

# Using 5G mobile networks in radio

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world **dab**

1. 5G capabilities

2. Using 5G for Contribution

3. Using 5G for Distribution

4. Conclusions

5G is the next step in the mobile phone network technology roadmap, each generation has a typical period of 10 years

	1G	2G	3G	4G	5G	6G
Typical deployment date	1980s	1990s	2000s	2010s	2020s	2030s
Theoretical download speed	2 kbps	384 kbps	56 Mbps	1 Gbps	20 Gbps	>20 Gbps
Minimum Latency	N/A	629 ms	212 ms	60 – 98 ms	1 ms	<1 ms
Cell density (users per cell)				Up to 400	>1000s	

- **Higher data rates**

- Mainly due to increased channel bandwidth, 4G max BW = 20 MHz, 5G max BW >100 MHz
- Very high bandwidth channels are only possible in FR2 spectrum > 24 GHz
- FR2 spectrum can only use small cells, hence cell density must be increased
- *For Radio this means high bitrate and more mobile services in an area*



- **Lower latency**

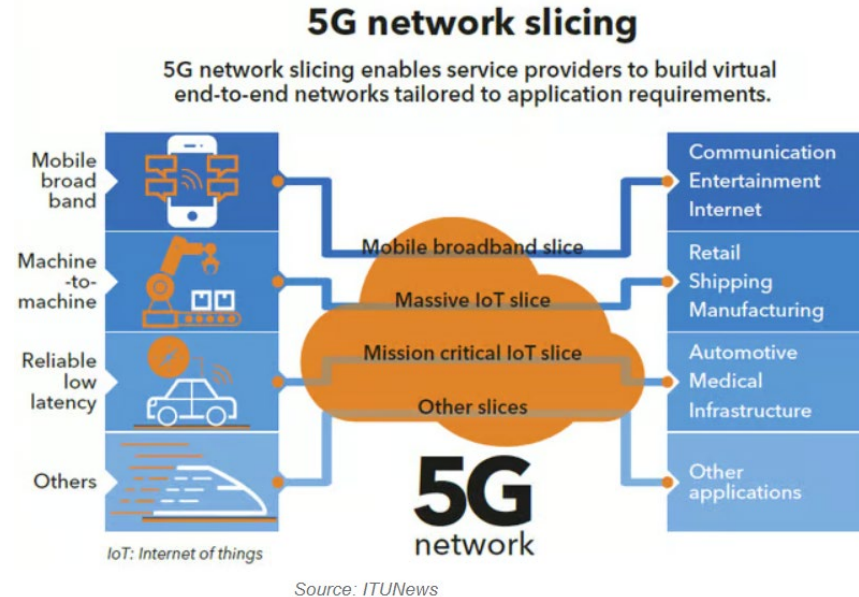
- 5G services can be configured for Ultra-Reliable Low Latency Communications (URLLC)
- This helps support applications such as IoT, real-time gaming, autonomous vehicles, and industrial automation
- *For Radio this means low latency links for live events*



- **Massive device connectivity**

- Enhanced multiple access allows more receivers (User Equipment) per cell
- Important for IoT applications
- *For radio this means better access for wide area events, e.g. motor racing*

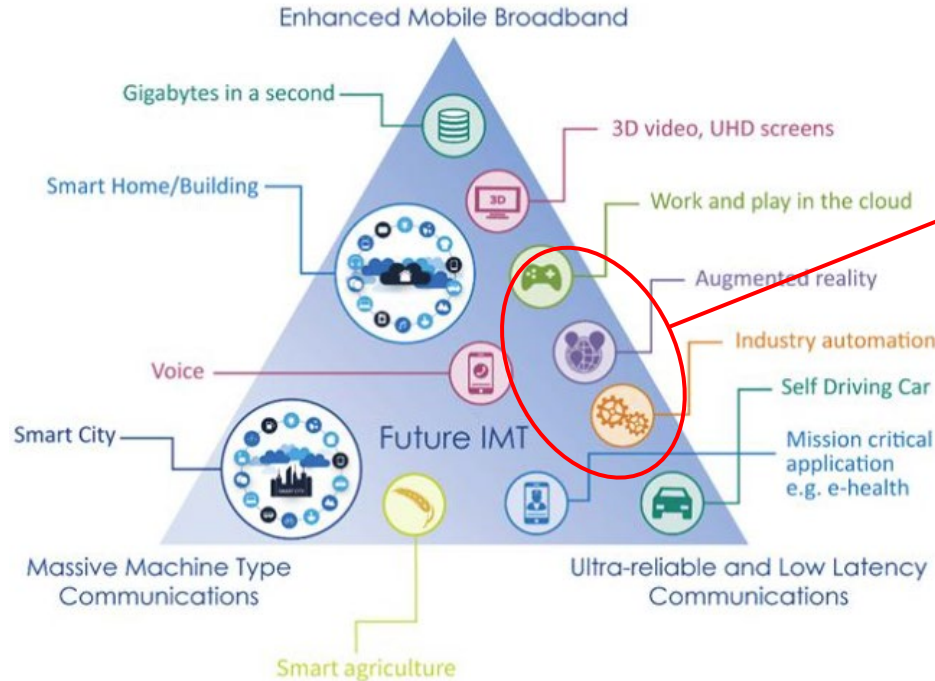
- **Network slicing**
  - Provides the ability to create VPNs within cells. Each VPN can have its own characteristics optimised for its use case
  - *For Radio that means the ability to provide high QoS for radio links*
- **Enhanced security**
  - Stronger encryption and privacy protection
  - *For Radio this means more robust services*
- **Energy Efficiency**
  - Improved device power control such as sleep modes, dynamic power control, more efficient signalling
  - *For Radio this is important for battery powered devices*



