NABSHOW®

Where Content Comes to Life

EXHIBITS: APRIL 14-17, 2024 | EDUCATION: APRIL 13-17

LAS VEGAS, NV

How IP-based broadcast meets 5G for resilient and sustainable media distribution

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SESSION: APPLICATION OF 5G IN BROADCASTING

Apr 15, 2024, 3:00 pm - 4:00 pm @ West Hall W222-W223

What is this paper all about?

To shed light on initiatives targeting interworking – rather than convergence – of broadcast and mobile systems, whether at the system core, on the RF level or on the service layer.

To provide some perspective on what those initiatives could lead to.

The Problem: Merge, Interwork or Compete?

DTT standards evolved towards IP-based approaches and multimedia broadcasting

- Initially targeting fixed television, but progressively attempting to include mobile devices
- Broadcast now interlinks with broadband for enhanced services (e.g., HbbTV)
- Modern IP-based DTT standards (e.g., ATSC 3.0, DVB-NIP/T2), designed for both fixed and mobile reception, make the distinction between DTT and multimedia broadcasting systems vanish

3GPP standards incorporated multicast and broadcast capabilities

- Initially tailored for mobile point-to-point bidirectional communication
- The shift in demand towards streaming led to cellular broadcast technologies and ultimately 5G Broadcast
- 5G Broadcast now has the potential to play a role in DTT delivery among the already well-established DTT systems

Riverbanks are getting closer but seem unlikely to merge

Clear limits are set in stone, e.g., the physical layer

Overview of the Paper

1 Broadcasting Standards' Road to IP, Multimedia and Mobile

- First-Generation DTT Standards: The First Building Blocks
- Second-Generation DTT Standards: Paving the Way for Multimedia Broadcasting
  - Incl.: latest IP-based standards: ATSC 3.0 and DVB Native IP (DVB-NIP) combined with DVB-T2

2 3GPP's Path Towards Broadcast and the UHF Band

- 5G Broadcast's Foundations and Variants
- 5G Broadcast Features and Value Proposition
- Prospects and Challenges for 5G Broadcast
- 5G Media Streaming (5GMS)

My focus today

3 Ongoing Initiatives and Perspectives for Interworking

- ATSC's Global Harmonization Efforts
- Interworking at the System Core – ATSC Broadcast Core Network
- Coexistence at the RF Level – Time Division Multiplexing
- Interworking at the Service Layer – DVB-I over 5G

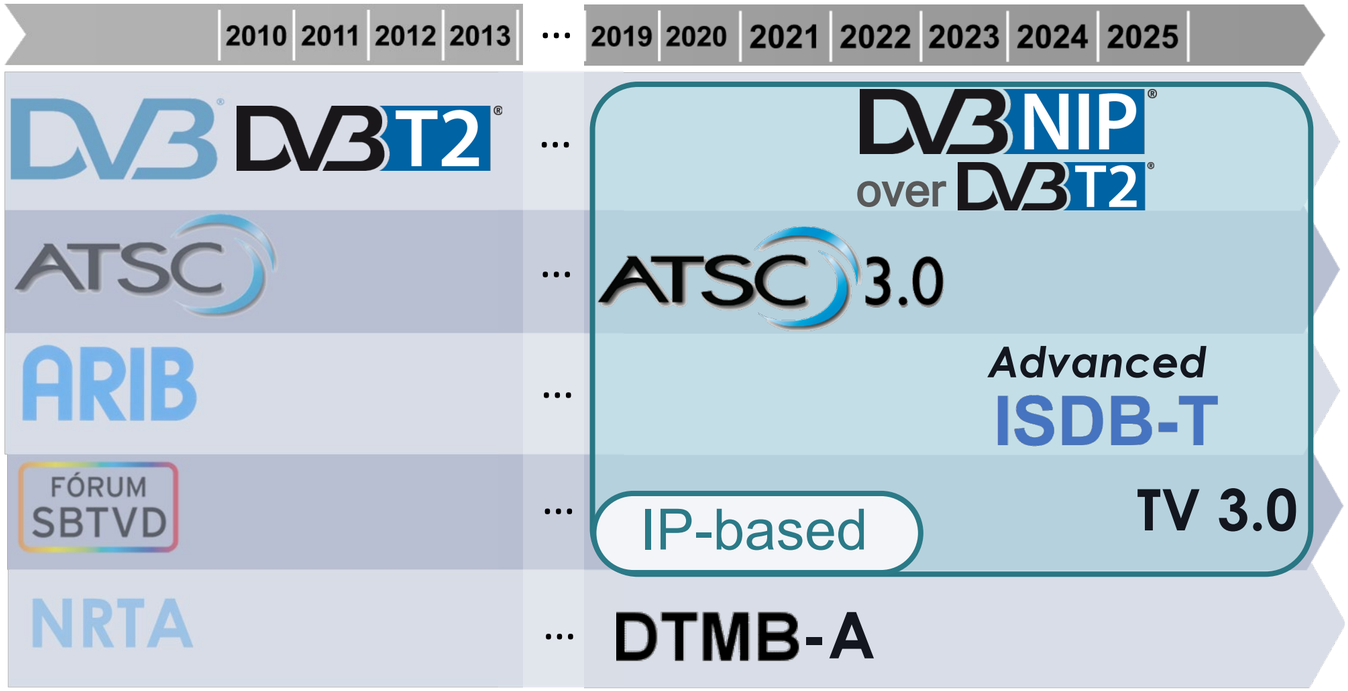
1 Broadcasting Standards' Road to IP, Multimedia and Mobile

