

## **Superfast broadband rollout costs could be slashed by using IMT-Advanced mobile systems**

As the bulk of the cost of rolling out superfast broadband across the country are due to the civil engineering costs involved in digging up roads, I feel that a wireless option has been missed that could potentially slash the cost of rolling out superfast broadband nationally.

The Japanese mobile network operator, NTT DoCoMo, demonstrated a prototype 4G (now referred to as IMT-Advanced) mobile phone system [transmitting to a mobile receiver at a data rate of 5 Gbps](#) in February 2007.

My suggestion is to use NTT DoCoMo's system, or another of the IMT-Advanced mobile systems, but for the system to transmit at very high frequencies, such as 10 GHz or above, where demand for spectrum is low. If the Government made sufficient spectrum available, the system could then deliver Gbps-speed data from BT telephone exchanges, or from mobile phone base stations, to BT's roadside telecoms cabinets. VDSL2 could then be used to deliver the superfast broadband signal from the roadside telecoms cabinets to users. Alternatively, if receivers for such a system were available for consumers to buy, it wouldn't be necessary to use BT's copper wire for the final leg of the journey into people's homes, so it could potentially allow the creation of a mobile superfast broadband competitor to BT.

The advantage of such a scheme is that it would reduce the civil engineering costs because roads wouldn't need to be dug up in order to lay the fibre. It would also be especially advantageous to use wireless distribution in less densely populated areas, because the civil engineering costs are proportional to the length of road that needs to be dug up.

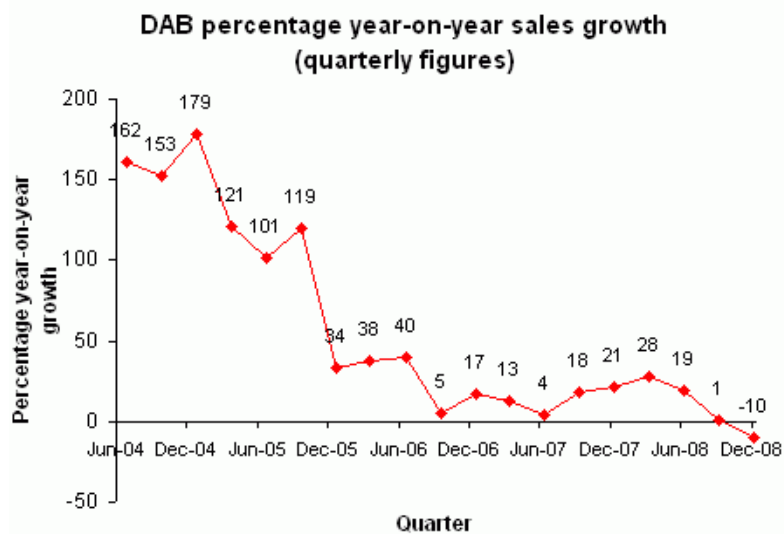
A bandwidth of 5 Gbps would be sufficient to provide superfast broadband to a large number of households. BT has suggested a figure of "up to 40 Mbps" for its plans for FTTC, so 5 Gbps would provide sufficient capacity to allow 125 users to download at maximum speed simultaneously. In reality, people don't all download simultaneously, so if, say, a 10:1 or 20:1 contention ratio were used this would allow 1,250 or 2,500 households to be served respectively – more when you consider that many people won't live close enough to the roadside cabinet to receive the full 40 Mbps download speed on VDSL2.

The speed of a system such as NTT DoCoMo's would also be scalable to higher bandwidths than 5 Gbps, because the technology that enables those speeds is MIMO antenna arrays, where the speed is proportional to the number of antennas used. NTT DoCoMo used a 12 x 12 MIMO array for its system, but the number of antennas used on a mobile phone system is obviously constrained by the size of mobile phone handsets, whereas the same isn't true for distributing broadband signals to roadside cabinets or directly to consumers. So a system could use a 24 x 24 MIMO array to deliver 10 Gbps, or a 48 x 48 MIMO array to deliver 20 Gbps, without requiring any additional bandwidth.