## Overall

- 5G will provide a range benefits for both contribution and distribution
- It may also change a number of operating practices particularly for outdoor event reporting

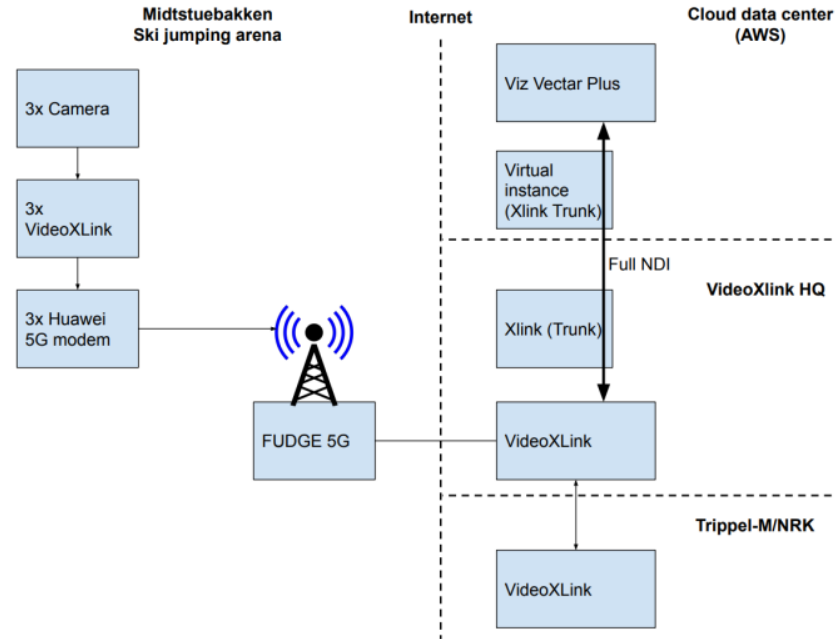
Note that users cannot have all the benefits at the same time, there are trade-offs depending on the application



Typical operating range for Outside Broadcast (OB) links and backup distribution

## Using 5G for radio production and content capture

- See EBU Trials Report – TR080 – March 2024, summarized in EBU white paper – April 2024
- *“5G technology has been extensively tested and has now reached the point where devices and services are becoming available, marking the start of a potential transition from the experimental usage to every-day operations.”*
- Most use cases required Non-Public Networks (NPNs) due to constraints in capabilities of public Telecom networks
  - Spectrum access is critical for NPN 5G networks to be successful
  - Harmonised regulatory conditions will provide international 5G opportunities, e.g. international live sports
  - The use of Public 5G networks will require network slicing capabilities to ensure guaranteed QoS



NRK Trial 2 setup

The **EBU TR 080 Trials Report** includes examples of Remote content capture and Remote production

- The trials were conducted from 2021 – 2023 with multiple European broadcasters including BBC, NRK, RAI, SWR and others
- Primarily AV based but applicable to audio only as well, See the RAI experiment in live audio performance from multiple locations emphasizing the need for low latency
- Also included 5G for telemetry, communication, monitoring etc
- Both throughput and low-latency are important, high QoS is essential
- There has been a gradual move away from cable based OB systems for some time, however conventional PMSE needs individual radio links with a correspondingly high coordination effort
- 5G based trials use individual IP streams on a common 5G network, thus minimising setup time