- First-Generation DTT Standards: The First Building Blocks
- Second-Generation DTT Standards:
  Paving the Way for Multimedia Broadcasting
  - ➔Latest IP-based standards: ATSC 3.0 and DVB Native IP (DVB-NIP/T2)

2nd Gen DTT Standards are Designed for both Fixed and Mobile

Setting the scene for the momentum towards alignment with mobile systems

- **DVB-T2/T2-Lite** trials showed satisfactory performance but the lack of ecosystem support hindered market adoption
- The first fully IP-based DTT, **ATSC 3.0**, is trialed alongside 5G Broadcast for direct to mobile (D2M) reception in India, ATSC 3.0 shows higher spectral efficiency compared to 5G Broadcast (which requires 40% to 150% more sites)
- **DVB-NIP** combined with **DVB-T2** is close to ATSC 3.0 in terms of its RF performance and in having an IP-based core



- 2nd generation DTT sytems are the most **efficient** physical layers for one-to-many delivery, and rely on **resilient** infrastructure

Despite technological advances, major challenges remain for market adoption

- Mobile devices must integrate specialized hardware that varies from region to region
- Users' ability to consume free-to-air content on mobiles disrupts MNO business models

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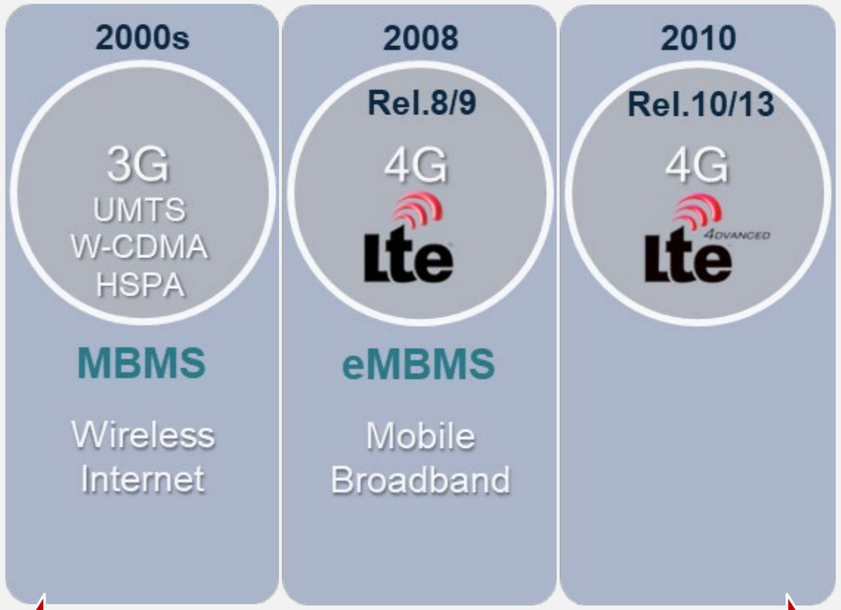
3GPP's Path Towards Broadcast and the UHF Band

