

WhiteNet

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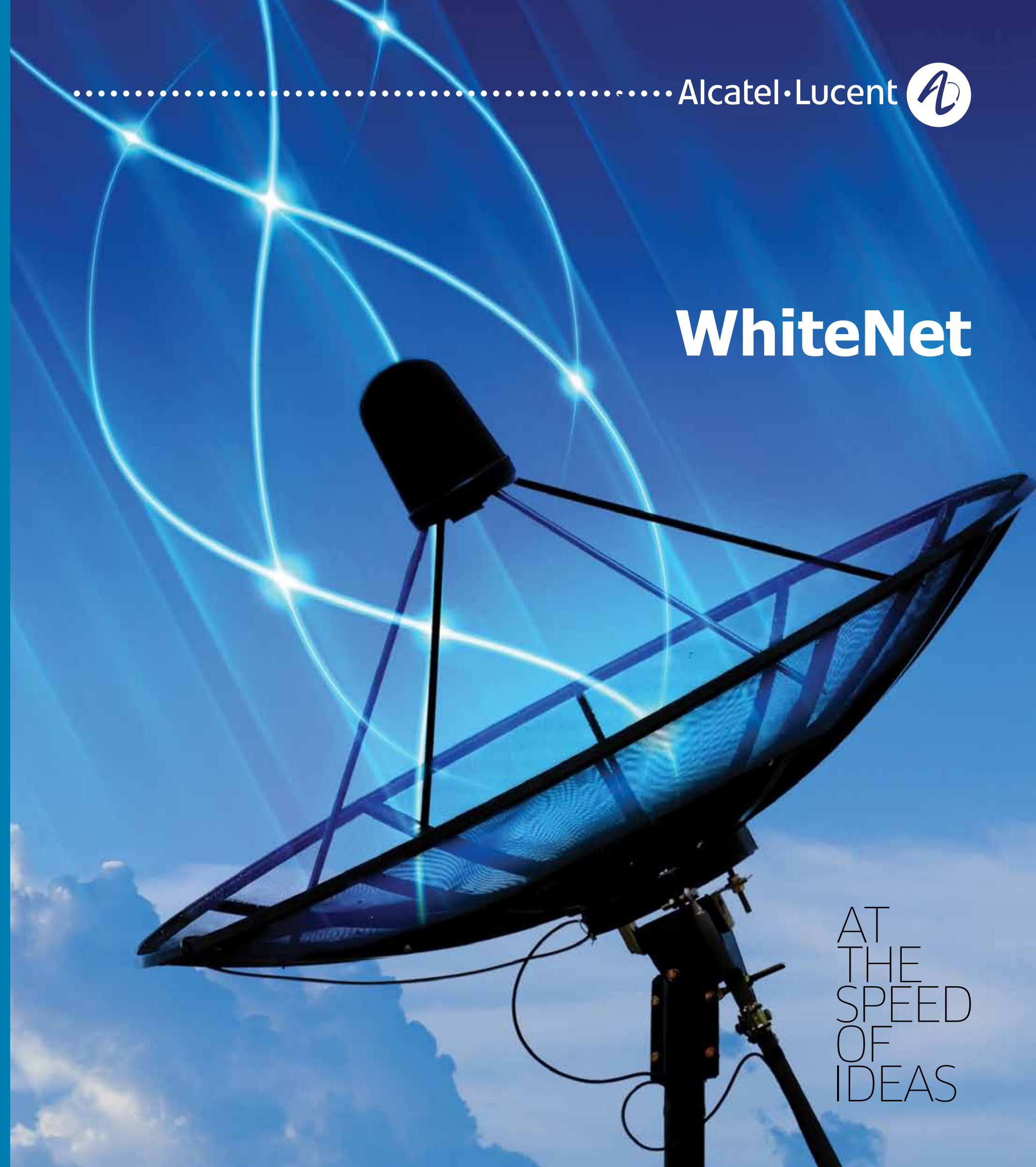


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Project Profile

Migration from Analog to digital Television transmissions in many countries and the new FCC ruling of opening up Television whitespaces for unlicensed access heralds an era of innovation in wireless technology.

Much of the media and the industry excitement stems from the fact that the unused TV spectrum can travel much further and penetrate walls and obstacles better than Wi-Fi signals. However, having a network operate over this spectrum is not as easy as one would imagine.

