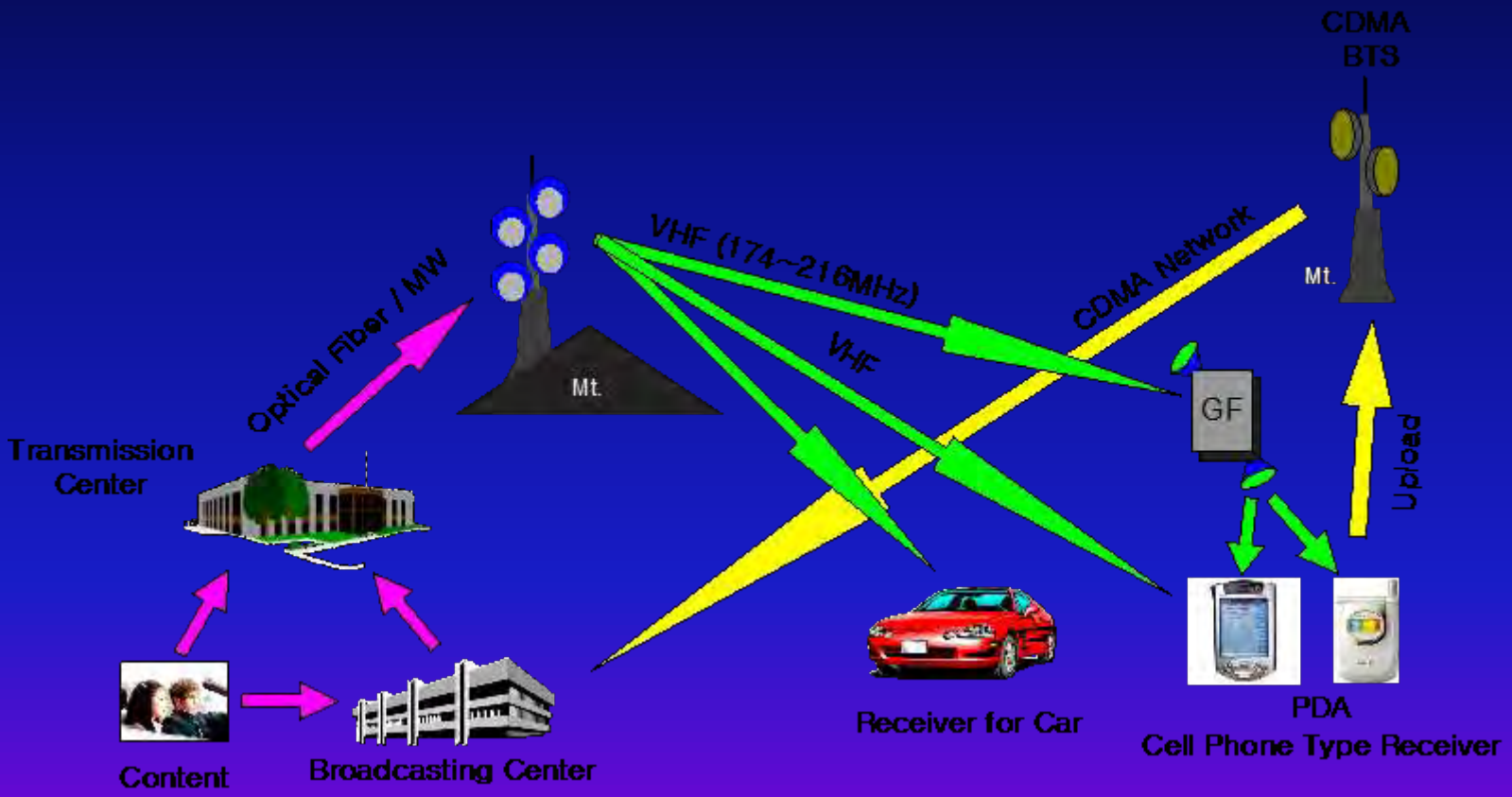
Mobile TV:
A bit of History

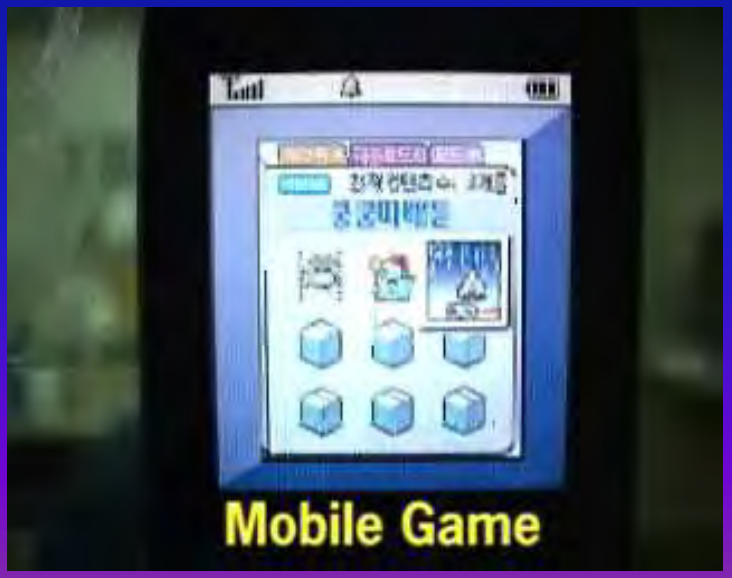
T-DMB System

T-DMB Broadcasting



Source: KBS

Mobile Experience is always Exciting



Source: KBS, 2005

KBS Mobile

Interactivity

Audience Participation

