Technical Report EBU Part III

5G FOR THE DISTRIBUTION OF AUDIOVISUAL MEDIA CONTENT AND SERVICES

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4. Media Distribution Stakeholders' Views

4.1 5G Roll out and related deployments

5G has started being deployed in various countries in 2019, based on 3GPP Rel 15 functionality, i.e. targeting primarily eMBB use cases, and based on the so called Non Standalone Architecture (NSA), i.e. attaching 5G NR access networks to existing LTE core networks and requiring LTE Anchor coverage. The first Standalone Architecture (SA) deployments are expected during 2020.

In Q1 of 2020, the US, Korea and Japan have extensive 5G deployments, with a focus on mid band in Korea, and high band "mm Wave", but also low band 600 MHz in US. China has started large scale 5G deployments, while European operators have limited deployments in mid band.

The EU commission maintains an EU 5G Observatory [17] that contains up to date information on the status of 5G licencing and rollouts for Europe. The GSA (Global mobile Supplier Association) [18], provides recent reports and updates on the global 5G market, including for user devices. In a March 2020 report [19] the GSA counted about 250 devices (smartphones, tablets, hotspots, modules etc) supporting 5G NR.

Several manufacturers have put 5G capable handsets on the market. According to [20] several '5G phones' are available from a variety of manufacturers such as Samsung, OnePlus, LG, Huawei, Oppo and Xiaomi.

The market is, however, fast moving and it is expected that many more 5G devices will be available in due course. A press release issued by Samsung in January 2020 indicated that it has already shipped 6.7 Million 5G handsets worldwide and confirmed the launch of a 5G capable version of the Samsung tablet series Tab S6 in 2020.

Functionalities beyond those primarily adopted at a global scale are not included by default. In the particular case of media distribution, no equipment yet supports 5G Broadcast (i.e. from Rel 14 included, and onwards). Widespread support cannot be expected any time soon without visibility of large applicable markets.

So far broadcast reception support is limited to eMBMS Rel 12 in a few 4G capable handset models. The GSA report in July 2019 [21] states the following about LTE Broadcast (eMBMS i.e. Rel 12 and prior):

- Five mobile network operators have launched eMBMS services (Telstra in Australia, China Unicom in China, Reliance Jio in India, KT Corporation in South Korea, and Verizon in the USA).

• Two operators are deploying (Globe in Philippines and AT&T Mobility in the USA)
• Thirty four operators are known to have been testing and trialling eMBMS.

On the device side, it is not always possible to know the exact capabilities of the devices available on the market as manufacturers rarely state the device capabilities beyond those for which they have been tested. Even more, the full set of capabilities contained in the specifications is not necessarily implemented in networks and devices. In general, eMBMS capabilities supported in commercial deployments include a series of mechanisms relevant for mobile network operators. These are:

• Rel 10. RAN based counting of UEs indicating interest in an eMBMS service to allow the network to decide if it is more efficient to serve users via unicast or broadcast (Rel 10).
• Rel 12. MBMS operation on Demand (MooD), which automatically activates or deactivates the eMBMS service based on the counted number of interested UEs. This allows for example to create an eMBMS user service to deliver content which was initially delivered as unicast.
• Rel 12. MBMS PHY measurements: UEs can be ordered to perform measurements of signal power, error rates and such, which can then be used in network optimization, particularly in the MBSFN mode.
• According to GSA, 69 chipsets are supporting eMBMS, with up to 59 devices able to operate it (in some instances after operator specific upgrades). Main chipset vendors are Qualcomm, Mediatek, GCT, Intel, Sequans and Altair Semiconductor. eMBMS is widely supported in Mediatek's HelioP35, and various Qualcomm Snapdragon mobile platforms. Devices such as Samsung Galaxy Note 8 and Note 9 phones support eMBMS.