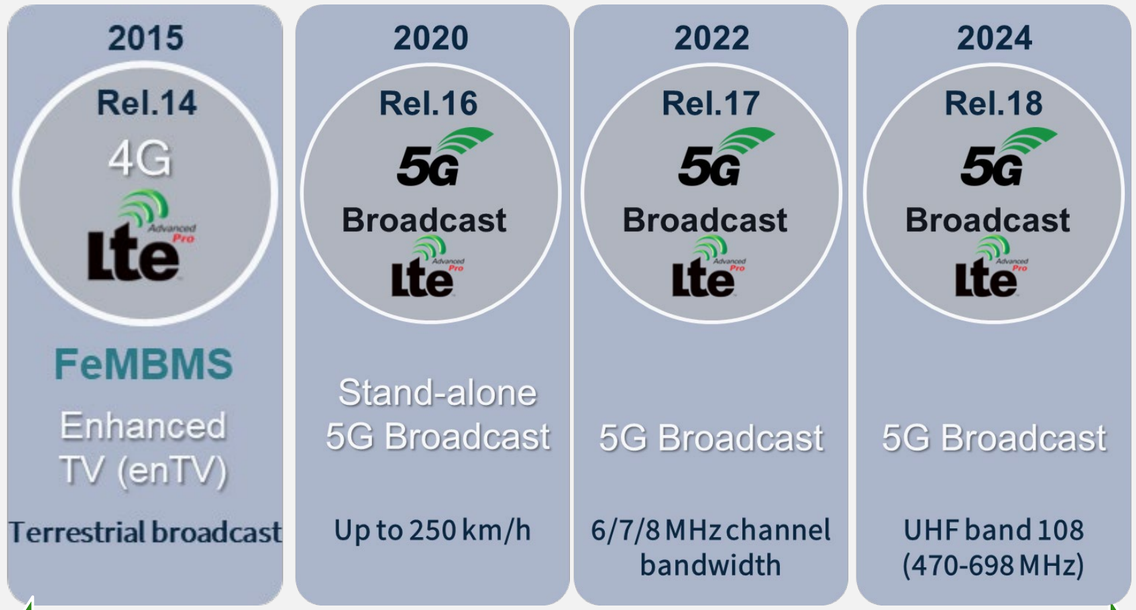
Cellular broadcast technologies evolved across several generations

- MBMS (Multimedia Broadcast/Multicast Service) dates to the days of 3G
- eMBMS (evolved MBMS) leverages 4G's new LTE radio access technology (wireless broadband)



Focus on cellular operators' market

- FeMBMS (Further evolved MBMS) leverages LTE-Advanced (Enhanced-TV) that meets most of broadcasters' requirements for digital terrestrial television broadcasting
- Rel. 16: LTE-based 5G Broadcast independent from cellular networks for downlink-only traffic, using High Power High Towers
- Rel. 17/18: enables broadcast deployments using UHF spectrum



Target expanded to broadcasters' market

5G Media Streaming (5GMS) versus 5G Broadcast

- Unlike 5G Broadcast, 5GMS relates to **operator spectrum** (IMT) and **cellular infrastructure** (low power)
- From Rel. 16, **5GMS allows 5G networks to be used by third parties** (other than MNOs) for media delivery over **unicast**, providing opportunities for collaboration beyond merely acting as a bit pipe
- From Rel. 18, 5GMS also incorporates **Multicast/Broadcast**-delivered media using 5G New Radio (NR)

5G Media Streaming

Operator spectrum

Cellular infrastructure

Low Power
Low Towers
(LPLT)

Unicast

Multicast/Broadcast

LTE-based 5G Broadcast

Broadcast spectrum

Broadcast infrastructure

High Power
High Towers
(HPHT)

Broadcast downlink-only traffic

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3 Ongoing Initiatives and Perspectives for Interworking

- Interworking at the System Core: ATSC Broadcast Core Network
- Coexistence at the RF Level: Time Division Multiplexing
- Interworking at the Service Layer: DVB-I over 5G

