Response to Ofcom's discussion document on regulating geolocation for cognitive access

8th February 2010

This response represents the shared views of Dell, Google and Microsoft.

We welcome this opportunity to respond and we commend Ofcom for taking the lead in Europe, in opening up the white spaces in the interleaved spectrum (the TV White Spaces), for new applications. Ofcom's discussion document is a valuable contribution to the ongoing, global drive to secure greater economic benefits from spectrum and promote wider broadband connectivity.

TV White Spaces have the potential to make a major contribution to widening and deepening broadband connectivity. Opening them up will enable, among other things, next generation in-home networks and cost-effective rural broadband coverage.

The main requirement for regulation should be to enable new applications, without causing harmful interference to legitimate existing spectrum users. Beyond this, regulators should provide industry with the greatest possible scope for adding value and widening consumer choice.

In our view, the regulatory framework for geolocation/database-enabled access should be based on the following principles:

- Multiple database service providers should be allowed, to avoid a monopoly over cognitive access and increase value and choice for consumers
- Devices which are in close proximity to each other should be allowed to share frequency availability data. For example, a white spaces access point might distribute the list of vacant frequency ranges to other devices within its local area network, avoiding the need for each device to make its own connection to the database service
- Devices which present a lower risk of causing harmful interference should be allowed greater flexibility. For example, devices with higher location accuracy might gain increased capacity and power allowance, commensurate with the increased definition of their position
- Database service providers should be permitted to specify their own protocols for communication with end-user devices, beyond any harmonised top-layer needed to support roaming. This flexibility would enable greater business model and service innovation and thereby encourage greater industry investment. For example,

providers might choose to bundle a range of location-based content together with frequency availability data, in order to provide extra value to users and increase the commercial viability of their services

- Database service providers should be allowed to receive as much of the raw protection data (made anonymous) as they want, beyond that required for basic determination of frequency availability. This raw data would allow value to be added to database services. The raw data would include:
    - TV transmitter locations, antenna heights, power levels etc.
    - PMSE receiver locations and application types (e.g. indoor, outdoor ...)
    - Propagation algorithms and matching parameters
    - A list of exceptions – for each location: frequency ranges which the regulator has decided either to allow or prohibit, beyond what propagation-based calculations would suggest
    - Validation tools/data-sets – to enable database service providers to check the results of calculations and the integrity of pre-calculated data.

The list of excepted frequency ranges, mentioned above, is likely to be a source of extra capacity compared with the capacity determined purely by assessing the signal level at a given location. For example, where two regions (A and B) border each other it is quite common for a television station from region A to be receivable in region B and vice versa. However the regulator may decide that TV stations from A do not need to be protected in region B (and vice versa) and can thus release the corresponding frequency ranges, for cognitive access.

Multiple database service providers could be allowed to perform their own calculations

Provided that all database service providers receive the same raw inputs, as approved by the regulator, they will all be able to conclude the same vacant frequency availability and power limits. Thus we see no difference between the interference protection afforded to licensees when calculations are performed centrally, compared to that enabled by allowing distributed calculation.

The advantage of allowing database service providers to access the raw data is that they can add value to the list of vacant frequency ranges. For example, the database service might choose to supply information on vacant frequency ranges in order of quality: e.g. based on the level of noise and interference likely to be present (arising from licensed users).

The regulator would need access to the database service providers in order to check that calculations are being performed correctly and that the distribution to end-devices is timely and transparent.

The diagram below shows an example of geolocation/database service architecture. It is intended to illustrate how the functions could be split between different stages in the value chain. We show the functional components of the process at the top of the diagram and possible organisational scope below.