Regarding Rel 14, a series of trials have been conducted by public service broadcasters in Europe [22]. The most recent of a prototype software defined radio implementation of an eMBMS Rel 14 receiver and a corresponding professional transmitter which can be deployed in traditional broadcast infrastructure. The trial has been repeated to accommodate different reception conditions including fixed and mobile scenarios in several countries such as Germany, Italy, France, Brazil, China, or Spain.

Notable developments in China include plans for 5G Broadcast with initial demos foreseen in February 2022 to be followed by large scale deployments [23].

4.2 Mobile Phone Manufacturers

Most mobile phones are typically bought either from a mobile operator (MNO/vertical model), or direct from the manufacturer without a link or contract to an individual operator (horizontal model).

Increasingly devices are being bought without a contract i.e. people are buying a device and get a SIM card independently [24] [25]. In Germany, the volume of devices sold without a contract has reached 40% 45%.

Both routes to market have different requirements and potential. In either of them it is unlikely that devices would have features either developed or enabled that have not both been tested and have no sound commercial justification for their inclusion.

In a vertical model, it is entirely feasible that a paid for service could be broadcast by an MNO who also has access to content. This model would be relatively simple, requiring support of LPLT LTE B reception with a SIM card. The mobile industry is substantially based on the vertical model.

The horizontal market model – in which an MNO did not provide the broadcast service – is somewhat less well defined. It is not clear who would fund the necessary changes in hardware that would support free to air (FTA) reception with no SIM card, for example. Without a commercial model and a complete eco system there are extremely limited drivers to support any FTA/non vertical capabilities.

Several billions of mobile devices are sold globally every year. The cost of any added functionality needs to be strictly justified (even cents per device translate to massive cost with such volumes) with certainty of demand in large markets, ideally global, covering at least several hundred million potential customers. Conversely, R&D for additional features can be split onto huge numbers of devices. Thus, pure software enhancements can be justified much more easily than hardware additions which may have an impact on the bill of material like e.g. support of an additional RF band.

4.3 TV Manufacturers

The business case for manufacturers to consider adding a 5G tuner directly into a consumer TV set is still at an early stage and is not yet considered to be necessary by most (particularly in DVB served areas). Several items that are taken into consideration to reach this conclusion. TV manufacturers typically work in a horizontal market space and they must find the balance between appealing features and minimising production costs.

TVs are typically developed to a core architecture that can support small adaptations for different requirements in one market compared with another. For 5G to be routinely implemented, a similar development model would be expected. A clearly defined common specification that would be suitable for use in any relevant market would be essential.

Currently most Smart TVs are connected to in home Wi Fi networks. Initially, device manufacturers would therefore most likely consider Wi Fi to be the primary route to receive any new IP based services targeted at large screens within the home. Services delivered over 5G would therefore be anticipated to terminate at a Wi Fi router. This later point itself is not yet entirely clear but may vary from market to market.

Another alternative could be the ability to “Cast” 5G delivered content from a suitably equipped mobile device to a large screen TV, although this may not be a widely used method.

Since developing new consumer products requires time and the result needs to be a reliable high performance device, equipment manufacturers would wish to see a number of changes within the wider market first – for example the formation of an end to end ecosystem bringing with it the ability for manufacturers to test and verify the operation of any such potential implementation especially as there are currently concerns around indoor reception quality.

4.4 Infrastructure Manufacturers Considerations

4.4.1 Mobile Network Infrastructure

Mobile radio access network equipment typically sells in hundreds of thousands of base stations per year with larger volumes expected in the future as small 5G cells become more widespread. While there is progress in Software Defined Radio (SDR) technology, mobile radio access networks equipment is typically non commercial off the shelf (COTS) hardware, but tailored design due to the volumes involved and due to e.g. power consumption constraints. Core network equipment, however, increasingly relies on COTS hardware with tailored software. Like for mobile devices, the cost impact of additional features both in terms of R&D and in terms of hardware requirements needs to be justified by vast, ideally global markets. Many of the features required to support e.g. 5G Broadcast would be in software, but additional frequency band support would trigger hardware development impact for the RF parts.

