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Emergence of Whitespace Technology for the Creation of Super Wi-Fi Network

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Abstract: With the growth of the digital economy, more people need access to quality broadband internet. However, there is still an important deficit in access outside of major metro areas because of costs and availability. White Space broadband has the potential to revolutionize the way we access the internet, especially for those in rural areas, where there is ample free, unlicensed White Space spectrum to utilize. The next generation of wireless networks will include software defined radios, cognitive radios, and multi-radio systems which will co-exist harmoniously while operating over a very wide range of frequencies. In most developed countries, there are huge gaps in internet access. Because Wi-Fi has many problems like limited range, slow speed etc. White Space WI-Fi has the ability create a new class of application to develop the Wi-Fi network. The objective of this research to know why ordinary Wi-Fi network can't cover a wide range and to know about TV white space Wi-Fi Technology. To utilize this unlicensed spectrum band, TV Band Devices (TVBD) must com-municate with a database to obtain a list of currently available white space channel. However, to ensure that those unlicensed transmissions didn't interfere with existing TV broadcasts, the FCC required devices working in the whitespaces to register themselves with a TV white spaces database. Avoiding interference is a complex and dynamic process. This paper is based on brief study on how white Space technology can be helpful in creating super Wi-Fi broadband network which covers larger area. It focuses on wireless broadband communications

Keyword: Whitespace, Super Wi-Fi, Wireless Communication, wireless broad-band, Frequency, TV band devices.

INTRODUCTION

White space is defined as the unused frequencies allocated to broadcasting services but that are left unused in particular areas of the country. White Space refers to the unused broadcasting frequencies in the wireless spectrum. Television networks leave gaps between channels for buffering purposes, and this space in the wireless spectrum is similar to what is used for 4G and so it can be used to deliver widespread broadband internet. Typical home Wi-Fi can travel through two walls. White Space broadband can travel up to 10 kilometres, through vegetation, buildings, and other obstacles. Tablets, phones, and computers can all access this wireless internet using White Space through fixed or portable power stations. The actual amounts of spectrum vary by region, but White Space spectrum ranges from 470 MHz to 790 MHz.[1]

The size of the frequency gaps, and their precise frequency, varies too - meaning there is no single white space frequency that can be used around the country. Devices such as mobile phones and tablets could use the free spectrum by knowing which frequencies are available, at what power levels, and at which times of the day in a particular location. This spectrum is located in the VHF (54-216 MHz) and UHF (470-698MHz) bands. It is an opportunity to develop new wireless networks to utilize this spectrum. The growing demand for wireless communication imposes the search for alter-natives to the current situation. TV white space spectrum will become one of the key drivers in the development of wireless communication. This technology is under researched. TVWS technology is appealing for industry because it can travel longer distances and more easily through walls than the bands mainly used by other wireless technologies, such as Bluetooth and Wi-Fi. It also offers potential for fast rural broadband provision. Today's Wi-Fi has a limited range and can be blocked by walls or other environ-mental barriers. Whereas TV White Space technology can cover a wide range of area.[2] This breakthrough technology was nicknamed "super Wi-Fi because of its superior range and ability to penetrate obstacles such as trees, buildings and rough terrain.

How white space technology can be implemented

The new technology, known as white spaces devices, will share the band with the existing uses, Digital Terrestrial Television (DTT), including local TV, and Programme Making and Special Events (PMSE), including in particular wireless microphone users. The sharing will take place dynamically, controlled by databases which will hold information on the location of DTT and PMSE users and white space devices. They use this information, following the approach set out in this document, to allow white spaces devices access to the spectrum band, but only to the extent that this does not cause harmful interference to the existing users of the spectrum.[3]

The coexistence framework is designed to allow as much use as is compatible with a low probability of harmful interference and therefore allows greater powers at closer distances for equipment that will cause less interference. The availability analysis that we have done shows that there should be sufficient availability to support likely use cases in a good percentage of the country.[4]

The diagram below provides an overview of how we proposed access to white spaces based on geolocation would work in practice. In this model a "master" white space device (WSD) would first consult a list of databases provided on a website. It would then select its preferred database from this list and send to it parameters describing its location and device parameters. The database would then return details of the frequencies and power levels the WSD is allowed to use.[5]