Response

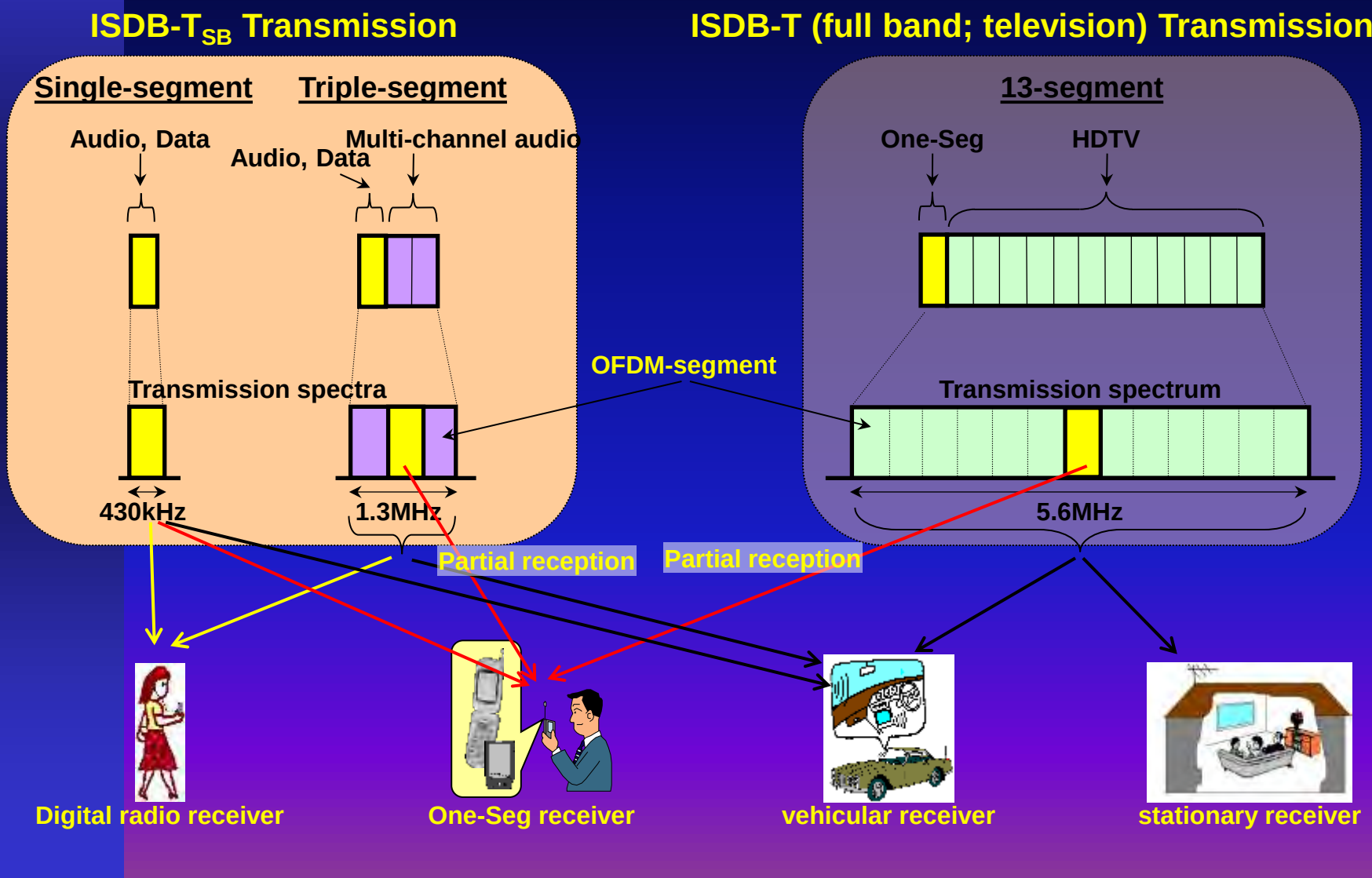
TV Simulation

- Quiz show
- Drama
- Entertainment show
- Multimedia & 3D game

Source: KBS

1-Seg System

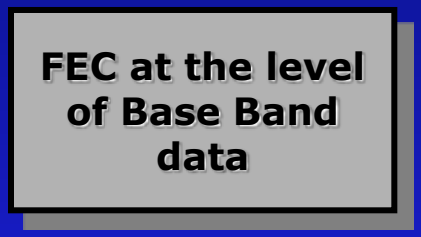
1-Seg Concept



DVB-H System

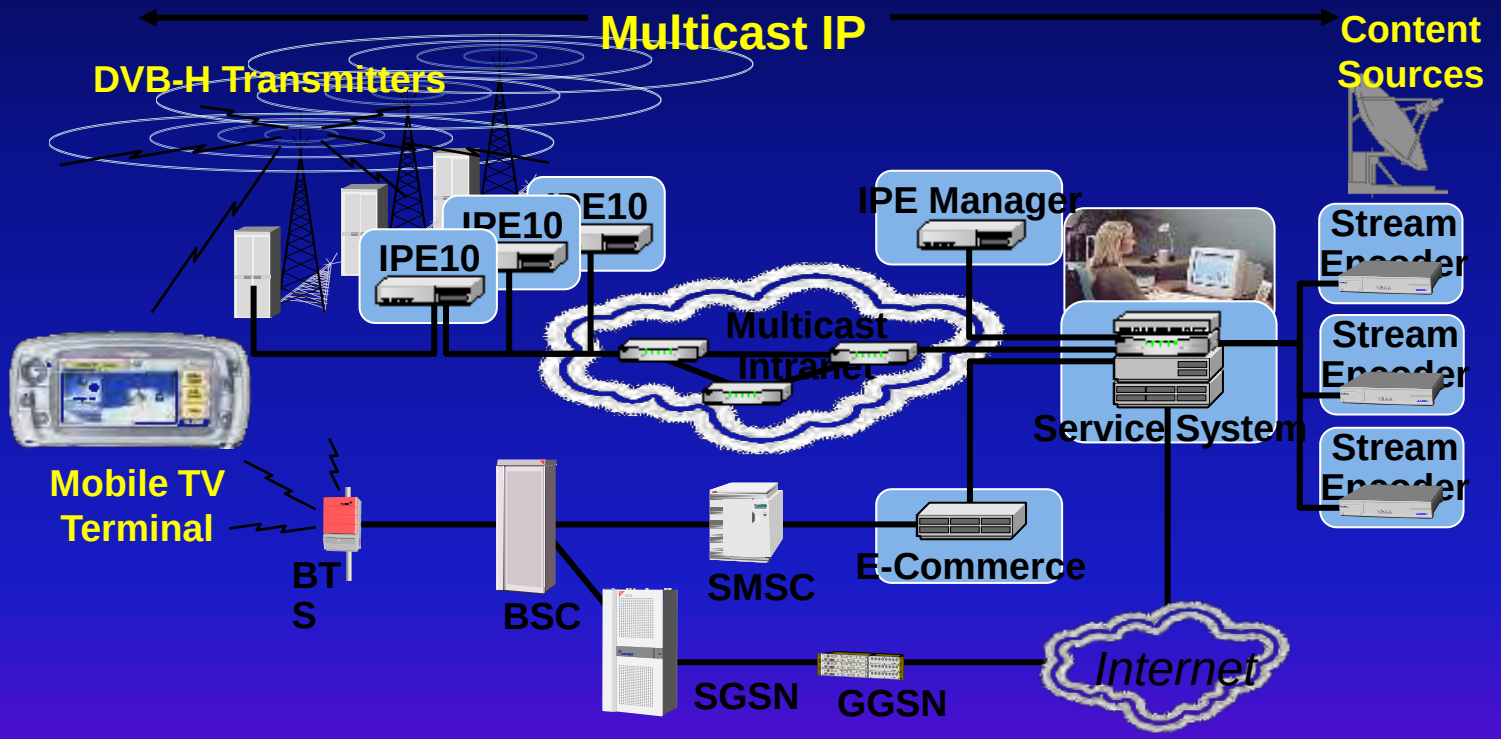
