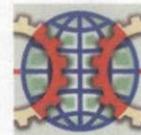


Difference engine | Bigger and better than Wi-Fi



Wireless networking: The spectrum released by TV's switch to digital broadcasting will soon be put to good use

THOSE old enough to remember television before the age of cable and satellite TV may have wondered why half the channels on old-style analogue TV sets seemed to be missing. Apart from channel two, the rest of the original VHF channels on the dial were usually just the odd numbers from three to 13. Why? In over-the-air VHF broadcasting, the channel between two analogue stations had to be left unused so that it would not interfere with adjacent ones. When UHF broadcasting came along, empty "guard bands" were added to each channel for the same reason. In some places, this "white space" of unused frequencies separating working channels amounted to as much as 70% of the total bandwidth available for television broadcasting.

Mobile-phone operators and other would-be users of wireless spectrum have long lusted after television's empty airwaves. In America, after two years of wrangling, the Federal Communications Commission (FCC) in Washington, DC, has finally given the go-ahead for white-space frequencies to be put to use.

In 2008 the FCC voted to reallocate the various segments of white space and unused channels between 54MHz and 806MHz (channels two to 69), which would no longer be needed when the last of the country's analogue television transmitters switched to digital broadcasting in June 2009. Unlike analogue transmissions, digital signals do not "bleed" into one another and can therefore be packed closer together. As a consequence, television broadcasters now need little more than half the spectrum they hogged before switching to digital. That has not stopped them fighting tooth and claw to hang on to their unused white space. Most had grand plans for using such frequencies to sell information services to the public.

It was not to be. Instead, the FCC has used the switch to digital as an opportunity to liberate huge swathes of bandwidth for others to use. The most valuable frequencies of all, those in the 700MHz band (channels 52-69), have been auctioned off to mobile-phone operators. Between them, Verizon, AT&T and others paid nearly \$20 billion to clinch this prime spectrum. The reason these channels are so valuable—and why they were chosen for terrestrial television in the first place—is

that their signals travel for miles, can carry a lot of information, are unaffected by weather and foliage, and go through walls to penetrate all the nooks and crannies within the bowels of buildings.

The white space freed up below 700MHz is to be made available for unlicensed use by the public. By doing this, the FCC hopes to trigger another wireless revolution—one potentially bigger than the wave of innovation unleashed a decade or so ago when Wi-Fi, Bluetooth and other wireless technologies embraced the unlicensed 2.4GHz band previously reserved for microwave ovens, baby alarms and remote openers for garage doors.



The difference this time is that the frequencies being released will allow much higher data rates. The latest version of Wi-Fi, called 802.11n, shuttles data at 160-300 megabits a second (vtbps). White-space devices are expected to be able to zip data along at 400-800Mbps. And whereas Wi-Fi signals peter out after 100 metres or so, their white-space equivalents could have ranges of several kilometres.

From hotspots to hotzones

Enthusiasts talk about white-space devices offering a "third pipe" for access to the internet, to rival cable and telephone broadband. Others see them providing an alternative to mobile phones. When wireless zones cover entire university campuses rather than mere coffee shops, anyone with a smartphone running Skype or something similar would be free of usage charges and operators' restrictions.

Before any of that can happen, though, a lot of technical problems will have to be licked. For one thing, white-space transmitters have to avoid interfering with both local television stations and the wireless microphones used in conference halls, sports arenas, theatres and churches. As a white-space gizmo moves around a city, the channels it can use will change, depending on how close it gets to various transmitters. The central access tower it communicates with may then have to hop from one channel to another—checking with all the other client devices using it to see if they can follow suit. If a newcomer joins the network (client devices will be joining and leaving continuously) and happens to be near a transmitter, the tower and its various clients will have to scramble to find yet another channel they can all use without causing interference. The computational problem is not exactly insignificant.

The prototype white-space devices used in trials had little trouble sensing occupied TV channels, typically picking them up at signal strengths less than a thousandth of that needed to display an image on a TV screen. In other words, they could hop off an occupied channel and onto a vacant one before causing so much as a blip on television sets in the area. Even so, the equipment-makers argue that, though doable, all this sensing palaver makes white-space devices needlessly complicated and expensive.

The FCC seems to agree. At a meeting in September the commissioners voted unanimously to ditch the spectrum-sensing requirement and let device-makers rely solely on interrogating online databases to find vacant channels. Meanwhile, wireless microphones are to be allocated two separate channels of their own.

Having been given the go-ahead, equipment-makers now expect that the chips needed to make the technology work in phones, laptops, tablets and other gadgets will start trickling out over the next year. White-space consumer products could then hit the retail market by late 2012. If Wi-Fi is anything to go by, white-space networking has the potential to change the way people live, work and play. All it needs now is a snappier name. ■

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