## Internet radio should be included in the plans towards digital migration

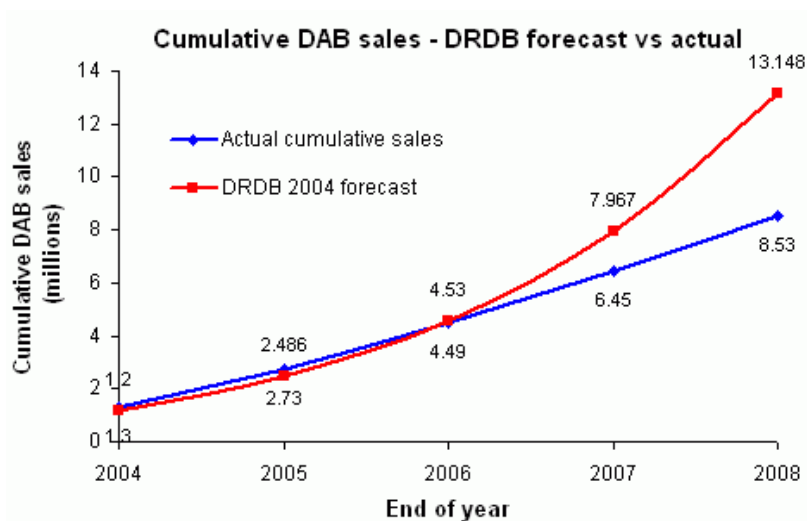
### DAB is unpopular with consumers

Despite the BBC showing twenty-one 'high-impact' TV advertising campaigns for DAB since 2002 and there being a similar number of advertising campaigns on commercial radio, DAB's year-on-year sales growth has been extremely poor for the last three years, and growth actually turned negative for the first time in Q4 2008.



[Source: DRDB, Grant Goddard's blog article, 'Warning! Digital radio objectives may appear closer than they are in reality', <http://tinyurl.com/asw7u7>]

As a result, cumulative DAB sales are now far below the DRDB's sales forecasts in 2004.



[Source: DRDB document 'DAB Digital Radio Set Forecast', October 2004, and own historical figures]

Both the Digital Radio Working Group's (DRWG) final report and the Digital Britain interim report favour maintaining the status quo. However, DAB's sales growth figures show that the status quo isn't working, and a different approach is called for.

Both reports seem to view digital radio from the same perspective as in the late 1990s and early 2000s, when the view was that radio should be delivered via a main digital platform. However, digital radio is now inherently multi-platform, and the status quo of pushing everyone towards DAB is simply holding back the migration to digital. For instance, if people were told about the benefits that Internet radio has to offer, which I will list below, the rate of digital radio take-up would increase.

A split has emerged between younger and older age groups, as older age groups prefer to listen to radio via traditional audio equipment, whereas younger age groups prefer to listen via more modern methods, in particular the Internet. As such, BBC TV adverts attempting to persuade everyone to listen via DAB would effectively only be targeting a subset of the population, because younger people, who don't consider DAB to be 'cool', will simply ignore these marketing messages. If anything, all pushing everyone towards DAB will achieve is to hasten the decline of radio listening amongst younger people.

Both reports also fail to even consider the possibility that DAB will simply never actually make it to FM switch-off; or despite the best efforts of those concerned, it will take far more years to achieve that than the DRWG or the Government thinks – the DRDB was no doubt sincere when it made its sales forecasts in 2004, but those forecasts have now been shown to have been exceptionally optimistic, and the same could easily happen with today's digital radio plans. The estimate that digital migration could begin by 2015 is definitely unrealistic, and I very much doubt that the DRWG's less optimistic target of digital migration commencing in 2020 will be achieved, either.

DAB's growth figures have all the attributes of a lead balloon, and any attempts to coerce the public to switch to DAB, such as by the removal of major stations from FM, would simply lead to huge numbers of people deserting radio for good, which isn't in the best interests of listeners, broadcasters, or the Government. The status quo needs to change, and what's needed is to include Internet radio in the plans towards digital migration.