- Public network tests showed that 5G is not currently suitable to replace video over fibre in high-end production
  - No control on how many devices are connected to the network – **no Network Slicing available** to “carve off” network capacity
  - Handover between cells results in quality below acceptable levels
  - No ability to control UL capacity which is usually set at around 20% (due to DL video consumption)
  - Latency time variations due to a centralised core can trigger un-necessary packet resends and congestion
  - 5G coverage consistency is essential, fallback to 4G can cause data glitches
- Public 5G newsgathering working similarly to 4G
- The main next steps include easier access to 5G spectrum for NPNs and QoS support in Public MNOs
- For more information see: EBU 5G-MAG, 3GPP

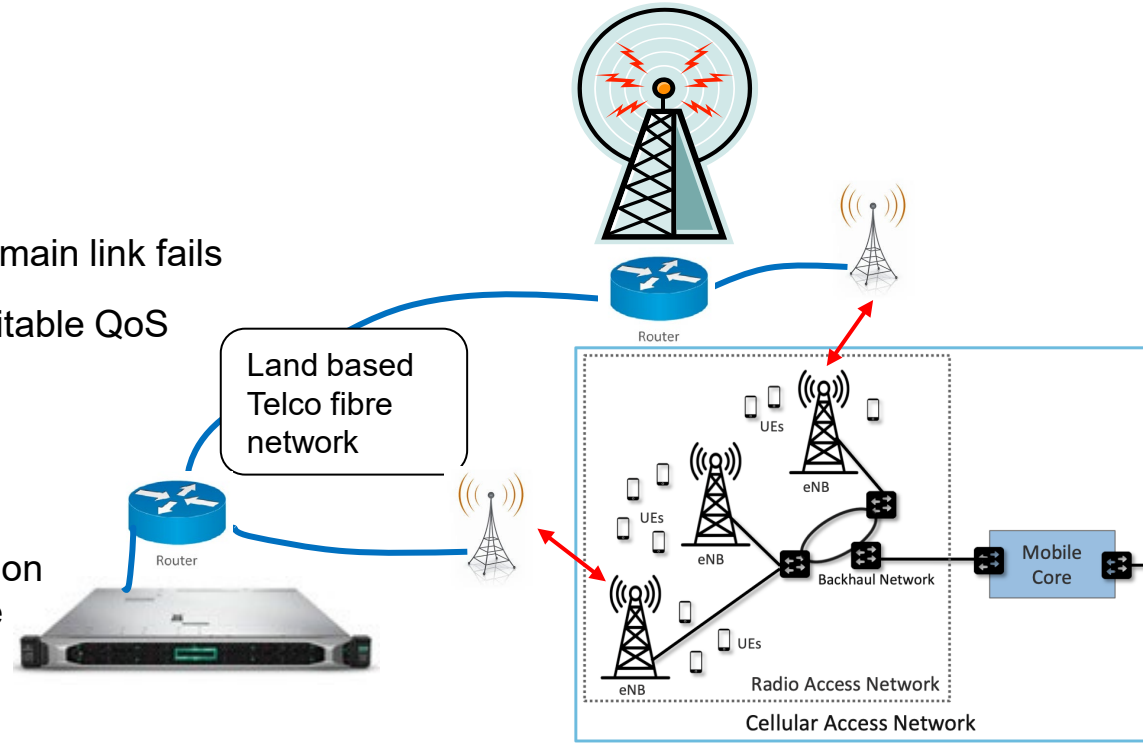
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There are several potential uses of 5G for distribution of radio content, e.g.:

- The delivery of DAB+ ETI over IP (EDI) from a multiplexer site to transmission towers, most likely as a back-up link
- The delivery of IP streamed radio over 5G to mobile phones
- The use of 5G Broadcast to deliver radio to mobile phones
- The use of 5G streamed data for Hybrid Radio, e.g. to cars

## ETI delivery to Tx sites

- 5G data service between the multiplexer and DAB+ transmission site as a back-up to wired/fibre primary delivery
- The 5G data service would
  - be via a public MNO
  - normally be in-active, only used when main link fails
  - will need Network Slicing to ensure suitable QoS
- Pros
  - Relatively cheap backup
- Cons
  - May have out of service glitch when activating the 5G connection
  - Network slicing not yet available



## The delivery of IP streamed radio over 5G to mobile phones

- Most radio stations provide both primary broadcast delivery as well as secondary streamed delivery
  - Mobile streaming can be delivered to smartphones in homes, cars etc
  - Pros
    - Can access radio services via personal smartphone
  - Cons
    - Mobile networks are less reliable than broadcast
    - Quality can be reduced due to delays, jitter and network outages
- 
- See the Plum report on 4/5G coverage - <https://getdigitalradio.com/wp-content/uploads/2021/10/Plum-Consulting-Wireless-Delivery-of-Audio-Services-January-2021-1.pdf>
  - UK OFCOM recommends broadcasters initiate field testing to validate Plum findings.
  - See BBC project Timbre: <https://www.bbc.co.uk/rd/blog/2024-03-project-timbre-investigating-mobile-coverage-for-live-radio-streaming-on-bbc-sounds> to explore QoE
  - EBU 5G-MAG 5G live streaming – live contribution and remote production