DVB-H: “Layered” Concept

- 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



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

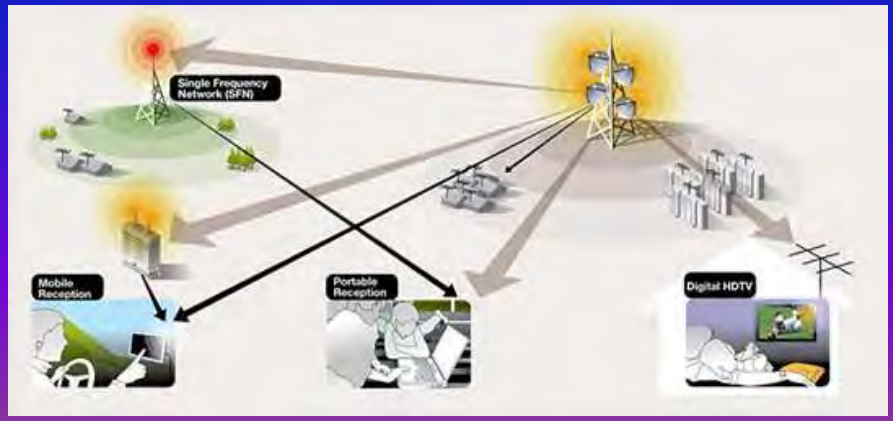
Source: Qualcomm

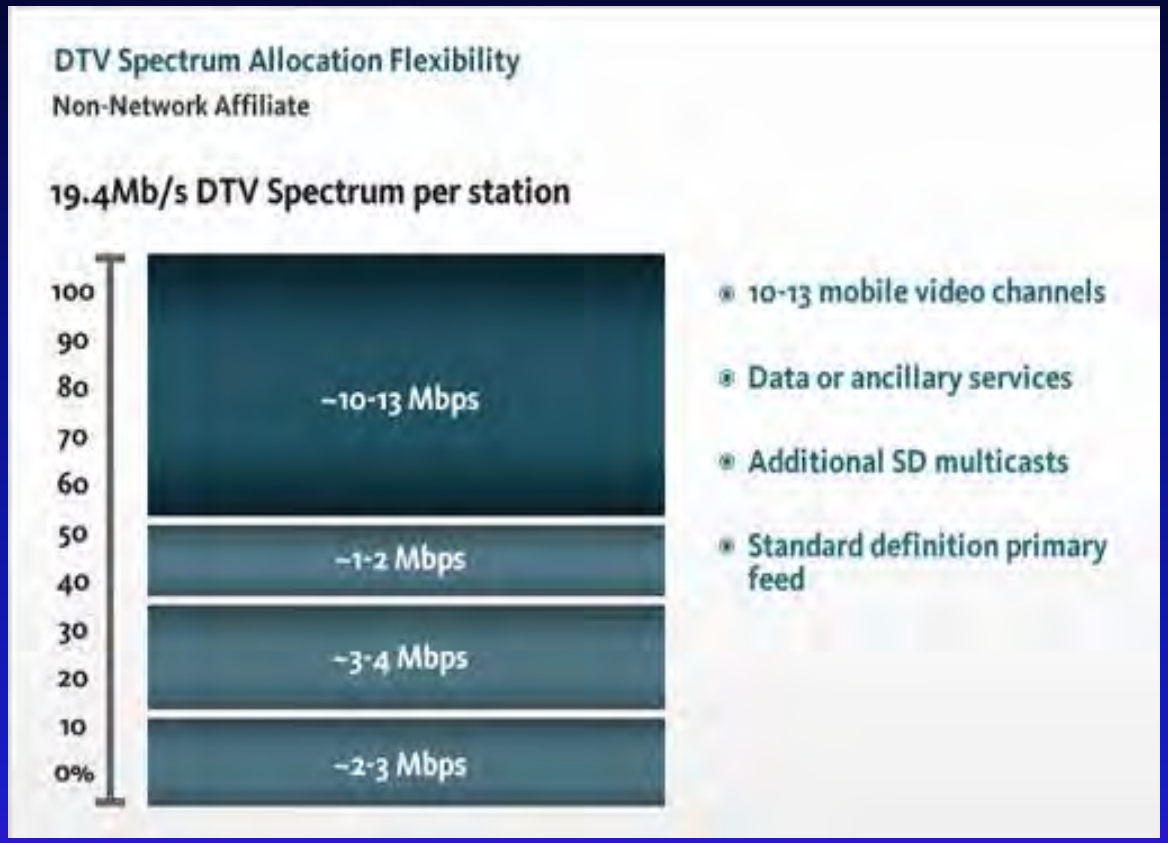
ATSC Mobile

