Technical Report EBU Part IV

5G FOR THE DISTRIBUTION OF AUDIOVISUAL MEDIA CONTENT AND SERVICES

This report elaborates on the potential of 5G to facilitate the distribution of the whole range of PSM services to portable and mobile devices. It is a result of collaboration between stakeholders in the media sector, including public and commercial broadcasters, broadcast and telecom network operators, equipment manufacturers, and technology providers. Hence, the views presented in the report do not necessarily reflect a formal position of the EBU or any of the contributing parties.
The report addresses 5G network deployment opportunities for the distribution of media services. Even though the media industry, led by the EBU, successfully engaged in the standardization of 5G, in particular 5G Broadcast, this does not guarantee that all standardised features will inevitably be implemented in 5G networks and devices. The scope and timing of market deployment of a particular feature are largely driven by the existing or expected market demand.

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5. 5G Deployment Opportunities

§ 2 outlines three categories of content and services that media companies provide today i.e. linear, nonlinear and hybrid. All these services could, in principle, be delivered by 5G, particularly given 5G's features to distribute AV media, including unicast, multicast and broadcast.

The following discusses the ability of 5G to deliver the three service categories while fulfilling the requirements set out in § 2.4. Three different 5G deployment options are investigated: 5G Broadcast alone, 5G Mobile Broadband including multicast / broadcast and 5G Media Streaming Architecture and a combination of 5G Broadcast and Mobile Broadband.

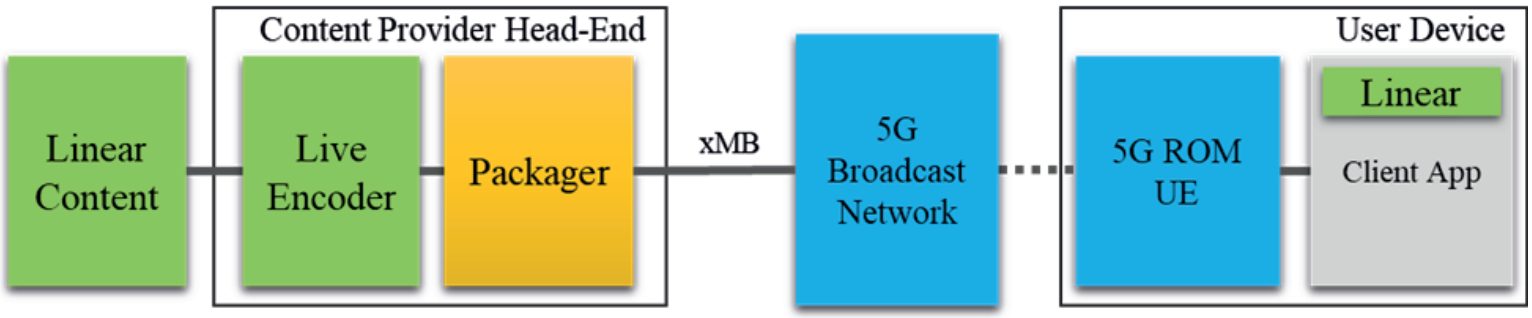

Figure 9: Distribution chain using 5G Broadcast

5.1 5G Broadcast Distribution

This section investigates the ability of 5G Broadcast to deliver linear services to compatible devices including smartphones, tablets, vehicles, and conventional TV sets. As 5G Broadcast was specifically designed for this purpose, 5G Broadcast may, in general, fulfil the requirements of § 2.4 in a similar manner to conventional terrestrial broadcast technologies. The following subsections provide additional details.

Figure 9 depicts the distribution chain to model 5G Broadcast. Note the possibility for the service provider to directly interface with the network operator.

5.1.1 Universal Coverage and Universal Access

5G Broadcast could, in principle, enable the distribution of linear services to audiences of a national scale in the same way as existing broadcasting technologies (e.g. DVB T2 and DAB) do today. The extent of coverage would depend on the data rate (i.e. video or audio) and quality of the content being transmitted (i.e. SD/HD), the number of programmes / channels, the audio / video codec, the receiving environment and the network, as is the case with other terrestrial broadcasting technology. 5G Broadcast networks would normally be envisaged as being configured in SFN mode, as this is a cornerstone of this technology. Removing the need of an uplink makes coverage limited by only the downlink.

5G Broadcast defines operation modes targeting fixed, portable and mobile reception. Where portable and mobile reception is possible, stationary reception is possible as well. This means that a wide range of devices (e.g. fixed TV and smartphones) could be reached from a single transmission network, should it be appropriately designed.

Annex C indicates that it is much more challenging to deliver content to handheld mobile devices, particularly if they are indoors, compared to rooftop receiving antenna – the link budget to handheld devices is very onerous. Although such analyses are highly dependent on the circumstances at hand, the network simulations in Annex C reveal that universal indoor coverage to handheld devices would likely require very dense LPLT networks. Universal coverage of mobile handheld devices out of doors would also likely require an element of LPLT networks particularly in areas further from the transmitters – conventional MPMT and HPHT broadcast infrastructure alone does not appear to be adequate for near universal coverage. Car mounted antenna reception or fixed roof top benefit from a more favourable link budget.