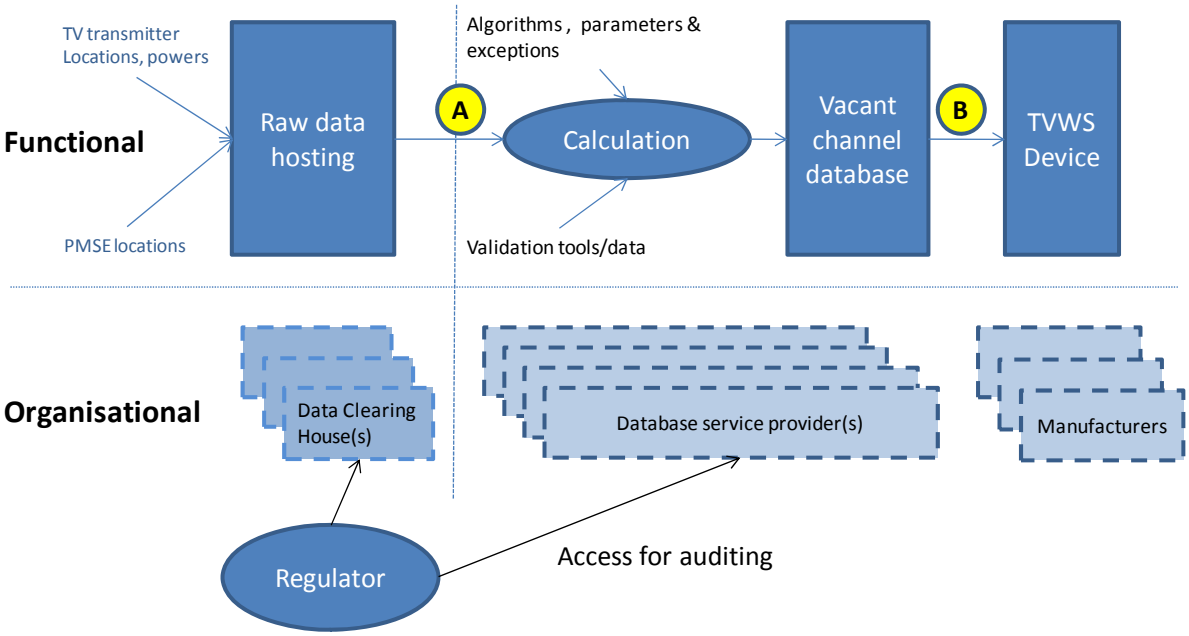

Figure 1 – Geolocation database service architecture – an example

The database service architecture may be considered as two basic components:

1. Data clearing house(s), where the raw protection data is aggregated and hosted, comprising TV transmitter positions and other data listed earlier. We expect this role to attract regulatory scrutiny, to ensure equitable access arrangements for all database service providers – particularly if there is only one such organisation.

2. Database calculation and distribution, where the raw data is processed and the results distributed. We believe that commercial organisations may be more attracted to this role, which provides greater scope for creating value.

The key for the regulator is to ensure that the raw data, together with other approved calculation inputs are available on an equitable basis to all database service providers who might choose to enter this market and can satisfy the regulatory criteria.

Funding the database service

We expect that the flexibility advocated earlier in this document would encourage industry to invest in database service provision as well as in developing devices for end users. Some companies may prefer to share the costs of such a service, whilst others may want their own

end to end proposition. The diversity of companies which have offered to become database providers in the U.S.[1] provides encouragement that there will be a commercial interest in providing such a service here in the UK, as well as in other parts of Europe.

[1] In response to a request from the U.S. Federal Communications Commission, nine entities submitted proposals for managing a white space database including Comsearch, Frequency Finder Inc., Google Inc., KB Enterprises LLC and LS Telecom, Key Bridge Global LLC, NeuStar, Inc., Spectrum Bridge, Inc., Telcordia Technologies, Inc. and WSdb, LLC. *See Office of Engineering and Technology Invites Proposals from Entities Seeking to be Designated TV Band Device Database Managers,* ET Docket No. 04-186 (25 November 2009).

Answers to questions

Q1: Should we suggest only high level parameters, leaving further work to industry, or should we seek to set out full details of parameters to be exchanged?

We would encourage Ofcom to keep to as high a level as is consistent with ensuring the required protection against harmful interference. This will preserve flexibility and encourage industry to invest in innovative services, creating greater value and choice for consumers.

Q2: Should both closed and open approaches be allowed? Should there be any additional requirements on the providers of closed databases?

We believe that open and closed approaches each have their own merits. Whilst we believe that it is critical to have at least one open database, allowing both open and closed models to exist will enable the maximum scope for innovation and for sustainable business models to emerge. In both cases we would expect the regulator to require access for the purpose of auditing the information held or provided by the database service provider. We therefore see no difference in the protection afforded to licensed services, between open and closed approaches.

We also see value in having multiple open databases, beyond the 'resilience' mentioned in the consultation [Section 3.5, p5]. This is because individual database services might add value in variety of ways, whilst all agreeing on which frequency ranges are allowed. For example, services might list vacant frequency ranges in order of quality and provide additional content relevant to a user in a particular location.

Q3: What information should be provided to the database? Are our assumptions about fields and default values appropriate?

We agree with Ofcom's initial thinking that the requirements on devices should be kept to the minimum needed to prevent interference.

- Device location is clearly central to interference protection. Assuming a standard accuracy for this parameter is a practical measure, which could simplify the provision of database services

- Device type should be optional, since it is not essential for the protection of licensed services. However, it would be reasonable to enable devices which present a lower interference risk than the norm, to benefit from greater flexibility. For example, a fixed mains-powered home media centre might be allowed higher transmission power levels than a mobile device.

In our view, the regulatory focus should be on the interface (labelled A in Figure 1) between the entity operating the data clearing house and the database service providers, rather than on the database to device interface (B). The latter should be the province of industry, operating within the constraints of the regulatory requirements. These requirements should be framed in terms that allow database service providers and device manufacturers to offer more value to consumers by, for example:

- Trading-off location accuracy against the number of frequency ranges available and the power levels that could be used
- Allowing facilities such as pre-fetch, whereby moving devices could load frequency availability data in anticipation of the positions they will pass through, working within the time validity window defined by the regulator.

Q4: Should the translation from transmitter location to frequency availability be performed in the database or in the device?

We believe that database service providers should be allowed to take responsibility for the translation into frequency availability. As device capabilities evolve, it might be possible for some devices to perform the translation themselves. In our view, this is a matter of implementation, which should be left to agreements between database service providers and device manufacturers. The database service provider would carry the ultimate regulatory responsibility.

