Joint response to Ofcom's consultation: Implementing Geolocation

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This response represents views held in common by: **Atheros Communications Inc., Broadcom Corporation, Dell Inc., Google Inc., Hewlett-Packard Company, LG Electronics, Marvell Semiconductor, Inc., Microsoft Corporation, Nokia Inc. and Spectrum Bridge Inc.**.

We welcome this opportunity to respond to Ofcom's consultation on its proposals for implementing geolocation-based access to the TV White Spaces.

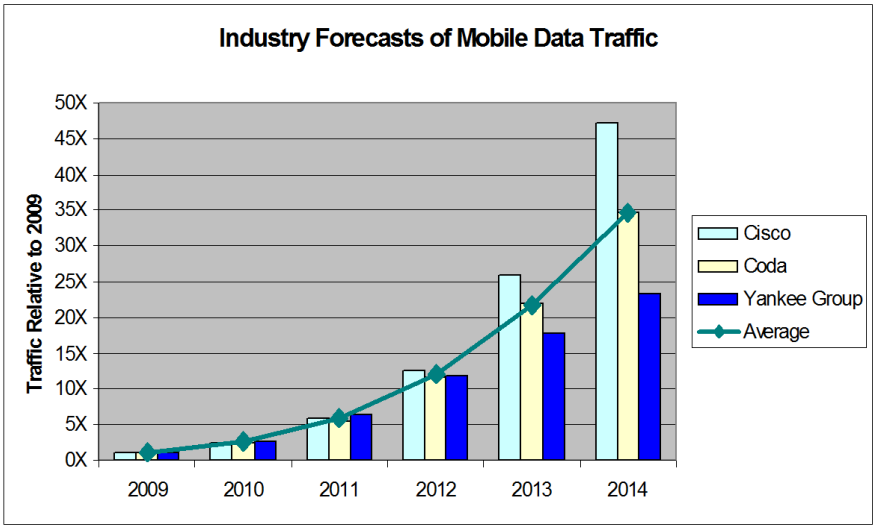
It is vitally important to the future prosperity of the UK and Europe that regulators move urgently to introduce much greater flexibility in the way spectrum is managed. By opening the TV White Spaces using geolocation–based access, Ofcom has taken a major step in the right direction.

The abundant unused capacity in the TV White Spaces has the potential to deliver significant economic and social benefits. We believe that the approach proposed by Ofcom in this latest consultation document provides a practical way to deliver these benefits and we urge Ofcom to take its proposals forward as quickly as possible.

The urgency of the TV White Spaces opportunity

Rapid growth in the take-up and use of wireless data services has driven rapidly growing demand for spectrum. Industry forecasts point in the same direction, as consumers embrace the convenience of wireless access to increasingly media-rich online services, aided by the availability of affordable devices with high quality display and interaction capabilities. The emergence of the 'Internet of Things' adds further pressure.

- Ericsson predicts that mobile data volumes will double each year and estimates that there will be 50 billion connected devices by 2020 [1].
- Similarly, the U.S. Federal Communications Commission (FCC) has projected strong growth in mobile data traffic levels – by a factor of five between 2009 and 2011, a factor of more than 20 by 2013, and a factor of 35 by 2014 [2]. This is illustrated in the following chart.



In addition to the mass-market data requirements of consumers, there are a number of niche users who could provide additional benefits to society from more intensive use of spectrum. These users, which include the emergency services, often have dedicated spectrum but may find the existing capacity too constrained to meet future requirements.

There are three essential strands to addressing the need for capacity, which should be pursued simultaneously:

1. Network capacity needs to be enhanced by increasing base station density. The closer optical fibre can be brought to end-users, the better the service they can enjoy
2. It is also important for regulators to be more aggressive in clearing spectrum of less efficient technologies. However, it is evident from the efforts of the European Commission and member states on securing the Digital Dividend, just how difficult and lengthy the process is – even for a bandwidth of 72 MHz
3. Finally, given the extent to which licensed spectrum lies idle for much of the time, regulators also need to focus urgently on enabling shared and opportunistic access to spectrum. The TV White Spaces are the first major opportunity to turn this vision into reality, stimulating the development of advanced sharing technologies which can facilitate far more flexible use of spectrum.

TV White Spaces' Potential

The TV White Spaces (TVWS) have significant economic potential. In the US alone, the opening of TV White Spaces could generate an annual value of between $3.9 billion and $7.3 billion. This would amount to a total of up to $100 billion over 15 years [3].

This projected economic value is derived from the substantially better propagation characteristics of spectrum below 1 GHz, which would enable each wireless network node to provide three to five times greater range than a Wi-Fi network node — using otherwise identical operating parameters. This potentially multiplies network coverage by a factor of nine, without increasing the cost. Better penetration of walls and other structures, facilitated by TVWS characteristics, would improve indoor network availability and reliability.