LPLT sites exist for mobile networks and could be also used for 5G Broadcast transmission. In some countries, mobile network sites are owned by tower rental companies which also may have a broadcast network business.

Nevertheless, universal coverage is network dependent and could be achieved through the combination of appropriate transmission modes and network design. However, the cost of networks that may be required to provide, in particular, indoor coverage would need to be carefully considered. More intensive infrastructure sharing between BNOs and MNOs could alleviate costs related to network densification for both parties.

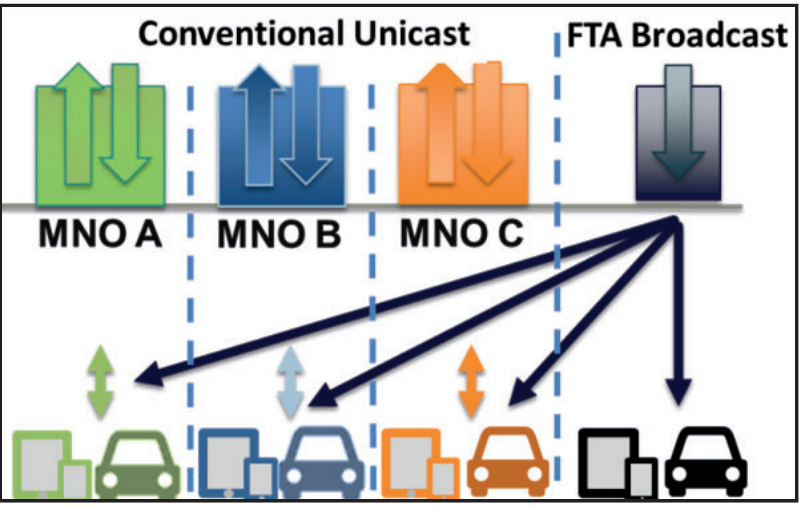

Figure 10: Universal access provided by a single FTA broadcast network

5.1.2 Free to air (FTA) Access

5G Broadcast specifies receive only mode operation which enables content to be delivered without an uplink, SIM card or subscription to an operator or service. Free to air reception without a SIM card is thus possible. Provided that the FTA broadcast network were extensive enough to provide universal coverage, universal access could also be provided for the linear services from a single network as the 5G Broadcast signal could be received by all compatible devices regardless of the MNO network to which they subscribe (or even if they have no network subscription or SIM card). Figure 10 illustrates the concept. The FTA broadcast network could either be operated by the media content provider, or a third party (e.g. an MNO or BNO).

5.1.3 Defined Quality of Service (QoS)

5G Broadcast would allow the QoS for linear services to be set by the service provider, as it is done today in broadcasting networks. 5G Broadcast defines an interface (xMB) between service provider and the network. The "transport only" mode enables service distribution without transcoding and the injection of multicast IP sources, which can be defined by the service provider together with the receiving application. The system supports external content formats defined by TV / radio broadcasting standardization organizations to be delivered over IP (e.g. MPEG TS over IP). The system reserves capacity on the radio access for the provision of services with a dedicated and constant amount of capacity / resources. In principle the QoS could therefore be defined by the content provider and guaranteed across the network.

5.1.4 Scalability

5G Broadcast allows the delivery of linear services at a national scale with defined QoS. 5G Broadcast creates an end to end broadcast distribution path with reserved capacity in the core and radio access networks. An unlimited number of users may receive the broadcast content as its delivery is anonymous and independent of audience size.

5.1.5 Service Integrity

5G Broadcast allows the service integrity of the linear services to be guaranteed with the transport only mode which passes content through the network unaltered. For example, a multiplex of linear TV programmes carried as an MPEG transport stream can be passed through the network by encapsulating the signal as an IP stream delivered over 5G Broadcast and unpacking on the receiving device.

5.1.6 Prominence

5G Broadcast would allow the prominence of linear services within an application to be guaranteed by the design of the application, particularly if designed by the service provider. However, should apps be made available through third party app stores (e.g. android and apple stores), due prominence may require additional measures, such as appropriate regulation, particularly for PSM companies.

5.1.7 Ease of Use

5G Broadcast would allow the 'ease of use' of linear services for consumers to be defined by the design of

applications running on the end user device. For application developers, a new eMBMS Application Programming Interface (MBMS API) was introduced primarily for developers of web and user applications to simplify access to eMBMS procedures.
However, to download and update apps, it is likely that an additional internet connection would be required.

5.1.8 Accessibility

5G Broadcast would allow accessibility content for linear services to be provided in the same format that is used for TV and radio broadcasting standards today. The display of such features on user devices may be defined by the design of the applications.

