# Hybrid 5G Broadcast A worked example

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# Why 5G Broadcast

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## Why 5G Broadcast

Citizens can currently access broadcaster content on their mobile devices using existing mobile networks, unicast delivery, so why do we need 5G Broadcast?

Unicast delivery,

- Requires a SIM card
- Uses a considerable amount of a citizen's data allowance
- Has the potential to heavily load a mobile network
- Can result in significant Content Delivery Network (CDN) costs for the broadcaster

5G Broadcast network could,

- Reduce the cost to broadcasters for distribution of their content to mobile devices
- Benefit mobile network operators by reducing mobile network loading
- Reduce the cost to the citizen (lower data usage)
- Be accessible without a SIM card

# Existing DTTB network

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# Existing UK DTTB coverage

The three UK PSB DTTB multiplexes use a network of 1163 sites serving ~98.5% of UK households (fixed reception). The sites are 50 HTHP main stations plus 30 primary relays which serve ~90% of households, these are referred to as the 80 main sites. The remaining coverage (~8.5%) is provided by more than 1000 smaller relays with powers down to 1 Watt ERP.

The three UK Commercial DTTB multiplexes use the 50 HTHP sites and 30 primary relays and serve ~90% of households.

The existing DTTB networks use all of the available spectrum

## **Dedicated 5G Broadcast Network**

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#### **Dedicated Network**

A dedicated 5G Broadcast network would

- Provide SIM free access
- Eliminate citizens mobile data usage
- Avoid loading the mobile network
- Eliminates CDN cost

Initial assessment based on the existing DTTB network looked at

- The number of sites needed to match existing DTT coverage, ~98.5% of households.
- The number of sites needed to provide coverage of roads.

Coverage is outdoor only, transmit powers are the same as existing DTTB, additional sites based on mobile sites operating with omnidirectional antenna and 2.45 kW ERP.

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Coverage calculated for 95% and 99% locations

#### **Dedicated Network: Households Served**



#### **Dedicated Network: Road coverage**



### **Dedicated Network Summary**

- To match existing DTTB coverage a dedicated 5G Broadcast network based on the existing UK DTTB network would require hundreds of additional sites.
- Additional sites may cause interference to existing DTTB coverage, hole punching and additional interference.
- Reception of 5G Broadcast from a non co-sited site may be limited by adjacent channel interference because of mobile device adjacent channel selectivity (ACS).
- Requirement to ensure robust coverage means that the data rate is restricted and a large contingency ~13 dB (2.32 \* 5.5 dB for 99% locations) needs to be included in coverage calculations. Contingency means higher powers, lower data rates more sites all of which means greater cost.
- In a dedicated network all data is delivered by 5G Broadcast so cost to the user, mobile data usage, and CDN cost are minimized.

# Hybrid network

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A hybrid network uses elements of both a broadcast network and a mobile network.

A mobile device would typically uses the 5G Broadcast network but would switch to the mobile network where 5G Broadcast is not available. Leveraging the coverage of mobile networks, assumed to have universal coverage, can lead to significant savings in the build and operation of a 5G Broadcast network.

A hybrid network can

- Provide SIM free access where 5G Broadcast is available
- Significantly reduce a citizens mobile data usage
- Avoids heavily loading the mobile network
- Can reduce the cost of content delivery compared to unicast delivery via mobile broadband

A hybrid network is a balance between the cost of building and operating a 5G Broadcast network and the savings made in content delivery. But where does the balance point lie?

For that we need the costs...