Increased coverage efficiency would translate into more seamless and reliable broadband connectivity for consumers and organisations (commercial, educational, healthcare, industrial, and government). TV White Spaces networks can also operate at lower power than is necessary with Wi-Fi, over a comparable range. This would help to reduce the environmental impact of wireless broadband access and extend the battery life of mobile devices.

Potential benefits from applying TV White Spaces spectrum include:

- Wireless broadband access in rural locations and poorer inner-city areas
- Increased connectivity in classrooms and other public spaces
- Whole-home wireless networks that can reach every device in a multi-storey building
- Larger and more reliable commercial hotspots and campus networks

- Wide-area systems control and sensor networks, helping local government and enterprises manage their responsibilities more effectively. For example, more effective and longer-range remote management of home and offices would help conserve energy.

UK consumers and citizens should be able to start enjoying these benefits as soon as possible.

Industry is investing in developing the technology

Industry is actively developing products that can use the TV White Spaces. For example, the IEEE's 802.11af Task Group is currently working on specifications to extend 802.11 Wi-Fi signalling into the TV White Spaces bands. In June 2010, the Wi-Fi Alliance started building on the IEEE 802.11af standard to create test plans and deploy a product certification program for white space devices.

A diverse group of network operators, chip vendors, device manufacturers, among others, is supporting this development, illustrating the strong industry interest in gearing up for the TV White Spaces opportunities. The list of signatories to a letter to the FCC, filed earlier in the summer, also demonstrates the level of interest [4].

TV White Spaces trials provide a vivid illustration of the potential

Building on the FCC's early decision to allow the use of TV White Spaces (TVWS), a number of networks have been deployed successfully in the U.S., under experimental licences [5]. In these networks, white space devices query a database to determine spectrum available, for a wide range of applications, including:

- **Rural Broadband**. In 2009, a TVWS-based wireless broadband network was established in Claudville, Virginia, a remote mountain town which had previously lacked broadband Internet access. Spectrum Bridge Inc. installed a central white space node which establishes wireless links to Wi-Fi hotspots in a local school and café

- **Connected Campus**. In Redmond, since 2009, Microsoft has been operating a campus-wide wireless access network demonstrating cost effective coverage which would be equally applicable to shopping centres, factories, and universities. Dubbed *White-Fi*, the network allows users travelling in company buses to enjoy continuous broadband Internet access as they move between locations. The use of TV White Spaces enabled a level of coverage that would not have been practical using Wi-Fi in the 2.4 GHz band or at higher frequencies

- **Smart City**. Early in 2010, Wilmington and New Hanover County, North Carolina established a TV White Spaces network to support municipal and country applications including the monitoring of water quality in wetlands, traffic management, and lighting management in city parks. The city also established a "middle mile" wireless network that connects its fibre network with Wi-Fi access points in city parks and areas poorly served by Internet service providers, thereby bringing affordable broadband access to low-income populations. Based on the success of this trial, there are plans to start remote monitoring of critical bridge and highway infrastructure using the white spaces network

- **Smart Energy**. In mid-2010, in Plumas-Sierra County, California, Google and Spectrum Bridge deployed the first Smart Grid over TV White Spaces. This enabled the local utility to

automate substations across this mountainous region and initiate a smart-meter network, helping consumers to save energy and lower their heating and air-conditioning costs

- **Healthcare**. This autumn, Google and Spectrum Bridge deployed the first TV White Spaces network for healthcare providers, in Logan, Ohio. The network, using database technology, enables a rural hospital to access affordable broadband and supports telemedicine applications

- **Broadband for all.** Rice University is developing a wireless broadband access network to serve around 4,000 homes in Houston's working-class East End neighbourhood. TV White Spaces will help fill gaps that could not easily be addressed with the higher frequency licence-exempt bands and will deliver a network that adapts to users' needs and locations.

A number of organisations are now planning and deploying trials in the UK, building on the experience gained in the United States.

Geolocation databases are the most practical and secure solution

We agree that regulation based solely on geolocation databases is the most practical way forward, providing the best protection for existing licensees and maximising the benefits from the new white spaces applications, for consumers.

We also agree that it is not necessary to require spectrum sensing in addition to geolocation databases. Within the protection defined by the geolocation database, manufacturers should have the freedom to choose which technologies (including spectrum sensing) they use in implementing products. This should also help make more efficient use of spectrum.

Ofcom's proposal for the database to return the *maximum power allowed* gives useful flexibility. Further flexibility might be enabled by allowing the white space device to declare the power it intends to use (if less than the maximum permitted).

We agree that a licence-exempt approach is the best fit with the TV White Spaces. It avoids the need for partitioning of the available capacity and should result in a greater range of end-user equipment. We note that geolocation databases have the potential to enable a more flexible approach to managing secondary access to spectrum, supporting a wider range of applications, users and business models than traditional licensing approaches.