### **Including Internet radio would speed-up digital migration**

Over the last fifteen months, the phenomenal success of the BBC iPlayer has clearly demonstrated the general public's appetite for consuming broadcast content online, and the TV industry now predicts that [40% of all TV viewing will be consumed on-demand by 2013](#). DAB, however, cannot deliver on-demand content at all, as it is a broadcast standard that has no return path, which is required to deliver on-demand content.

In comparison to DAB, Internet radio offers consumers some huge advantages:

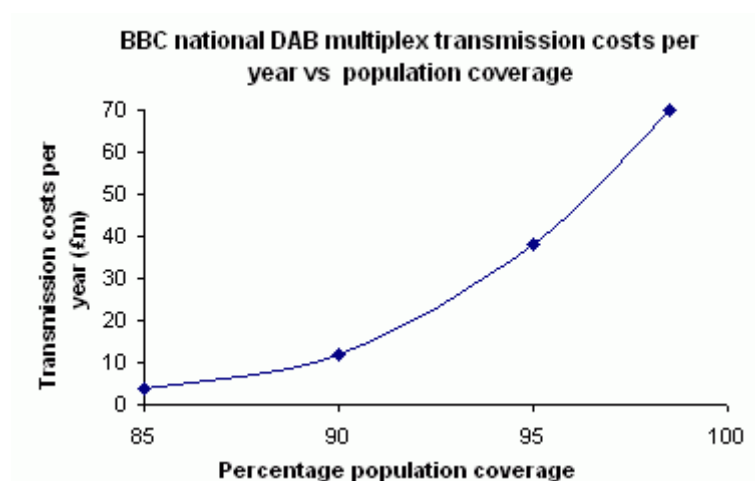
- There are thousands of Internet radio stations, on-demand streams and podcasts, compared to a few tens of live radio stations on DAB;
- Internet radio streams offer much higher audio quality than DAB, and the quality of Internet radio streams will only improve over time due to increasing Internet bandwidth and advances in audio coding technologies;
- Internet radio offers personalised radio services, such as last.fm, which would be impossible to provide via DAB;
- Internet radio could easily provide ‘high-definition radio’, whereas it would be impossible to deliver that via DAB, DAB+ or DMB-Audio;
- Internet radio inherently supports interactivity and personalisation, which DAB cannot provide;
- Internet radio allows video to be broadcast alongside radio, whereas DAB and DAB+ don’t support video.

### **Excluding Internet radio stifles innovation**

The biggest success story of digital radio in the UK this decade hasn’t in fact been anything to do with DAB; it has been the success of last.fm, which was sold to CBS for £140 million in 2007. Excluding Internet radio from the long-term plans for digital radio in the UK will therefore simply stifle the creativity of the Internet industry in the UK.

### **DAB is very expensive to transmit**

The figure below shows the distribution costs for the BBC’s national DAB multiplex for 85% and 90% population coverage levels, along with the BBC’s estimate of how much it would cost to cover 95% of the population, and the curve is extrapolated to the ‘universal’ coverage levels required to replicate FM.



Whatever the final figure will be for the distribution costs of the BBC’s national DAB multiplex, one thing for sure is that it’s going to be very expensive, and multiplying

the annual figure over the course of a long-term contract, it could easily come to over a billion.

## **DRWG didn't investigate alternatives to DAB**

Considering the enormous sums of money involved in rolling the BBC's digital radio services out nationally, you would reasonably expect that the DRWG would have carried out in-depth research into the costs involved for all of the possible alternative technologies. Unfortunately, that couldn't be farther from the truth, as the following quote made by Mark Friend, the BBC Controller in charge of digital radio, and the Chairman of the Technology sub-group within the DRWG, shows:

Nick Piggott asking a question from the audience: "It seems like a common thread of the discussions both on the panel here and a wider circle, is about the cost of digital radio, and that seems to be where most people are highlighting their concerns. Given that we are talking about taking radio into a digital age, can we have a look at what the relative costs of doing digital radio, that is radio wirelessly to 99% of the population via IP might be, using some of those technologies like WiMAX that I think were mentioned earlier in the preamble. Where does that leave us in terms of costs relative to DAB?"