4.4.2 Broadcast Infrastructure Manufacturers

Today broadcast transmitters are operated by Broadcast Network Operators (BNO). These networks typically have transmitters with powers ranging from a few Watts to thousands of Watts. As 5G Broadcast uses OFDM – the same underlying waveform used in all modern DTT standards (DVB T/T2, ATSC3.0, ISDB T) broadcast transmitters can be used for 5G Broadcast by making changes to transmitter's modulator. Additional support for interfaces and protocols is required to integrate broadcast transmitters in a mobile core network, however, as all these enhancements are software based with almost no impact for the RF parts and the manufacturing costs of the transmitters.

4.5 Network Operators Considerations

4.5.1 Broadband Network Operators

Video dominates Internet traffic today and video traffic levels are growing . Consumption of live and linear services, in the form of those in § 2, sports events or e sports are also growing as more content is available on the Internet and people are becoming accustomed to accessing it on mobiles, tablets and computers. These live events, which are nearly all delivered using unicast streams, create large peaks in synchronous network demand, with an impact on network costs.

Figure 8 shows the increase in peak traffic on a mobile network, attributable to people watching events that cause significant increases in peak traffic levels also involve multiple end points receiving the same bit streams.

The natural solution to such a problem would be to use a point to multipoint network technology, such as multicast.

To date though, multicast is not widely used and its use for distribution is mainly restricted to network operators' own content services. Some reasons for the relative lack of success of previous generations of multicast – whether for the fixed network or the mobile are:

- The network provider is the primary beneficiary of multicast. Content service provider benefits are secondary, so the case for multicast may not be sufficiently compelling compared with normal CDN costs.
- Partial end device support. Few end devices have been able to directly consume multicast and, even if they can, application layer standards do not normally support it. Set top boxes have been required on fixed networks and special multicast aware versions of applications are required for 4G.
- Limited coverage. Any individual network operator will only be able to cover a fraction of the population. A content service provider would need to buy multicast from several providers and even then, they will most likely fall short of their requirements.
- Cost of connection. Each content service provider will need to create a connection to each network operator separately.

For 4G deployment, the partial support of eMBMS by handset vendors has been a very significant issue. It is difficult to break the deadlock whereby handset vendors do not add eMBMS support because few networks deploy it, and network operators see little benefit because not all handset vendors support it.

An additional challenge is that the number of content service providers providing live content is rising. This means that, from a network operator perspective, on boarding a new content service provider must be very straightforward.

Similarly, it is not clear which content providers will deliver the most popular content at any moment. Therefore, a flexible and dynamic approach to multicast is required, where content streams can be switched between unicast and multicast fully automatically, or at least with little manual intervention.

As a result, the requirements for the wider success of multicast are:

- It must be very straightforward to on board any content service on the Internet. This means minimal impact on the content delivery path and minimal impact on CPE/application.

- Whilst the primary goal is efficiency of live content, other content types should also be able to benefit from multicast.
- There must be a valid business case for partial or staged roll out, both in terms of customer/geographic coverage and end device support.

This leads us to conclude that, from a network operator perspective, multicast should be used as an enhancement to Internet distribution of content.

To avoid historic issues around attempts to sell multicast as a service, multicast could be deployed as an internal optimisation technology for network operators to use as part of their internal capacity management strategy.

The requirement would be to wrap multicast in such a way as to have minimal impact on the content servers and end device applications. Technically, this is particularly challenging. CableLabs has specified a multicast ABR standard [27] which allows for the distribution of HTTP Adaptive Streaming content over multicast (specifically HLS) and 3GPP also have a similar way of supporting this in [28], [29] and [30]. DVB is in the process of producing its own multicast ABR standard, DVB mABR (Multicast Adaptive Bitrate) [31].