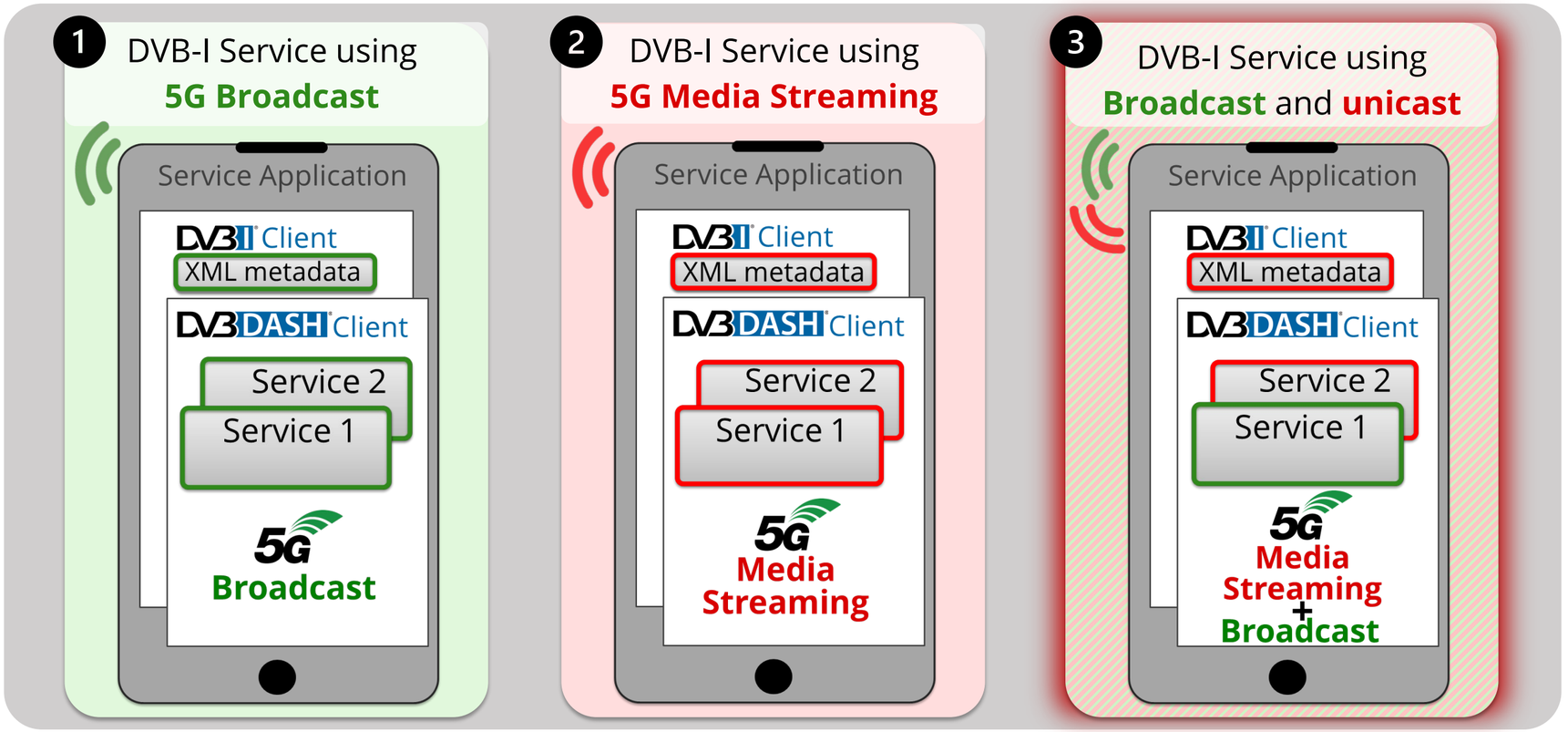
Instead of replacing one system with another, these initiatives aim at creating an environment in which the systems can co-exist independently or cooperatively

Interworking at the Service Layer – DVB-I over 5G (1/2)

DVB standardizes the service aspects of 5G (for 5G Broadcast & 5GMS)

- In July 2021, DVB published commercial requirements for '**DVB-I over 5G**' (BlueBook C100)
- A joint DVB & 5G-MAG task force wrote deployment guidelines, published as ETSI TR 103 972
- This defines a 'DVB-I over 5G' reference architecture, with **three scenarios**:

***DVB-I** (Internet)*
Network-agnostic ***service layer*** *defining the metadata for service discovery* ***via internet***



5G Broadcast
(DTT spectrum)

5GMS
(IMT spectrum)

Interworking at the Service Layer – DVB-I over 5G (2/2)