Mark Friend's reply: "So, in terms of the build-out of WiMAX, we haven't done an estimate of the cost, to be honest. We're still at the stage of working out exactly how it's going to be viable and in what kind of areas; so the trials going on in Birmingham and elsewhere we're looking at and monitoring very closely. So we don't have an estimate of the cost of building that out."

[Source: Audio recording, <http://tinyurl.com/ckvgt6>]

Mark Friend made that quote on 18<sup>th</sup> November last year, less than a month before the DRWG final report was published. The relevance of this is obviously that WiMAX is one of the prime alternative systems to DAB, but the DRWG – and the BBC – didn't even bother to look into how much it would cost.

Furthermore, the following figure shows a presentation slide from the DRWG Stakeholder Meeting held in the summer. This also shows that the DRWG's Technology sub-group clearly didn't even give any of the alternative technologies a moment's thought, because [all of the drawbacks listed for Internet radio are actually false](#).

## Some alternative digital radio platforms

<b>Internet</b>	<ul style="list-style-type: none"><li>• Greater interactivity and functionality, but -</li><li>• Not universal coverage</li><li>• UK capacity limited</li><li>• High cost to serve</li><li>• Reliability low</li><li>• Not portable</li><li>• In-car not viable in near term</li></ul>
<b>Wifi</b>	<ul style="list-style-type: none"><li>• Coverage focused on hot spots – unlikely to gain universal coverage</li></ul>
<b>3G</b>	<ul style="list-style-type: none"><li>• High cost to serve</li><li>• Not universal coverage</li><li>• Reliability low</li><li>• High cost to end user (at present)</li></ul>

The slide also ludicrously includes Wi-Fi as an alternative digital radio platform, despite the fact that Wi-Fi is a short-range wireless technology – how many base stations does the BBC think might be needed to cover the UK using Wi-Fi?

Clearly, the DRWG Technology sub-group had decided from the outset that they were going to recommend DAB, and no other alternative technologies were considered. The reason for recommending DAB was down to the broadcasters' and manufacturers' protectionism.

### DAB is the protectionist's choice

The DRWG recommending that DAB should become the main digital radio platform was clearly down to protectionist reasons: the BBC and commercial radio want DAB to be the main platform because DAB can carry the fewest stations out of any of the digital radio platforms, so their stations will face the least amount of competition; and the receiver manufacturers also favour DAB because they have the UK DAB receiver market sewn up.

Nowhere was this desire for protectionism more apparent than in the following quote from “The Drive to Digital” report commissioned by the RadioCentre, which details the prerequisites for commercial radio to “forge ahead with DAB”:

"This requires changes to terms of trade and the active support of the other principal players in radio - the government, Ofcom, the BBC and Arqiva - **including commitment not to pursue alternative technologies to DAB.**" [emphasis added].

[Source: Grant Goddard's blog, 'DAB: there is no alternative?', <http://tinyurl.com/d4qybn>]

## **DAB+**

If DAB is to be used as a primary network for radio in the UK, the very least the public deserves is that DAB+ should be used as soon as possible so that people can receive higher audio quality than the dreadful quality that's currently provided

Plans for the introduction of DAB+ should therefore be made public, and the BBC in particular needs to provide honest information about when it is planning to switch its stations over to DAB+.

## **Modern mobile technologies are vastly more efficient than DAB+**

It is hardly news that DAB is a massively out-of-date system. However, whereas DAB+ is a good system to use as an interim measure, it is still a very inefficient mobile system by modern-day standards, which is due to the fact that it still uses the original DAB system's transmission scheme – the addition of the AAC+ audio codec really only represented a coat of paint to gloss over the cracks that were appearing, but rust is already bubbling up underneath that coat of paint, and by the time FM is switched off, if that does indeed ever happen, DAB+ will simply be as outdated as DAB is today.