5.1.9 Public Warning

5G Broadcast would allow the reliability of linear broadcast services under emergency situations to be defined by the network design. The 5G Broadcast system use of dedicated resources for the provision of services guarantees their availability across the core and radio access networks, independent of other sources of traffic.

5.1.10 Encryption and Copy Protection

Television programmes that are encrypted and digitally transmitted using the DVB broadcast standard can classically be received by users with receivers and conditional access modules (CAM), mostly a CI+ Module. Meanwhile also TVs and STBs with embedded CA Systems, equipped with build in CA System chipsets, are available for specific platform products. In this case, users do not have to purchase a CI+ Module and can register online to access the encrypted programs.

5G Broadcast is basically an IP-based System that can include an MPEG 2 TS. For 5G Broadcast devices integrating a CI slot or CA Systems chipsets, existing encryption technologies can also be used (up to implementation but 5G Broadcast can support signalling in the MPEG 2 TS).
Future 5G Mobile devices such as smartphones and tablets will unlikely have a CI slot, also they might not support CAMs in different form factors, e.g. USB.
Alternative solutions for the decryption of encrypted 5G Broadcast signals are needed, some approaches could be:

-> Integration of CA System chipsets in mobile devices.
-> Solutions also applicable to TS where the CA System is applied by means of an App and connection to the internet.
-> Combination of MPEG2 TS delivery with unicast DRM protection systems.

This issue requires further analysis, it might also be useful to have a look at how standards with a high degree of IP integration (e.g. ATSC3.0) deal or will deal with the issue.

5.1.11 Targeted Advertising and Personalization

Enabling commercial propositions such as targeted advertising is mandatory for future distribution networks.
In this context one major use case to be realized by 5G Broadcast is dynamic ad substitution (DAS). For this purpose, it is expected that adverts (or other types of content) can be downloaded and pre stored on devices for later insertion and it is assumed that the following requirements are met:
-> Seamless switching between broadcast and pre stored content will be possible.
-> Placement opportunities can be signalled frame accurately.
-> A parallel bi directional connection will allow for submitting ad requests and for firing ad reporting events in real time.
-> The whole substitution / insertion process can be controlled by the service provider (i.e. the broadcaster).

5.1.12 Gatekeeping

The delivery chain of 5G Broadcast for linear services (see Figure 9) shows several areas where gatekeeping may appear. Some examples are provided below.
Network operator
A media service provider may wish to provide or procure a dedicated 5G Broadcast network. Annex C shows that to provide near universal coverage to handheld devices, either LPLT cellular networks or conventional broadcast networks supplemented by LPLT would be required in key areas. MNO operators may therefore play a role in enabling the service. This may involve granting access to mobile network sites and the support of 5G Broadcast at the RAN and core network. These may not be guaranteed; particularly if different regulatory frameworks apply to MNOs compared to BNOs, the latter often being regulated to provide fair access to network infrastructure.

Device manufacturer

§ 4.2 indicates that user devices are generally either bought from the manufacturer (directly, or through another retailer) or through a contract with a MNO. Manufacturers and MNOs are therefore able to define the functionalities that devices should support. §§ 4.1, 4.4.1 and 4.5.1 further indicate that no devices yet support 5G Broadcast, and that the case for either MNOs or manufactures to support 5G Broadcast is uncertain.

Client Application

§§ 5.1.6 and 5.1.7 indicate the need to provision services via applications. These may need to be installed and downloaded from app stores managed by third parties in case they are not pre installed in the user equipment. Current OTT applications would require modifications to integrate 5G Broadcast functionalities, which may be granted by standardized MBMS APIs.

5.1.13 Costs

Costs between Service Providers and MNOs
5G Broadcast (with SIM free transmission) permits linear services to be distributed with a cost model like conventional terrestrial broadcast networks when targeting fixed reception. A direct connection between service provider and network operator is made possible through the xMB interface which means CDNs would not be necessary.
However, § 5.1.1 and Annex C indicate that the link budget for handheld devices, particularly if they are indoors, is much more onerous than for fixed rooftop reception. This indicates that more transmitter sites would likely be required to deliver services to mobile devices compared with conventional broadcast networks dimensioned for fixed rooftop antennas. The additional sites imply greater distribution cost – a factor that further work should investigate. Such investigations may consider models to cooperatively use existing mobile network infrastructure like towers, power, backhaul etc. These could be used for both 5G broadcast transmission to mobiles as well as for mobile communications. In some countries, mobile network sites are owned by tower rental companies which also may have a broadcast network business.

Costs for users

Cost for the user may involve the acquisition of an application for receiving content, which is typically provided for free by PSM organizations. When an application for tuning 5G Broadcast services is not provided by default in the user terminal it would need to be acquired (downloaded) using a broadband network.
Royalty fees
Royalty fees for rights holders can be calculated by the same model established for terrestrial broadcast distribution. More information is provided in Annex B.

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