Super Wi-Fi Technologies

Microsoft

"The world is increasingly interconnected through mobile, high-speed communications yet two thirds of the world's population have yet to gain access to the Internet."

UN Millennium Goals , 2012 Update Report

Introduction

As defined by the UN, access to the Internet is now among global citizens' most basic rights. The European Commission's Digital Agenda goes one step further by similarly highlighting broadband access as a basic right. To achieve this near ubiquity of access, radical changes will need to be made in how citizens of every country connect to the Internet. Many impediments exist on the path towards this goal, but one of the most important challenges is delivering ubiquitous, affordable access to all consumers.

To achieve this goal, different technologies – wired and wireless – will need to be used in different settings. For the vast majority of the world's population, wireless technologies are proving the most economically efficient way of delivering reliable, affordable broadband access. But, even within wireless, a mix of solutions will need to be used. For example, technologies and business models that work well for delivering access to urban or wealthier populations might not work well for delivering access to rural or disadvantaged populations. Moreover, to address growing demand, wireless Internet service providers are increasingly encouraging consumers to use multiple forms of broadband access – for example, 3G and Wi-Fi – with the same devices.

One promising wireless technology is what is known as Dynamic Spectrum Access, which uses location-aware devices and online databases to deliver low-cost broadband access and other forms of connectivity to consumers. This approach is rooted in the idea that devices with greater knowledge of their surroundings can opportunistically use available radio spectrum. There are many TV broadcast channels that are unused in nearly every location in the world – these empty channels (blocks of spectrum) are what is known as "white spaces". Dynamic Spectrum Access will first be used in TV-band White Spaces to deliver what we call "Super Wi-Fi." Much like today's license-exempt (unlicensed) technologies – most notably Wi-Fi – Super Wi-Fi will be provided over radio spectrum that is shared among different users and Internet service providers. This under-utilized spectrum is proving to be a key part of the future of not just universal broadband access but of the solution for the explosion of devices connecting the Internet.

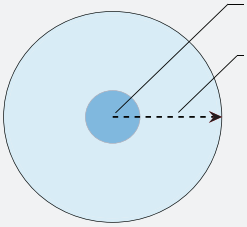
Benefits of Super Wi-Fi

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

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 kilometers.

Super Wi-Fi Signals Travel Farther

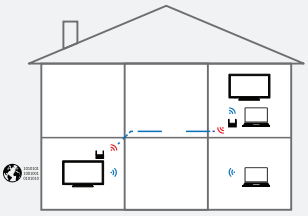


Four times the distance: 16 times the area covered. Same power comparing 2.4 GHz to 600 MHz. The result is more bandwidth, lower network costs, lower power consumption.

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 centers 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.

Super Wi-Fi Signals Penetrate More Walls



- In a typical home, a Wi-Fi signal can penetrate up to two walls. At the same time, a TV white spaces signal can penetrate through more walls and obstacles,enabling whole home media distribution.
- This will simplify and enrich in-home/ in-building networking opportunities.

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. In addition, consumers will be able to satisfy their ever increasing bandwidth appetites and Internet providers will be able to provide more throughput in more places to more consumers.

Who Benefits from TV White Spaces Broadband

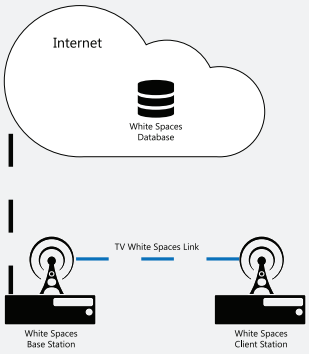
Using Super Wi-Fi to deliver broadband connectivity will benefit almost every part of the wireless Internet ecosystem. End users, network operators, and content providers are all potential beneficiaries and as the spectrum utilization continues to grow new enhancements will emerge including "Internet of things" and ubiquitous machine to machine communication. These latter two scenarios have the potential to ignite entirely new sectors of the global economy much like the first generation of Wi-Fi did for the Internet.

Some of the most immediate beneficiaries will be people currently living in what areas that cannot be affordably reached with existing technologies. These people range from rural inhabitants in mature markets such as the US or Western Europe as well as sparse populations spread out over large areas in remote parts of developing markets such as India, Brazil and across Africa.

How it Works

The most common implementation of Super Wi-Fi networks will be accessed using smart, radio-enabled devices that report their location to an Internet database. The database will tell the device which TV white spaces channels, and at what power level, it is permitted to operate on in its current location. The database has a list of all protected TV stations and frequencies across the country, so the devices can avoid causing interference to TV broadcasts and wireless microphone signals. This technology is truly dynamic – as different TV channels become available, Super Wi-Fi devices that can opportunistically switch from one group of channels to another. This win-win translates to greater network capacity, allowing a greater number of users in a given area while, at the same time, protecting television reception from interference. All of this engineering will be invisible to the consumer, who will simply experience more ubiquitous broadband connectivity.

Super Wi-Fi Access Safeguards Incumbents from Interference



1. Devices only use the TV white spaces channels specified by the database.
2. Devices are required to re-check the database for the list of available channels.
3. Databases are prohibited from providing devices access to the channels occupied by incumbent operators (e.g. broadcasters).
4. Databases are required to maintain up-to-date lists of protected operators.
5. Databases can block newly occupied channels to prevent further white spaces access.

Progress to Date

Microsoft has been working with industry consortiums and regulators around the world to demonstrate the viability and potential of Super Wi-Fi. With over a dozen successful trials and demonstrations, it is clear the approach works and most of the technical questions have been addressed. Demonstrations have been successfully implemented in Belgium, Kenya, Switzerland, Singapore, the United Kingdom, the United States, Uruguay, and other countries. The U.S. FCC has already adopted regulations allowing non-exclusive license-exempt access to the TV White Spaces. A recent full scale deployment trial in Cambridge, UK was completed with results that exceeded expectations and the UK regulator, Ofcom, is using these results to inform regulatory proceedings.

Other regulators, in addition to the FCC in the US and Ofcom in the UK, have begun to implement the changes necessary to enable commercialization of this approach and it is only a matter of time before both the heavy bandwidth users in developed markets and those yet to even be connected in the furthest corners of the world to benefit from the innovative use of Super Wi-Fi.