First, the TV band wireless networks will have different unused TV channels available in different locations. Thus, the available frequency band and channel width in Manhattan, NYC will be different from Edison, NJ. This is unlike traditional wireless networks where each network operates over a fixed frequency band with fixed channel widths (e.g., Wi-Fi operates between 2.402 GHz – 2.482 GHz with channels widths of 22 MHz).

Second, enhanced reach of this spectrum can be a boon and a bane. This is because the increased coverage also comes with increased interference from other TV band devices in the vicinity. Also, the nature of interference is very different from that in Wi-Fi band.



Simulation evaluation based on our research shows that the issues of fragmented spectrum and complex interference can be dealt with and TV whitespace can indeed provide significant gains over Wi-Fi spectrum.

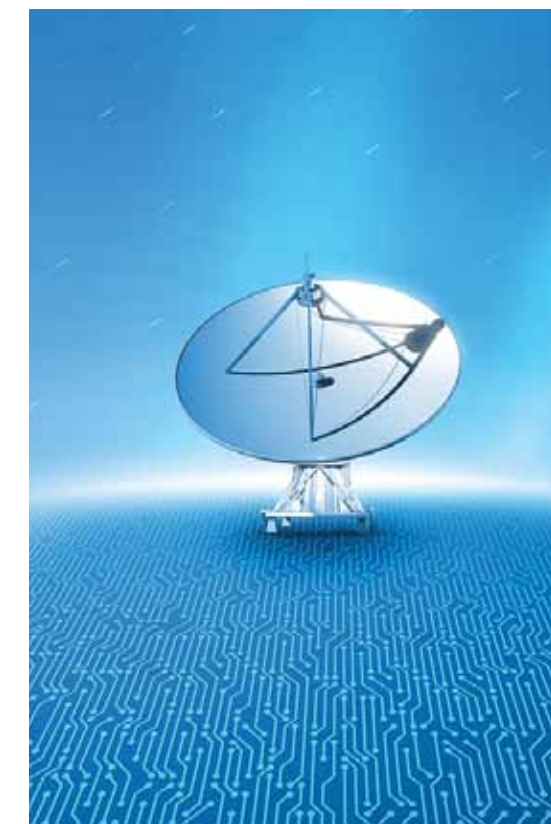
Bell Labs have developed a first-cut whitespace prototype of a multi-radio whitespace access point that can adapt to different frequency bands and channel widths. This platform can aid researchers to test and design algorithms and protocols to address the challenges posed by TV band spectrum.



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Problem & Opportunity

DTV Whitespaces: Across the world, countries are migrating from analog to digital television broadcasts. For example, in the US, this transition happened on June 12, 2009; while in the UK, this transition is slated to happen in a phased manner from 2008 to 2012. This analog-to-digital transition frees up a substantial amount of television spectrum that was previously used by analog transmitters. The spectrum between allocated television broadcasts are called as DTV whitespaces.



Telecom Regulatory Ruling: In a landmark ruling in November 2008 the FCC mandated that digital TV whitespaces can be used for unlicensed wireless access. Similar ruling is considered by OFCOM in UK.

Many technology companies are actively building business in this space. According to a recent study, the total market for whitespace related technologies is USD 100 Bn over 15 years. Beyond the hype, the unique characteristics of this spectrum open up a rich set of technological problems that have been barely addressed. This will also enable variety of applications that have not been possible with existing unlicensed technologies such as Wi-Fi. These applications could range from smart cities, intelligent off-loading of 3G/4G traffic, flawless home multimedia streaming, novel set-top box based applications etc.

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Solution

Our solution is a network access device and the associated software for TV whitespace spectrum. The network access device consists of the following:

- 1. Network access software stack that consists of software for MAC, routing, and flow control.
- 2. Associated RF hardware for transmission and reception over TV whitespace spectrum.
- 3. Access to a geo-location database to ensure that spectrum used by our device is different from that used by any TV channel or wireless microphone in the vicinity.



The network access device can work as either access point for TV whitespace access (similar to Wi-Fi access points but this operates over TV whitespace) or as infrastructure nodes for whitespace mesh. The software stack will be tailored depending on the use-case.



Technical innovation: Our main innovations are in designing efficient network stack for TV whitespace access. The issues of fragmented spectrum and complex interference are very unique to TV White spaces. We have designed a network stack and access devices that account for the aforementioned factors. Our ongoing research at Bell Labs represents state of the art in designing efficient network stack and protocols for TV whitespace access. So far, we have submitted several patents and few have already been filed.

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Team

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