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

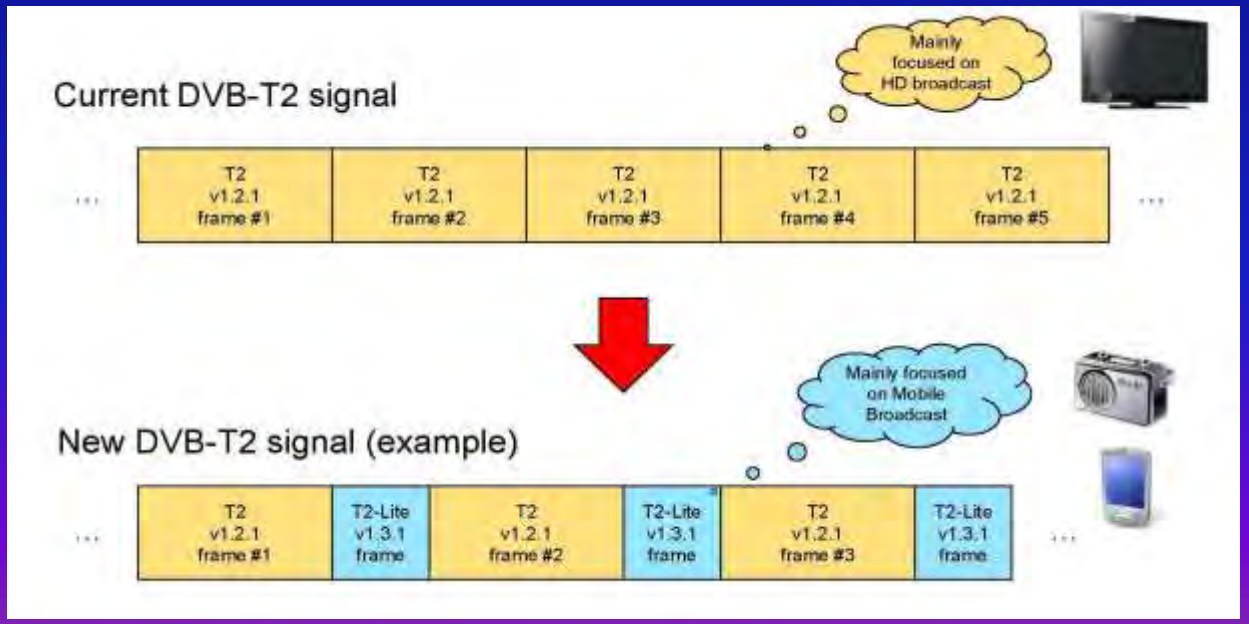
https://www.nab.org/mobiletv/learnMore.asp

DVB-T2 Lite System

DVB-T2 Lite: Future Extension Frames

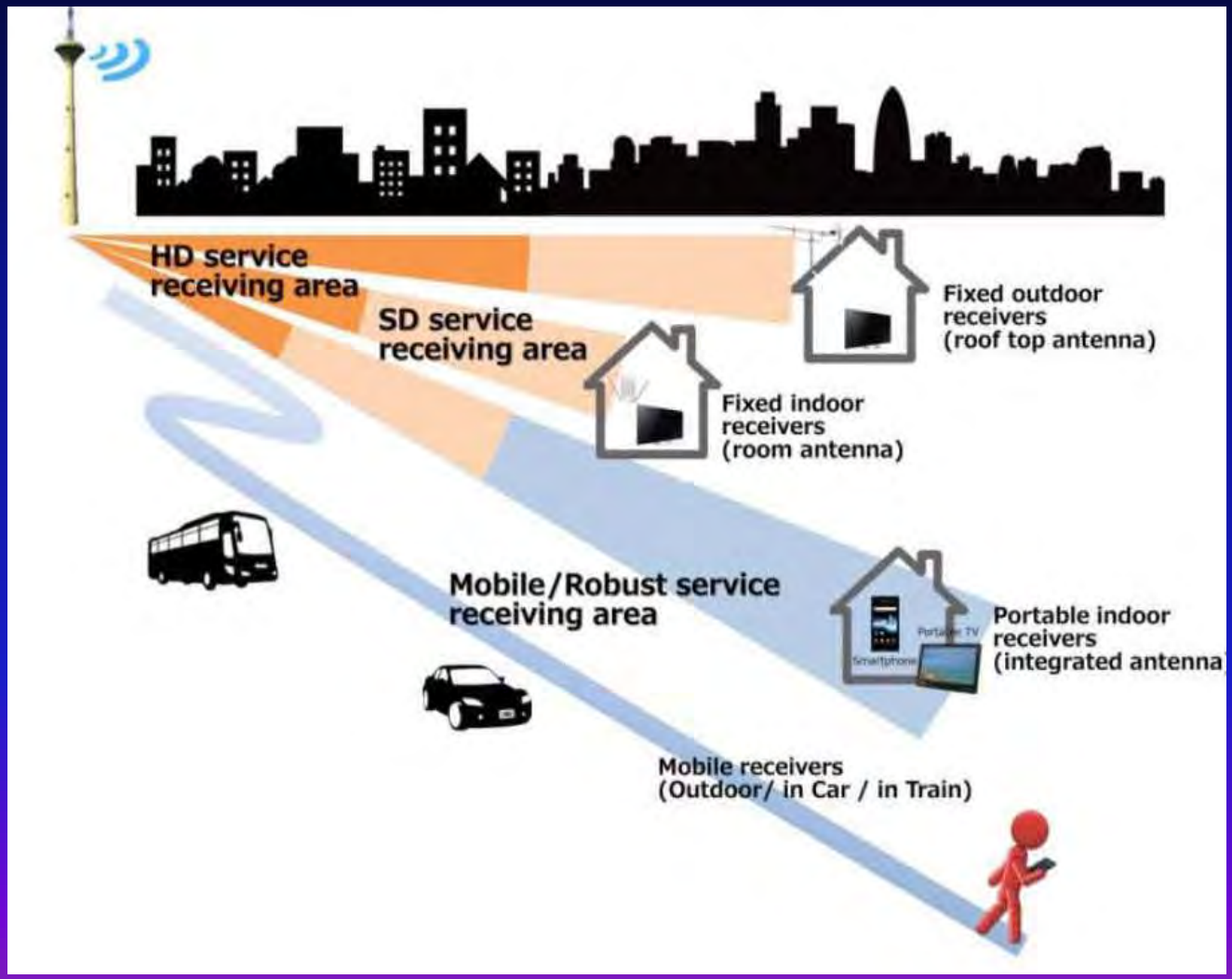
Allows a future system as "FEF" in T2 time slots