There is more work to be done though to progress multicast ABR technology to a point where it can really sit transparently in an otherwise unicast content delivery path. If we were able to achieve this, it would very significantly lower the barriers to multicast deployment. Multicast would effectively become one of the tools that a network operator could use to upgrade network capacity, alongside existing techniques.

As an internal network efficiency tool, the business case for multicast is made by the network operator in terms of their own cost savings. Such a case can be made locally, and so does not require national roll out before any benefit can be obtained. In contrast, offering multicast as a service would require substantial roll-out before any customers could be brought on board and even then, the revenue would be uncertain.

Since the network operator will know what devices are present on their network, they can be confident of the cost savings with only partial device support. Even a 50% reduction in the volume of synchronous traffic would be extremely valuable. Again, this provides for a very low risk business case.

4.5.2 Broadcast Network Operators

The current terrestrial broadcast networks are designed to fulfil all main requirements of Public Service Media Organisations as described in § 2.4.1. Most requirements of commercial content providers in § 2.4.2 overlap with those of Public Service Media. However, enhanced media services like HbbTV are complements to fulfil requirements on targeted advertising, nonlinear content, time shift etc. Also, terrestrial broadcast networks are able and used to provide Pay TV services.

In addition, the terrestrial networks are designed to meet all regulatory requirements both technical and "political" that are specific to the media sector. The technologies currently in use are specifically designed to cover all these requirements, while providing a universal coverage to an unlimited number of receivers, with state of the art technical performance (e.g. DVB T2).

Most terrestrial broadcast networks are currently designed for fixed linear TV reception with a fixed rooftop antenna, though fixed indoor antennas are also adequate in many cases. In some countries, those networks are specifically designed for fixed indoor and vehicular linear TV reception in cars. Moreover, these networks share much of infrastructure with FM radio and DAB radio with reach to virtually all European households and cars.

The terrestrial broadcasting networks are ultra reliable and are designed for sustained operation during long power outages to be able to meet public warning requirements. This is of course especially important for radio and television in crisis and public warning situations. Also, the terrestrial broadcasting networks protect the privacy of the user and are extremely resilient against cyberattacks.

The DTT networks are used by nearly half of the European population and the number of TV sets capable of receiving DTT can be estimated to some 500 million.

The Broadcast Network Operators are currently finalising the clearance of the 700 MHz band, which entails substantial long term investments by both BNOs and consumers. These investments and the clearance of the 700 MHz band has been made possible by EU decision DEC 899/2017 [32] stating that "Member States shall ensure availability at least until 2030 of the 470 – 694 MHz ('sub 700 MHz') frequency band for the terrestrial provision of broadcasting services, including free television, and for use by wireless audio PMSE on the basis of national needs, ……". In some Member states this decision has been translated into national law.

However, current BNO's networks are not designed to provide reliable reception of linear content by hand held devices such as mobile phones:

- The current terrestrial broadcast network infrastructures – often called "HTHP" (High Power High Tower) or MPMT (Medium Power Medium Tower) are certainly a good basis to address outdoor and vehicular reception (see Annex C), pending necessary investments to complement the network deployment to address new needs (e.g. additional sites in HTHP networks to provide coverage for portable reception).
- For indoor reception, hand held devices usually rely on Wi Fi or WLAN coverage. Seamless transition between such networks is nowadays possible/manageable. Also, DVB HB looks like a promising solution to provide indoor coverage.

Europe is diverse and AV situation differs from country to country. Any proposal needs to be flexible enough to cope with all different situations including countries with (very) high acceptance of terrestrial broadcast networks services (e.g. UK, FR, IT and ES).
The broadcast network operators would be willing to evaluate investments in future distribution technologies such as 5G in a mid or long term perspective. Such investments would be based on using the current infrastructure. However, a prerequisite would be that there are clearly demonstrated and accepted benefits to add an alternative broadcast technology to DTT or in the longer term migrate to an alternative technology, and, in such case also a corresponding favourable "business case" for both consumers, broadcasters, regulators and network operators.

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