The UK's experience with JFMG, providing database-enabled secondary access for wireless microphones etc., gives it a head start compared to regulators in other parts of Europe. Ofcom's investment in an open regulatory development process with all the stakeholders, over the last two years, provides it with an unrivalled understanding of the issues and opportunities around the TV White Spaces. We therefore believe that Ofcom is fully justified in proceeding with its proposals, enabling UK consumers and citizens to enjoy the benefits from TV White Spaces networks as early as possible.

We also encourage Ofcom to continue its advocacy within the CEPT and with the European Commission – in parallel with introducing the enabling UK legislation. Ofcom's contribution to the technical preparatory work in the CEPT has been constructive and valuable in helping regulators in

other member states to develop a better appreciation of the issues at stake and practical approaches to address them.

European harmonisation is an important goal, at least on the device-to-database interface and any other static requirements. We believe that geolocation databases could help reconcile the inevitable differences in regulatory approaches between member states and adapt to changes in allocation, which are likely to continue in the UHF bands over the coming years.

We agree that enabling access to the TV White Spaces will indeed bring great value to UK consumers and citizens and look forward to playing our part in delivering their promise.

Questions & Answers

Q1: What are your views on the likely use and take-up of WSDs? Do you intend to participate in this area, for example by hosting a pilot or developing equipment?

WSDs could become 'mass-market' more quickly than Ofcom estimates, with the white spaces interfaces joining other popular wireless interfaces (such as Wi-Fi and Bluetooth). However, much depends on the regulatory framework, and the balance between value and cost that it enables. The clarity provided by FCC and Ofcom has significantly helped to accelerate the development of standards, preparing the way for silicon and ultimately devices.

Some of the companies supporting this response are planning trials of TV White Spaces technology in the UK, which will further assist with developing products.

Q2: Are these appropriate conditions for licence exempting the WSDs?

Yes, we think they are.

As a potential refinement, we think slaves should be allowed to transmit directly to other slaves which share the same master device (Page 23), provided that they operate within the restrictions required by the database for their location. This would enable greater efficiency in using spectrum and provide more scope for applications.

Q3: Is the lack of European harmonised standards problematic for development of WSDs?

Harmonised standards would be helpful and the industry is already working on these, for example in IEEE and ETSI groups. First, however, it is important to have a clear common regulatory approach, such as the use of geolocation databases. This will help accelerate the standard-drafting process. We believe that the regulatory requirements should be technology-neutral, to enable greater innovation. The aim should be to harmonise only the minimum set of device requirements needed to protect the licensed services – such as the device-to-database interface. This would enable consumers to take their devices between member states.

The use of geolocation databases should help reduce the degree of regulatory harmonisation required, by allowing many of the detailed regulatory requirements (and national differences thereof) to be absorbed in the database contents rather than being hard-coded in white space devices – where economies of scale would be most beneficial.

Q4: Do you have any comments on these requirements? Are there any other requirements that should be placed on the database?

In general, the requirements appear reasonable to us.

However, we do not see why Ofcom is proposing that databases should be required to respond within 10 seconds. Since the speed of response does not affect the protection afforded to the licensed users, this should be left for database service providers to determine. It is clearly desirable, from an end-user perspective, for database services to respond rapidly, but there is no impact on the risk of interference.

The consultation notes generally, in Section 5 (Page 22), that database applicants would need to meet certain minimum criteria and so we expect that Ofcom would hold a separate consultation on what these should be.

Q5: Do you have any comments on these responsibilities? (p 23)

We believe that these responsibilities are reasonable.

Q6: Might you be interested in becoming a database provider? If so, can you provide more details on the extent and timing of likely provision? (p23)

Some companies in our group may have such an interest, which we leave for them to express in their own responses.

Q7. Is our approach of working with Europe where possible, but moving ahead alone if no European approach appears forthcoming, appropriate or should we await European harmonisation regardless of how long this might take? (p24)

We commend Ofcom on the proactive role it has taken with regards to TV White Spaces in Europe. Sometimes it is necessary to lead and show the way for others. We believe that Ofcom has been right to try to gain support in Europe for a common approach, based on its well-developed proposals. However, given the likely delay in arriving at a unified framework, we believe that the UK would be right to move ahead as soon as possible. In our view, this will accelerate progress in other member states on their own implementations.

We also believe that Ofcom's proposals are compatible with broader European policies and objectives, in enabling spectrum to be used more effectively, to promote more ubiquitous broadband and enhance the European economy.

References

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3. Ingenious, "The economic value generated by current and future allocations of unlicensed spectrum", September 2009, http://www.ingeniousmedia.co.uk/websitefiles/Value_of_unlicensed_-_website_-_FINAL.pdf .

4. Letter to the Federal Communications Commission, July 19th 2010, http://fjallfoss.fcc.gov/ecfs/document/view?id=702054971 .

5. Spectrum Bridge Inc., Observations and Conclusions from Experimental Deployment of TV White Space Networks, ET Docket No. 04-186, filed Jun. 24, 2010).