- **No restrictions in content in FEF**
- **May use DVB-T2 Lite (mobile, specified subset of DVB-T2)**



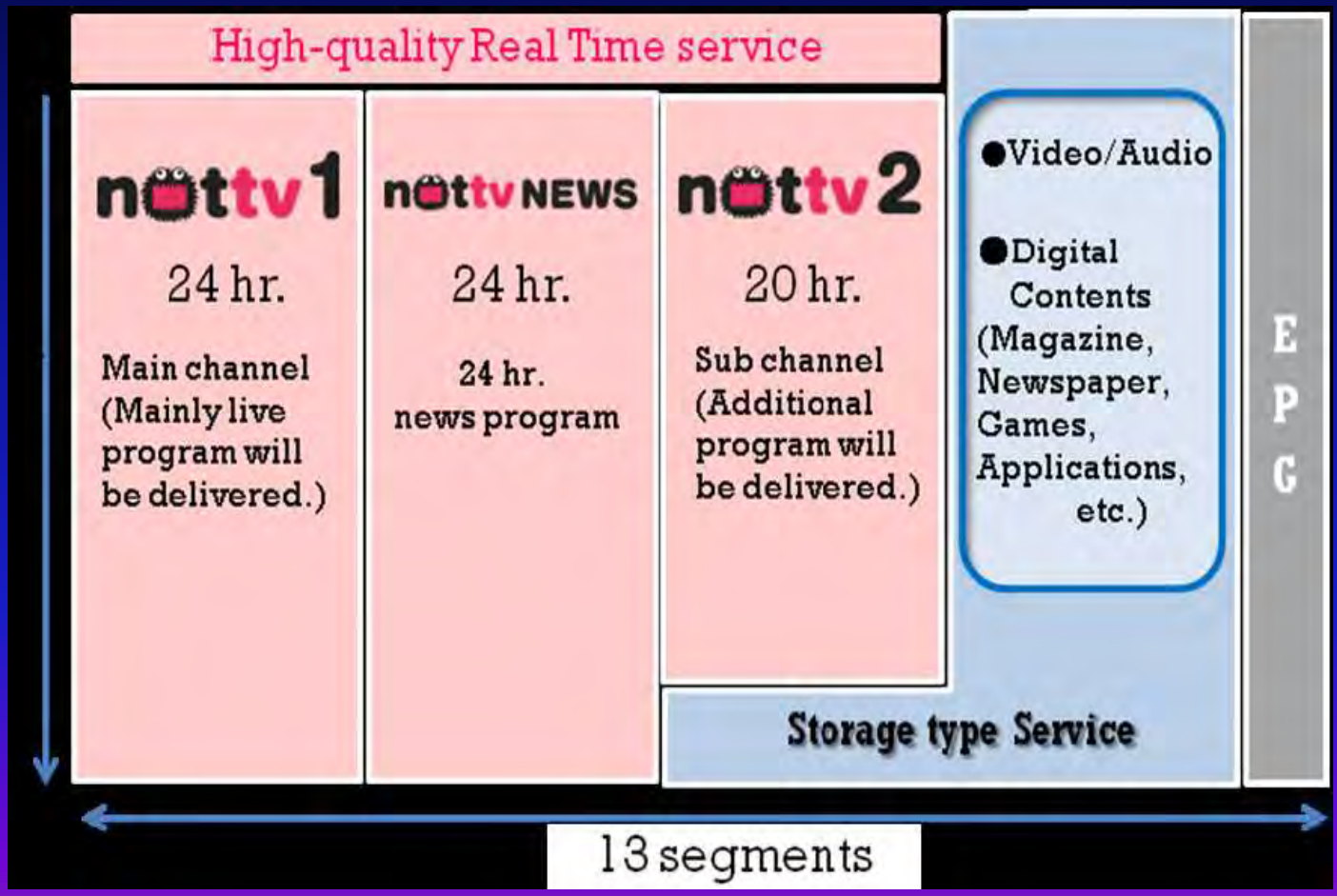
Source: DVB

Fixed, Mobile Services



ISDB-T_{MM} System

NOTTV Service Layout



Source: NOTTV

Receivers

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**

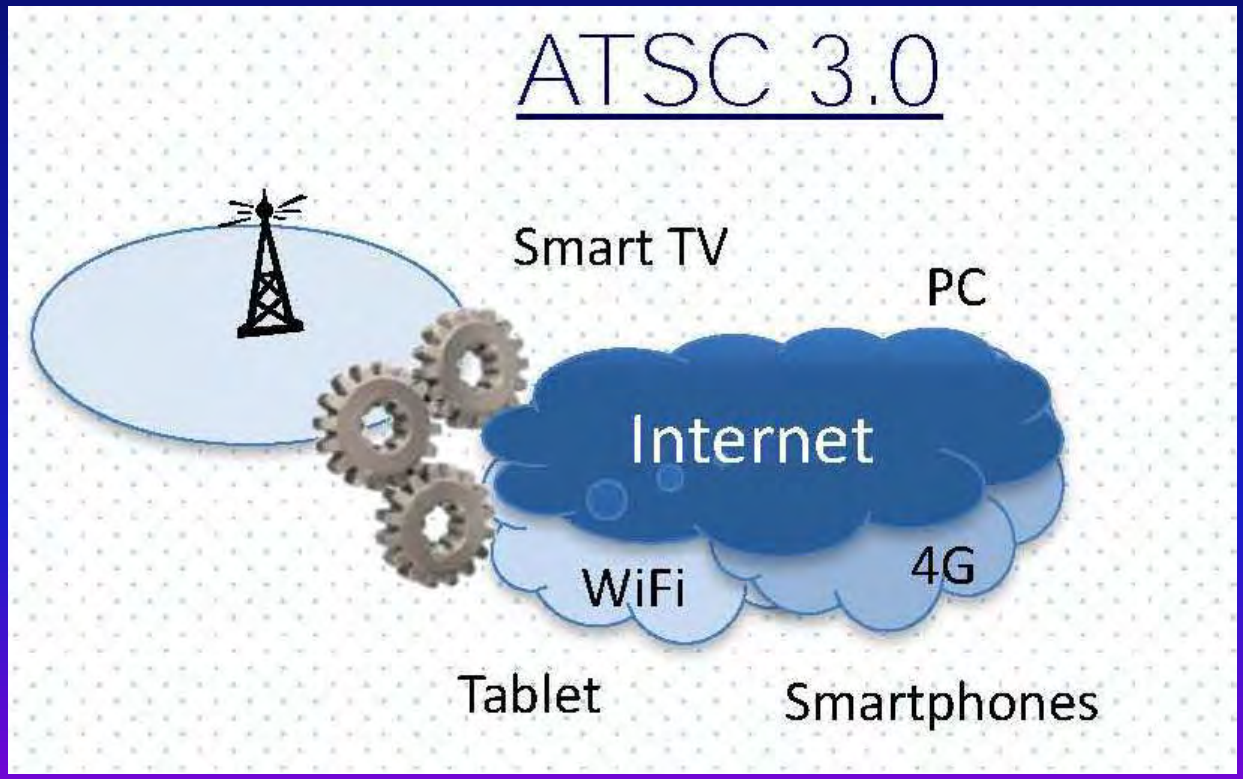