## Hybrid: Estimate of Data Consumption (Peak Hour)

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Number of users (N)
Proportion of users accessing the service (P)
User data rate Mb/s (D)
                                                  Data consumed in one hour (DH)
Data used = N * P * D Mb/s
                                                  DH = 3600 * 243,000 = 874,800 Mb
                                                  Which is 109,350 GB
UK Population (+15) N ~ 54 million
Proportion of users using the service
P * N = 0.001 * 54 million = 54,000
                                           Data rate may be lower but it is the proportion of the full multiplex....
FHD stream user data rate D = 4.5 \text{ Mb/s}
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Data used = 54,000 \* 4.5 = 243,000 Mb/s

Figures are an example, actual will differ on a case by case basis

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## Hybrid: CDN cost estimate

Content Delivery Network (CDN) costs vary considerably and the rates broadcasters negotiate are typically commercially confidential. As an example - Google quote \$0.02/ GB (Pricing | Cloud CDN | Google Cloud)

So distribution of content during the peak hour could cost 109,350 \* \$0.02 = \$2,187

Across 24 hours usage will vary considerably. Assume the average hour is 1/3 of the peak hour. I Probably 2 peaks a day, quiet at night ....

So the cost of distribution of content across a day would be \$2,187 \* 24/3 = \$17,496 / day

And for a year 365 \* 17,496 = \$6.386 Million

This is for a single programme stream. A 5G Broadcast multiplex could support 3 or 4 such FHD streams so the potential CDN cost, based on this example, is \$19M - \$26M.

Figures are an example, actual will differ on a case by case basis

## Hybrid: 5G Broadcast Cost

#### Site Capital costs

- Transmitter infrastructure
- Tower infrastructure

Site Operational costs

- Power
- Distribution
- Maintenance

Num of Sites \* (Site Capital Cost/Number of Years + Site Operational Cost) = 5G Broadcast Annual Cost

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#### Hybrid: Getting the balance right





Each 5G Broadcast site will reduce the amount of data that needs to be delivered by the mobile network, reducing CDN cost. But each 5G Broadcast site adds a cost. Adding a 5G Broadcast site is viable if the cost of doing so is less than the CDN cost saved. The CDN saving is a function of the 5G Broadcast site's coverage.

For a dedicated 5G Broadcast network we need robust coverage, a high location availability, before a pixel is considered served (95 – 99% Location availability).

In a Hybrid network we can be more relaxed as if the 5G Broadcast service fails the mobile device will switch to unicast. In such a case if a pixel is only served with a location probability of 70% we can consider that for a data delivery assessment that in this pixel 70% of the data would be delivered by 5G Broadcast and 30% by unicast.

# Hybrid: Service switching

For a hybrid network to work switching between 5G Broadcast and either mobile or WiFi reception needs to be possible.

The <u>Nakolos project</u> performs such a function Enabling unlimited IP content delivery



#### 5G Broadcast meets Broadband

Nakolos develops products and solutions for content providers and broadcast network operators to utilize the combination of 5G Broadcast and Broadband on Android mobile devices.

The core technology consists of a set of <u>modules</u>, namely a <u>5G</u> <u>Broadcast core</u>, a <u>Hybrid Connect cloud system</u> and a lightweight <u>Middleware</u> which enables a seamless integration of 5G Broadcast and Broadband into mobile Apps.

Join the waitlist for a free trial

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## Hybrid: Network Coverage



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## Hybrid: network Summary

As it leverages mobile networks, coverage of the hybrid network is as good as if not better than the mobile networks.

The cost of the 5G Broadcast network is determined by the number of sites which can be chosen to provide the most cost effective solution between unicast and broadcast delivery

A hybrid network offers considerable flexibility.

- Unlike the dedicated network the data rate is flexible. Increasing capacity on the 5G Broadcast network would mean coverage reduces so there is more offload to the mobile network.
- At times of low usage, such as at night, it may be cost effective to switch-off elements of the 5G Broadcast network in a particular area, moving all the load to unicast (useful for broadcaster cost management but puts full load on user mobile data usage).
- Unlike a dedicated network which requires most if not all of the network to be built before launching a service, a
  hybrid network in the extreme could arguably start with no 5G Broadcast sites with everything carried on the
  mobile network.



# Any questions?

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