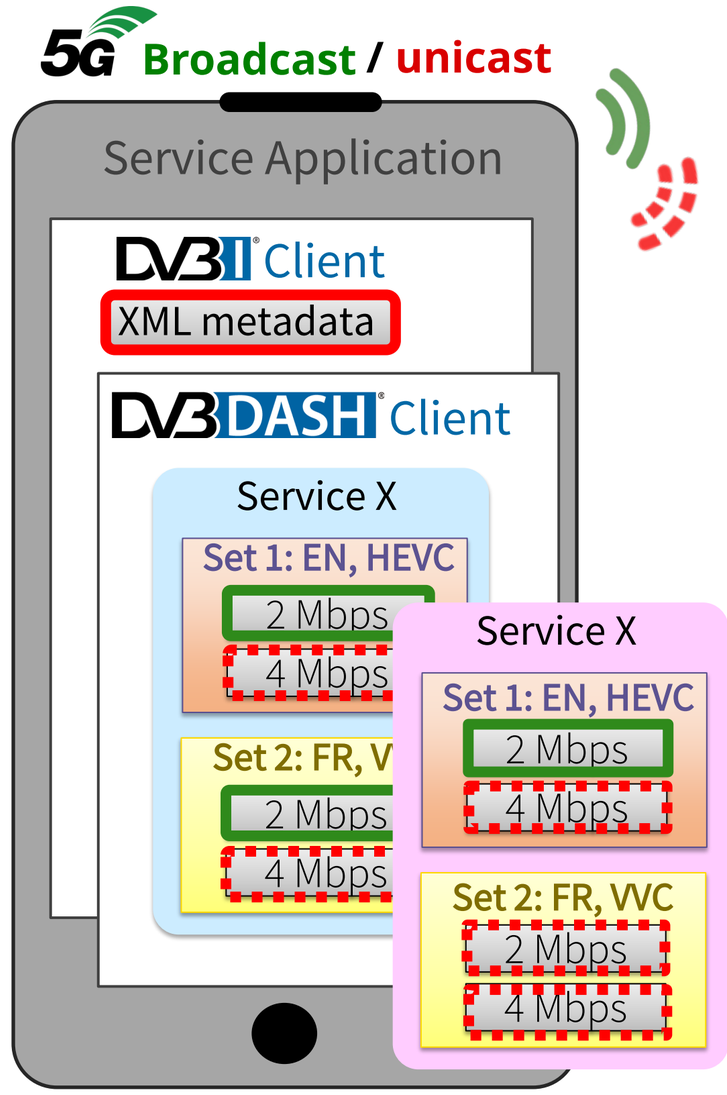
Scenario ❸ Hybrid service offerings – Use cases

The service is available on both 5G Broadcast and unicast, but only one bitrate, i.e, DASH *Representation*, of each instance, i.e., DASH *Adaptation Sets* (combinations of languages, codecs etc.) is on 5G Broadcast.

- **Session continuity**: The receiver consumes broadcast content when possible but when out of coverage, it uses unicast adaptive streaming,
- **Time-shifted viewing**: The content is retained on unicast for a period to support time-shifted access.

The service is available on both 5G Broadcast and unicast, but some instances of the service are only available via unicast.

- **Component replacement** enables enhanced offerings like additional languages, improved accessibility features, etc.
- **Content replacement**, when more alternatives of the content exist (potentially temporarily) via unicast, enables:
  - ✓ **Enhanced venue casting** (video feed sent from various cameras),
  - ✓ **Dynamic offloading** of unicast mobile networks to 5G Broadcast.