ATSC 3.0 System..2

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

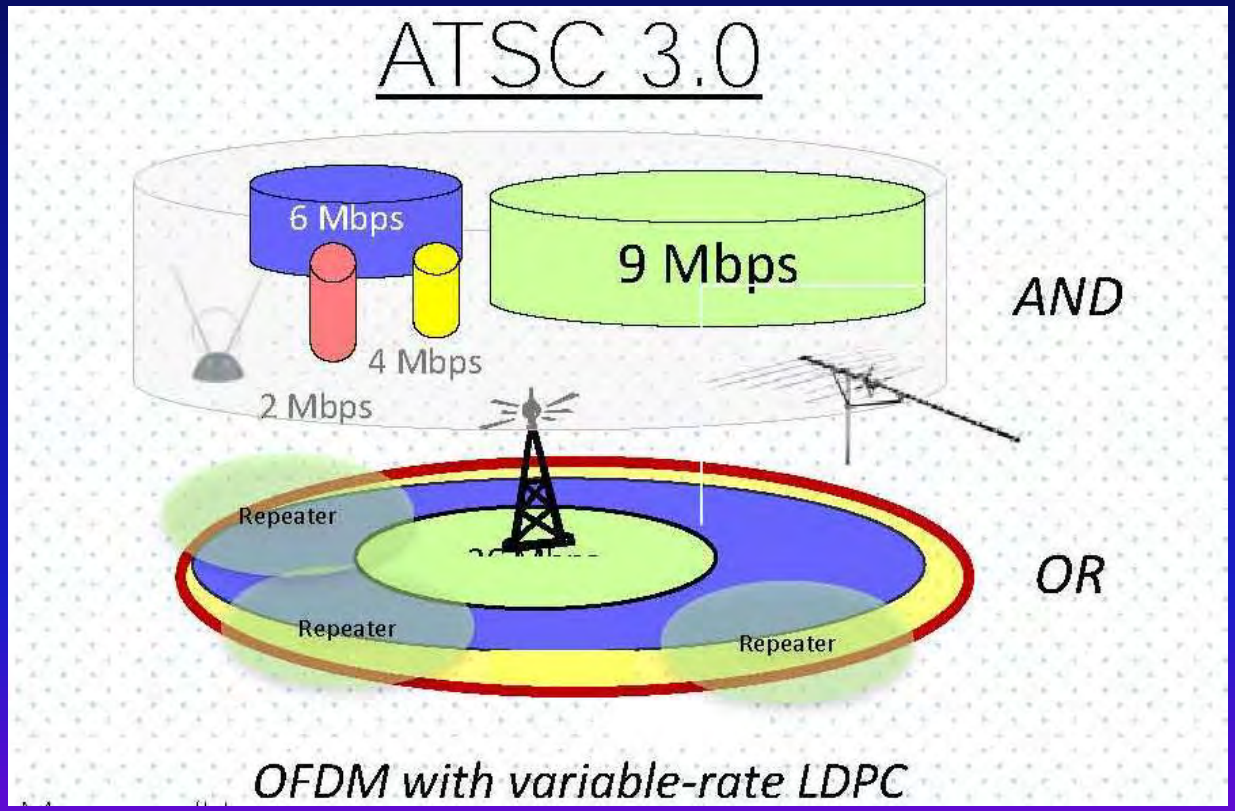
ATSC 3.0

Broadcasting becomes part of Internet



Source: ATSC

ATSC 3.0



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

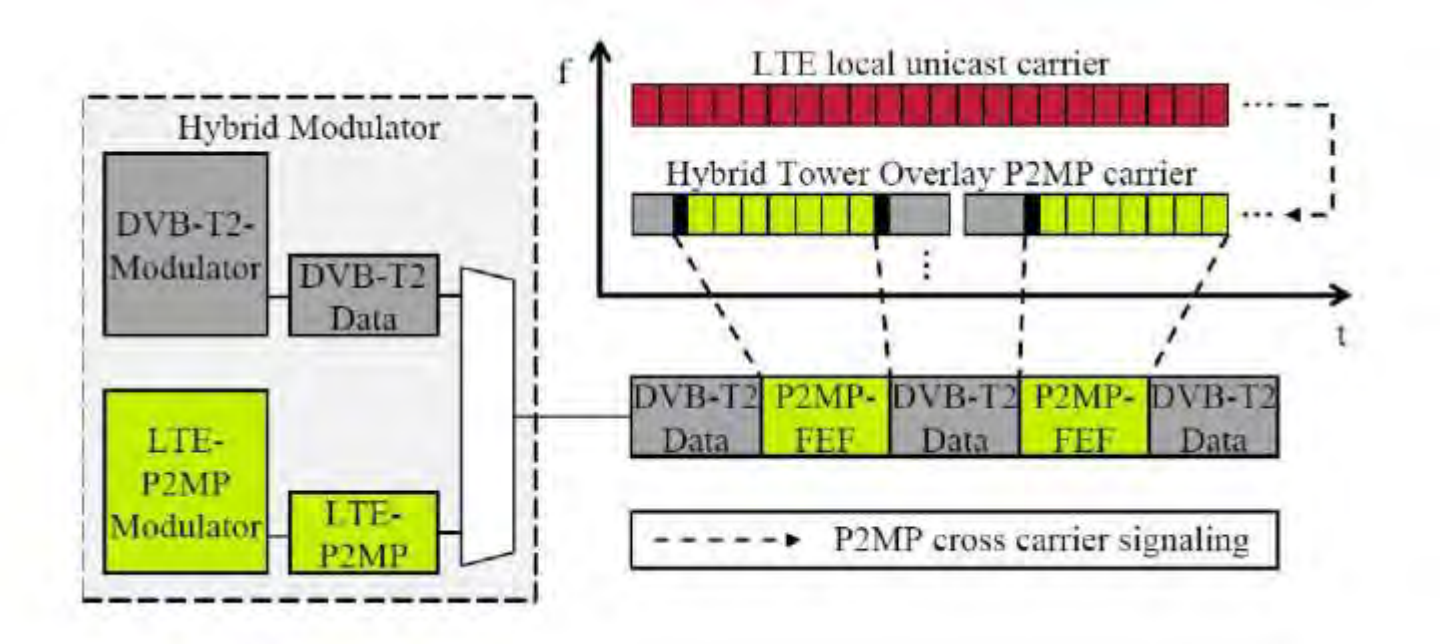
LTE Mobile (LMO) in Broadcast

- 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