Ofcom should be able to assure itself that database service providers can provide the necessary reliability and security in making and distributing the results of the translation, regardless of how the responsibility is divided between elements in the service architecture.

Q5: Have we outlined an appropriate information set for the database to provide to the device? Can industry be expected to develop the detailed protocols?

In our view, this is an appropriate information set. However, details such as the grid resolution (100 m by 100 m) need not be fixed in stone – over time it may be possible to move to finer grids and therefore enhanced spectrum efficiency.

We agree that providing frequency start and end, together with corresponding power level, gives the greatest flexibility. Database service providers and device manufacturers might also agree to exchange additional information, to enhance device function and performance.

We believe that the industry should be left to develop the details of the protocols, in line with the higher-level regulatory requirements. This will enable the benefits from white spaces to be maximised.

Q6: Is a two-hourly update frequency an appropriate balance between the needs of licence holders and of cognitive device users?

Two hours seems likely to be an appropriate balance, helping to minimise operating costs which would detract from the benefits that cognitive access could offer. However, it would be wise to allow this parameter to be variable, so that database services can provide end-user devices with a "time validity" indication, together with the vacant frequency range data. We take this concept further in our answer to Question 7.

Q7: Is there benefit to devices receiving a time validity along with any database request and to act accordingly?

Yes, as described in our answer to Q6, it would be useful for devices to know for how long frequency availability data would remain valid. This 'time validity', determined by the regulator, could vary with the time of day and geographic location, reflecting reduced risk of interference to PMSE licensees. Allowing variable time validity would increase consumer benefits, without compromising interference protection.

Q8: What role could push technology play?

Push technology appears to have significant potential to enable more timely updates of frequency availability to be delivered, without wasting network capacity on unnecessary checks by the end-user devices. However, we do not think that Ofcom should mandate the use of push technology, because it may not be appropriate for all devices in all application scenarios. The decision on whether and when to use it should be left to database service providers and device makers.

Q10: Do you have any comments on the suggested approach to implementing the database for PMSE?

We believe that the creation of PMSE entries in the database could be made quickly and easily, using established service platform technologies. The process need be no more complex than that followed by users of the current JFMG service.

We do not think that -77 dBm needs to be applied as a blanket signal level. Instead, the level could be chosen to match the type of venue, so that for typical theatre and studio venues the -67 dBm level might apply.

Q11: Do you believe it is practical to implement such a database?

Yes, we believe that such a database is practical and achievable. Although the data set is large, many of the required protection data changes are likely to be sparse, affecting only a limited area: so that the re-calculation load would not necessarily be high. With further

advances in technology, the database is likely to be able to support finer granularity of space and time, yielding increased spectrum efficiency without having to replace end-user devices.

Q12: Is it appropriate for third parties to host the database? If so should there be any constraints? If not, who should host the database instead?

Yes. Organisations could be qualified by Ofcom as competent and trustworthy, for the purpose of upholding the protection requirements. In the event that only one provider is willing to undertake the role, the Ofcom would need to lay down requirements for access to the data under equitable conditions. In Figure 1, presented earlier, we gave an example of how the database service function could be split into two parts:

1. Data Clearing House(s), where the raw protection data is held. If there is only one such organisation, this role could require greater regulatory scrutiny to ensure equitable access arrangements.
2. Database Service Provider(s), which could encompass both calculation and hosting of frequency availability data. Companies performing this role could operate on an authorisation basis, with access provided to the regulator for the purpose of validating the data supplied to end-user devices.

Regardless of how the functional architecture is mapped onto organisation scope, the most desirable outcome is to have multiple database service providers, competing with each other to drive innovation and value. In the event that only one database service provider emerged, the regulator would need to lay down equitable conditions for access.

Q13: How can any costs best be met?

We agree that users should bear their fair share of the costs of running the database service, where it is practical and proportionate to collect it. While we agree with Ofcom that charging end-users per use would probably be a strong disincentive to consumer adoption of the technology, we believe that business models should be left to the market to determine. If data access is on equitable terms and there is competition in the database service provision market, consumer-friendly business models should emerge.

The costs of current coordination arrangements for the bands in question are met by the licensees. These licensees could reasonably be expected to continue to contribute towards the costs of coordinating the use of the band, which will benefit them too.

Allowing the industry flexibility in implementing the regulatory requirements, should provide the greatest incentive for industry to invest in starting and operating database

services. We believe these would be self-sustaining. However, if initial industry interest were to prove insufficient, there could be a case for using public funds to help establish a database service, because of the wider public benefits to be gained.

Q14: What are the difficulties and expected costs to licence holders in providing the necessary information to the database? Could this information be provided in any other way?

We believe that the costs to licence holders of providing this information need be no greater than they are today, under the schemes administrated by Ofcom and the JFMG. PMSE users are most aware of such costs because their use of spectrum changes far more rapidly than that of broadcasters. We envisage that the mechanism they would use to enter protection information in the geolocation scenario would be no more difficult to use or costly than that provided by the JFMG. Indeed, there is scope for simplifying the task, reducing the time required to make an entry and the cost. Encouraging the industry to invest in database service provision would benefit licensed users too.