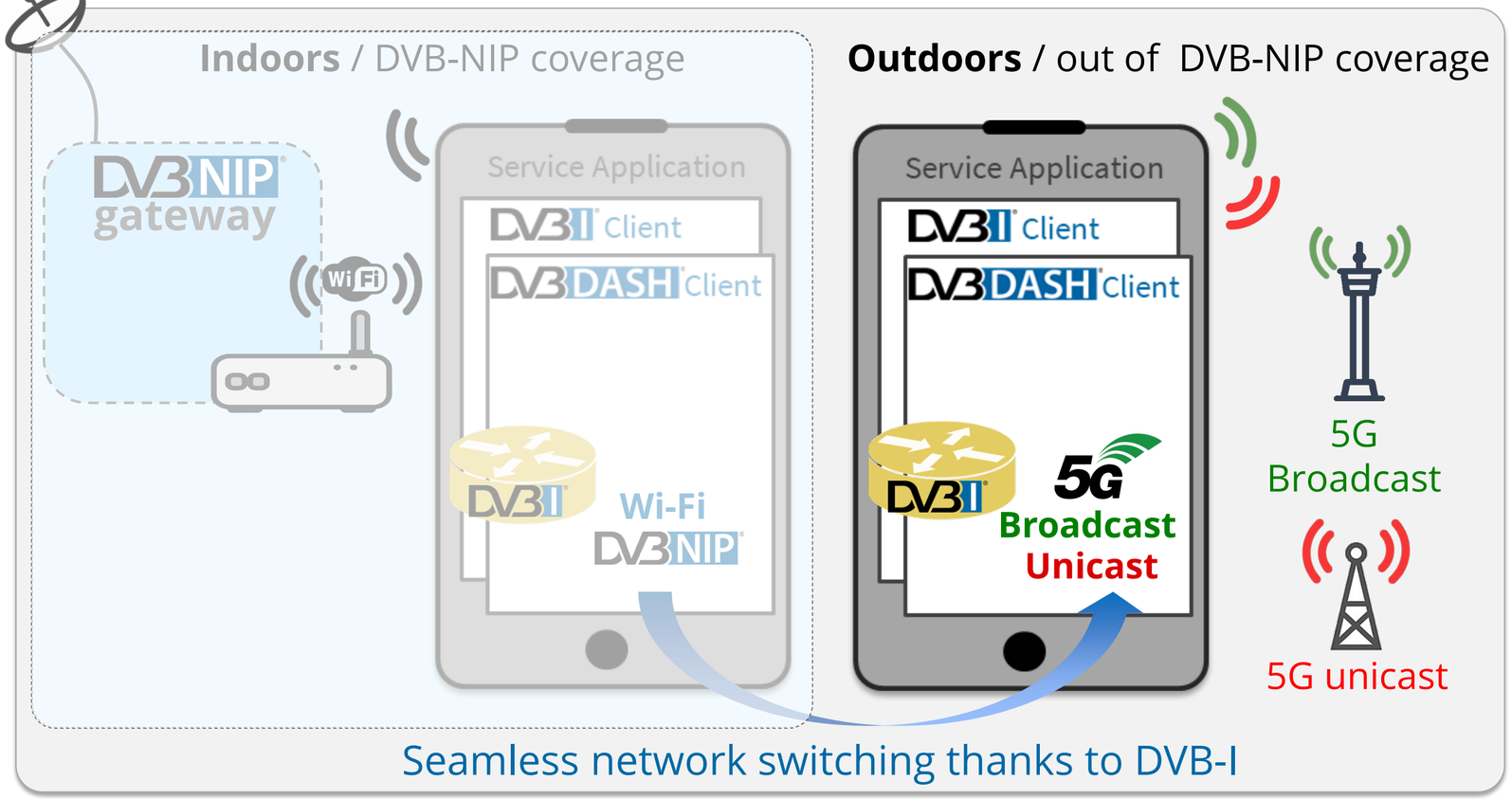


Interworking at the Service Layer – Adding DVB-NIP

A promising use case: DVB-I bridging satellite and 5G delivery

DVB Native IP broadcasting (DVB-NIP) can be used to **ensure indoor reception** for mobile devices through Wi-Fi hotspots, removing the need to include indoor coverage in the 5G link budget .

- **Reduces the number of towers** needed to cover a given target reception area
- **Leverages the existing infrastructure** and well-proven DVB-S2 networks
- Compatible with **legacy devices,** aiding migration paths



Note: DVB-NIP can also be used to feed 5G networks

Enhanced venue casting… by DALL-E

So, merge, interwork or compete? Interwork!

A standardized service layer for 5G

- ‘DVB-I over 5G’ allows LTE-based and NR-based 5G networks to carry services with an appropriate – standardized & ‘TV-friendly’ – service layer, which is a prerequisite for commercial success.

Using networks for their own strengths

- Being able to seamlessly switch between 5G Broadcast and 5G NR as appropriate, thanks to DVB-I, offers new opportunities for content monetization and mobile network optimization.

- The interworking of 5G delivery and DVB-NIP (combined with DVB-T2 or S2/S2X) enables deployment scenarios where networks can complement each other for their own strengths and facilitate migration journeys.

Thanks! Questions?

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