LTE Mobile in Broadcast … 2

- **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**

LMO Modulator Transmitter



Integration of LTE P-MP carrier into DVB-T2 FEF

Source: Gates Air

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

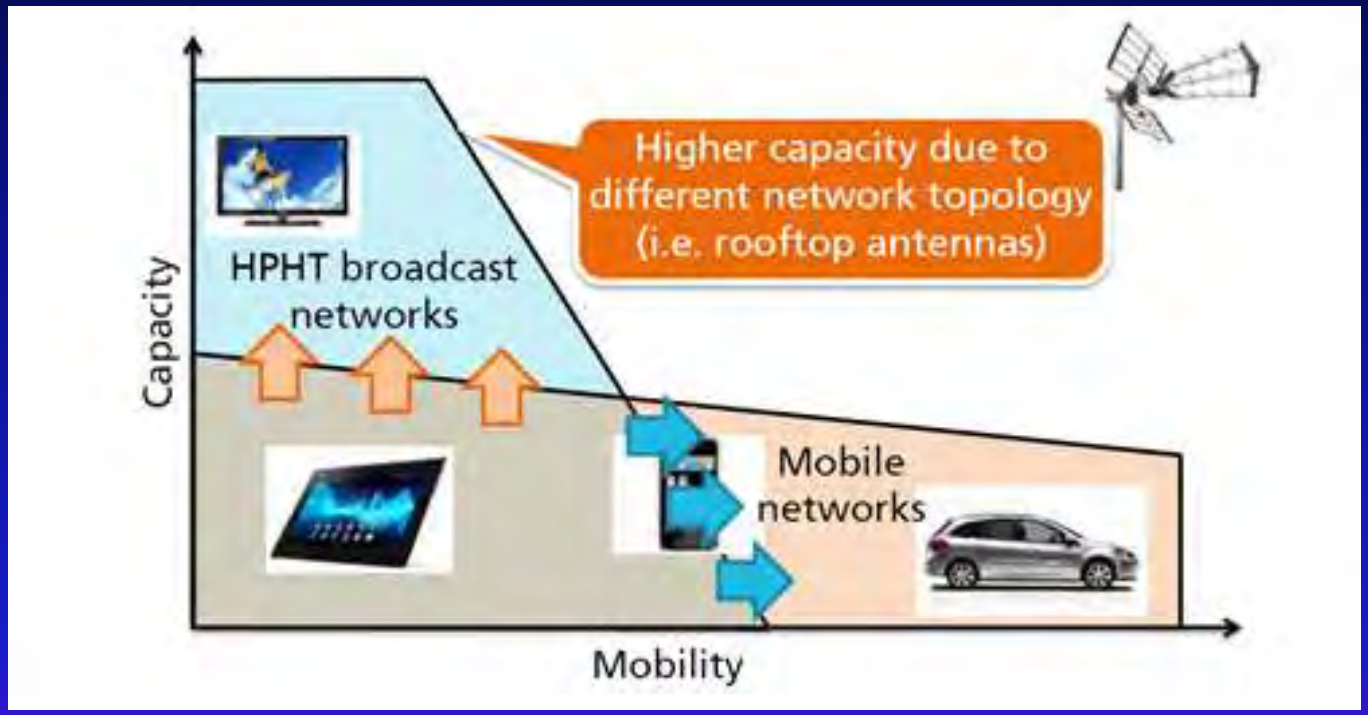
eMBMS ..2

- 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’