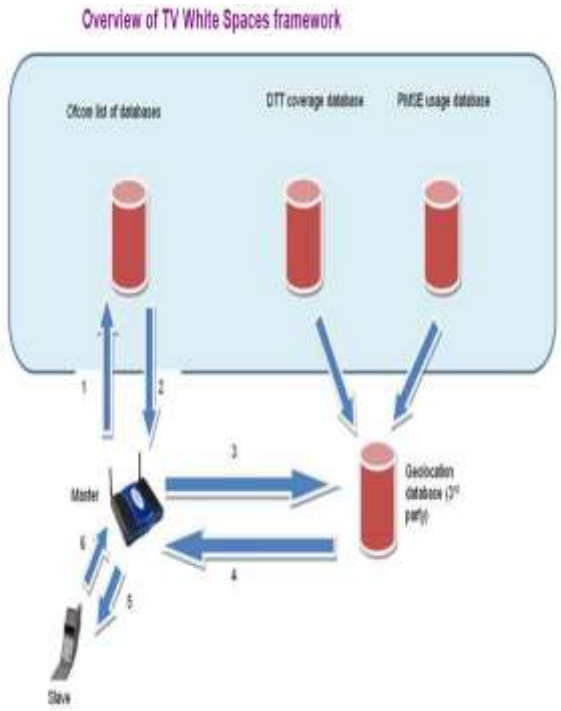

Figure 1: Overview of White Space Framework

The Figure shows that a high level way to potential 'white space' for a given DTT channel (channel 59, 774 to 782MHz). High power DTT frequencies which use the same frequencies need to leave space between their coverage areas to avoid interference. Darker green areas on the map indicate the approximate coverage areas of DTT transmissions in channel 59 while lighter green areas indicate the 'white spaces' in channel 59. These 'white spaces' in between can be used by lower power devices.

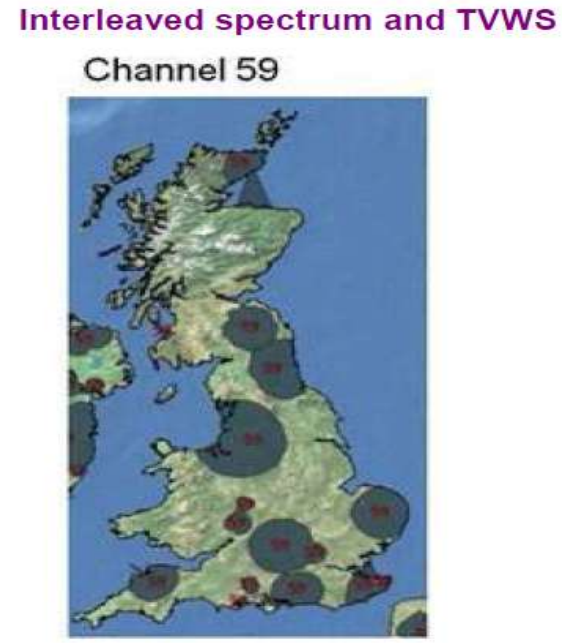

Figure 2: Interleaved Spectrum

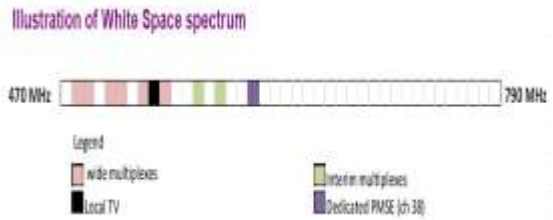

Figure 3: White Space Spectrum

We refer to the spectrum that is left over by DTT (including local TV) and PMSE use as TV White Spaces (TVWS). By this we mean the combination of locations and frequencies in the UHF TV band that can be used by new users which would operate in accordance with technical parameters that ensure that there is a low probability of harmful interference to DTT reception or PMSE usage or services above and below the band.[6]