Some of the main alternative mobile systems that deserve proper investigation, but which the DRWG completely ignored, are as follows:

### **eMBMS – Evolved Multicast Broadcast Multimedia Service**

eMBMS is the broadcast standard for the LTE (Long Term Evolution) mobile phone system, and it is the successor to the MBMS broadcast system for 3G.

Similar to broadcast standards, such as DAB and DVB-T/H, eMBMS employs single-frequency networks (SFNs) to improve spectral efficiency, and such SFNs can cover large areas, which makes the system much cheaper to run than the MBMS system was.

eMBMS also supports a hierarchical cell structure with dynamic switching of streams between hierarchical levels. This means that popular Internet radio streams with many listeners would be delivered via an SFN covering a wide area, whereas streams with few listeners would be delivered via unicast. Depending on the number of listeners in a given area, streams can switch between being transmitted via an SFN or via unicast. This is effectively the optimal way of delivering radio streams to listeners wirelessly, because unlike traditional broadcasting systems like DAB/DAB+, energy and spectrum aren't wasted transmitting to areas where there's no-one listening.

### **DVB-H2**

DVB-H2 is the successor to the DVB-H mobile TV system, and it shares many of the same technologies as the DVB-T2 system, which will be deployed for the HDTV multiplex on Freeview in the near-future.

DVB-H2 and DVB-T2 have both been specified to work in 1.7 MHz Band III channels, which means that the system could use the current band structure used by DAB/DAB+ in the UK.

As DVB-H2 uses the latest technologies that are available, the system is expected to have a spectral efficiency that's approximately three times higher than DAB+. This means that a DVB-H2 multiplex transmitting in a 1.7 MHz Band III channel like DAB is using at present, would have three times the capacity of DAB/DAB+, so three times as many channels could be carried per multiplex. This would also reduce the transmission costs per station by a factor of three (assuming a full multiplex), and it would provide a greater choice of stations to listeners, or mobile TV could be delivered on the same multiplex.

Extending the BBC's national DAB multiplex to universal coverage levels also implies that the last 10% of the population who live in sparsely populated areas will only be able to receive BBC stations, whereas if an efficient technology such as DVB-H2 or eMBMS were used they would be able to receive many more stations.

### **Network sharing with mobile network operators**

It would make sense to share transmission network costs with the mobile network operators to reduce costs. Using DAB/DAB+ obviously rules this out.

### **Over-the-air (OTA) software upgrades**

One method that would make it easier to migrate to the modern technologies mentioned above would be to implement OTA software upgrades, which is already being employed on Wi-Fi Internet radios, albeit that the upgrade is actually distributed via fixed-line Internet.

## **Conclusion**

As the past history of analogue radio shows, once rolled out, radio systems tend to be around for a very long time. It is therefore crucial that the right system is chosen for the job. However, the decision to back DAB seems to be more to do with convenience and to do with allowing large players to protect their existing business – including the BBC, which has clearly acted against the interests of the people who pay for it.

DAB is a very poor technological choice when viewed over the long-term, and considering that the DRWG didn't even bother to investigate any alternative technologies, the UK would be adopting DAB on a whim. Considering the huge sums of money involved, and the length of time that such a system would likely be in-service, it would be an utter disgrace if the UK uses the DAB platform for the next one, two or three decades.

The very poor sales show that consumers aren't interested in DAB, so pushing DAB against this resistance is going to be a very difficult if not impossible job to pull off. In contrast, the BBC iPlayer has proved to be highly successful, which shows the public's appetite for consuming broadcast content via the Internet. It therefore doesn't

make sense for the long-term plans for digital radio to exclude Internet radio, because inclusion of Internet radio would speed up the migration to digital radio. But that seems to be precisely what the DRWG and Digital Britain reports are recommending.