eMBMS ..3

- 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

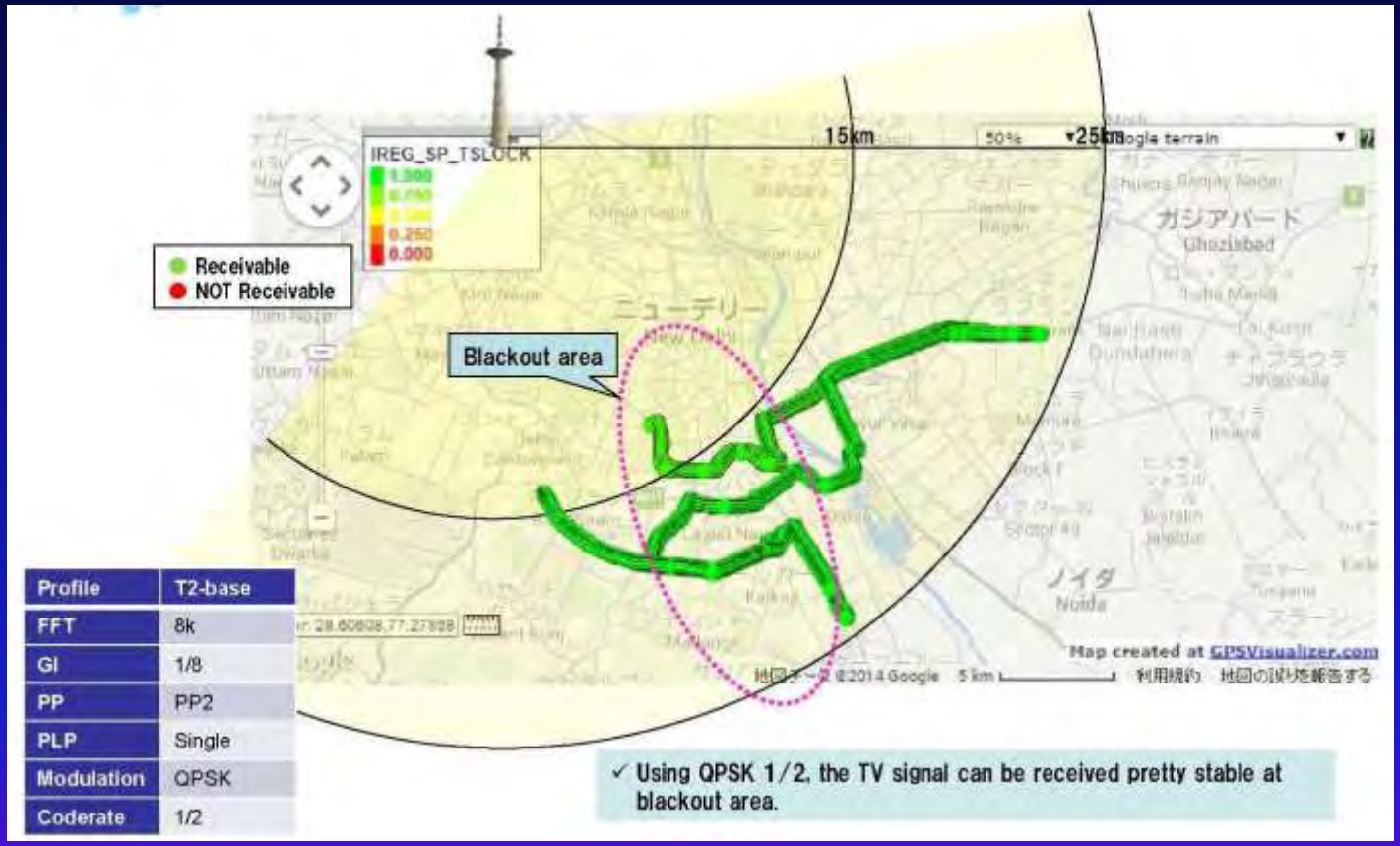
India: DVB-T2 Lite Trial

DVB-T2-Lite trials in India

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

Source: Prasar Bharati

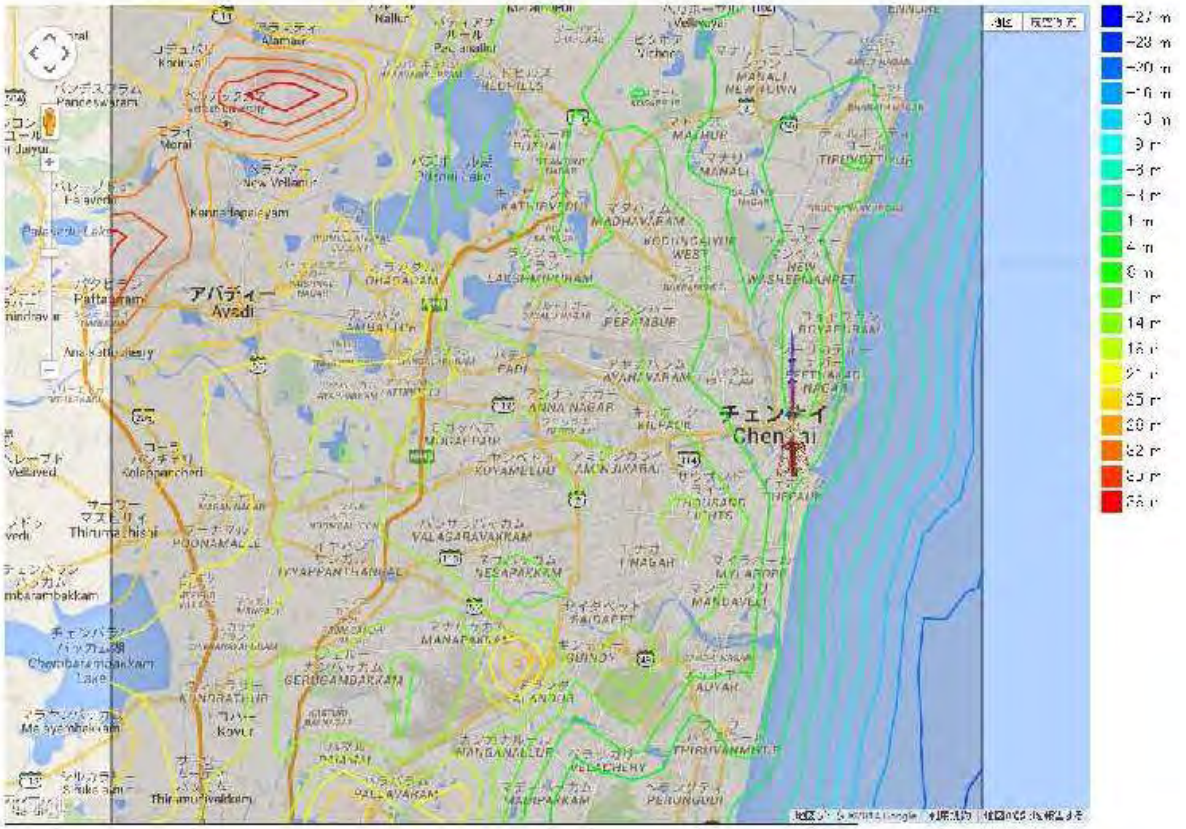
India: Field Measurements



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 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

- Former Director Technology, Asia-Pacific Broadcasting Union (20 years)
- General Manager, Telecommunication Consultants India
- Senior Director Engineering, Doordarshan India, Public TV broadcaster (23 years)
- Prof. of TV Operations, Film and TV Institute of India
- Former Vice-Chair, World Broadcasting Unions-TC, Steering Board Member, DRM, World DMB Forum
- Senior Expert ITU: RASCOM, DTV, DR, EWS Editorial Board, IJDTV
- Advisor Tech & International Relations, CEO, Prasar Bharati, India

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