Advantages of Super Wi-Fi

In super Wi-fi white spaces are used for transmissions. Frequencies that fall in between TV channels in the 470MHz to 700MHz range are called as white spaces and the transmission in which white spaces frequencies are used get vast range in same power and in other situations same range with less power usage. It works better than the other unlicensed bands having higher frequency. According to the Goggle telecom and media counsel Rick Whitt "The white spaces have the potential to spark the next generation of wireless communications," but to use the frequencies that are empty in the space FCC would require specific installers for the configuration of white-spaces devices. But if it happened then the upcoming super Wi-Fi will be much stronger than the current Wi-Fi because in the current Wi-Fi the speed is 54MBps on the frequency of 802.11a. but n super Wi-Fi the speed will be very fast than this it though the speed cannot be outlined accurately because the working on it is still in the way and under development and is not declared in numbers by the FCC. Still it will be highly boosted up.

On the other hand as far as the range is concerned the a router having standard antenna considered as an average Wi-Fi can cover up to 32m area with a good result as far as connecting to the computers used in homes it is good but if a person wants to use a waterproof laptop, a tablet or mobile in the swimming pool it is a foolish idea but super Wi-Fi can do it possible. It can work in the range of several miles suppose we do not consider the increase in speed still 54MBps having the range of several miles is awesome. It has the ability to penetrate in the walls and the buildings. If you are in a building and the person with whom u want to connect it is possible with it. Now brick walls basement and moving around is no more problem with it.[7]

Super Wi-Fi has many benefits that deal with the wireless transmission of data. Some important of them are as follows:

1. The broadcasters and the manufacturers do not interfere in the signals of each other with the help of super Wi-Fi.
2. It serves not just mobile device users such as tablets, iPods' and other devices but also the hospitals business places and schools.
3. In IT and internet field specially it would be very advantage to Goggle that their sites speed will increase.
4. It is an ideal technology for the cities and the constructed areas because it will have an ability to pierce into stone and brick walls.
5. Device manufacturing companies like Motorola, HTC Dell, and HP can make their profit more by making devices which can tap into the airwaves.
6. The availability will be free for everyone so the public will use it free.[8]

Super Wi-Fi, or using TV broadcast spectrum for Wi-Fi like connectivity, has several distinct advantages also:

(i) Greater Distances

Super Wi-Fi networks work in much the same way as conventional Wi-Fi, but the signals travel over longer distances than the typical Wi-Fi signal. In typical applications, a strong Wi-Fi signal can cover 100 meters while a Super Wi-Fi signal at the same power level can easily travel 400 meters and with higher power can cover many kilometres.

(ii) Penetrates Common Obstructions

Conventional Wi-Fi is relatively weak when it comes to working in typical physical settings – bumping up against concrete obstructions and many types of walls. Most population canters have thousands of likely Wi-Fi impediments and almost any installation in a building with more than a few rooms will eventually hit limits. Likewise, many rural areas are difficult to serve using existing technologies due to heavy foliage or topographical challenges. Super Wi-Fi can overcome these limits. Just as your TV signal passes through walls (and many of them), the wireless signal for your Internet connection will as well.

(iii) Greater Efficiencies

Covering a longer and wider range with approximately the same power and computing requirements results in systems that will deliver more bandwidth and more consumer benefits at lower network costs and lower power consumption.[9] In addition, consumers will be able to satisfy their ever increasing bandwidth appetites and Internet providers will be able to provide more throughputs in more places to more consumers.

CONCLUSION

White space spectrum in the TV frequency band is appealing for industry because it can travel longer distances and more easily through walls than the bands mainly used by other wireless technologies, such as Bluetooth and Wi-Fi. Spectrum is an important but limited resource, which is why we're exploring new ways of unlocking its potential, while balancing the needs of different users. Spectrum Bridge, a telecommunication software company, was one of the first databases certified by the FCC. The company has worked with Dell, Google, and Microsoft to deploy experimental broadband networks. An unused frequency of television channels provides opportunities to build a strong Wi-Fi network so that those who stay in some kilometres can access net frequently. This will be helpful in Next generation Wi-Fi and city sensing so that it can enhance can enhance internet coverage in indoor and outdoor urban locations and enable 'smart city' functionality, including linking webcams and other sensors. It will also provide

Internet on ships and boats, Broadband coverage enhancement, Flood defence, and fastest live video streaming etc.

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