**plum** not defined.

Wireless delivery of audio services - final report

12 January 2021

Richard Rudd, Phil Sheppard

## 5G Broadcast

- 5G Broadcast also known as FeMBMS or 5G Multicast Broadcast Service (MBS) was developed to provide broadcast services over mobile cellular systems.
- There have been many small scale trials of the various forms of 5G MBS starting from Rel 14 (4G LTE-A - 2017) with the latest modifications in Rel 18 (5G-Advanced - 2024)
  - Major companies and organisations pushing 5G MBS include Qualcomm, Rohde & Schwarz, EBU 5G-MAG
  - To date there are no commercially available 5G MBS capable smartphones
- 5G MBS has many useful features to help make mobile communications more capable and efficient

## However

- The 5G MBS delivery efficiency for Radio is much worse than DAB+ and hence much more expensive
- MNOs require additional equipment to support MBS for both TV and Radio delivery making it more expensive than current dedicated broadcast standards

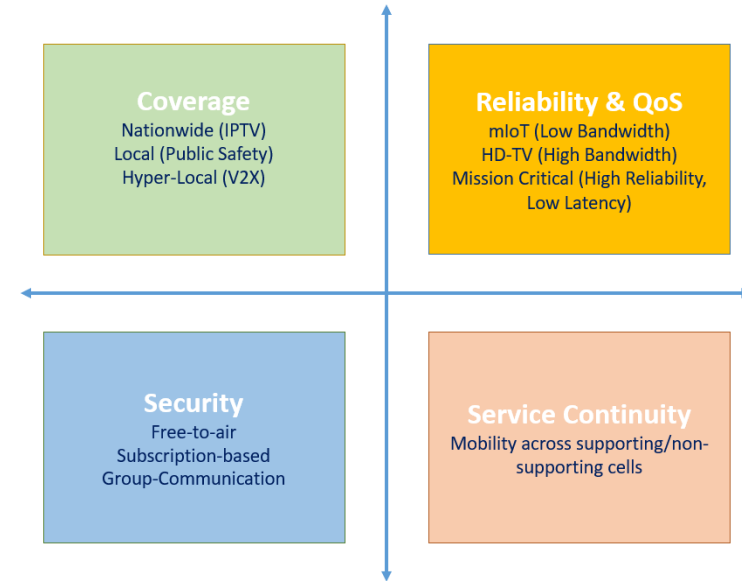


Figure 1. A simplified and generalized classification of service requirements for MBS

<https://research.samsung.com/blog/5G-MBS-Unleashing-the-Potential-of-Multicast-and-Broadcast-Communication-in-5G>

## 5G Broadcast

- Recent analysis shows that the current 5G PHY layer is **compromised** relative to DAB+
  - The target 5G Broadcast operating frequency is in low UHF (470 – 698 MHz) which results in between 6.6 dB and 11.7 dB higher propagation loss compared to DAB+ (174 – 230 MHz)

5G Broadcast bands	Range	Notes
Band 107	612-652MHz	Standalone Downlink-Only
Band 108	470-698MHz	Standalone Downlink-Only

- 5G Receiver bandwidth is larger resulting in lower sensitivity, 4.7 dB worse for a 5 MHz 5G channel
- 5G broadcast currently does not include any Time / Frequency Interleaving (TFI), at least 7 dB C/N required compared to DAB+
- Overall this means that 5G Broadcast at the lowest possible frequency needs to have a power increase of around 13 dB or 20 times that of equivalent DAB+ coverage, and the sensitivity is also 7 dB worse

## 5G Broadcast receivers

- 5G is now being included in all new smartphone designs
- 5G MBS / Broadcast support is unclear in most phones
- MNO support for MBS and Broadcast as a service is unclear
- PLUM report in 2021 indicated that there is little economic benefit to using FeMBMS on a large scale (see p35) and that further advances in 5G will still require economic justification (p37)
- So overall it seems very unlikely that MNOs will promote radio delivery over MBS

- Is 5G useful in radio?
  - **Yes**, great for content capture particularly for live production
- Can 5G be used in the distribution of radio streaming services?
  - **Yes**, better than 4G

However studies to date have shown that availability and reliability is not as good as DAB+

- Can 5G Broadcast replace DAB+?
  - **No**, needs more power and more sites
  - Is much more costly
  - Not guaranteed to be supported in all smartphones
  - Will it be included in new cars in the future? Probably in some form but probably not for radio



Thank You

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