

# Affordable Internet Access: From Research Labs in Scotland to Remote Villages in Kenya

The University of Strathclyde has partnered with Microsoft to demonstrate the benefits of using White Space radio spectrum for affordable Internet access in remote, rural communities. The work has been supported by a number of organizations, including EPSRC, and has involved the creation of a testbed/demonstrator network in Glasgow as well as a White Space pilot in Kenya which is connecting a number of schools and



PUPILS AT A LOCAL SCHOOL IN KENYA TRYING OUT THEIR NEW WHITE SPACE INTERNET CONNECTION.

healthcare offices to the Internet.

So-called 'White Spaces' are portions of radio spectrum which lie in a licensed band but remain unused in a particular geographical area or during a particular period of time. By allowing access to these unused portions of spectrum, regulators have a unique opportunity to create new opportunities for commerce, healthcare, education, and the delivery government services.

White Space technology and regulations have been in development for over a decade, with numerous trials conducted across the world

by Microsoft and others. The University's activities in White Space stem from an early testbed which it built in 2011 on the Isle of Bute, Scotland, in collaboration with six partners which included BT and the BBC. This provided early confirmation that White Space technology could be used to deliver broadband services to households and businesses in remote, rural areas, and made a valuable contribution to various technical and regulatory discussions within the UK and Europe.

Following the highly successful Bute White Space trial, the University has developed an urban White Space testbed/demonstrator on its campus in Glasgow's city-centre. This work, which has been funded by the Scottish Government with support from Microsoft and EPSRC, has demonstrated live digital video streaming across the campus using White Space radio links to connect outdoor cameras on the roofs of buildings to a central hub where conventional network access is available. The project has also demonstrated outdoor Internet access for people in public



VIDEO FEEDS FROM WHITE SPACE CAMERAS ON CAMPUS BUILDINGS IN GLASGOW.

parks and garden areas.

In 2013, the University partnered with Microsoft, with support from EPSRC, to develop the Mawingu pilot network in Kenya. ('Mawingu' means 'cloud' in Swahili.) This network is connecting schools, health clinics, and businesses to the Internet using White Space radio technology. The technology is capable of supporting data rates of up to



16 Mbit/s in a single 8 MHz channel, at distances of up to 16 km.

A separate but highly relevant challenge in rural areas (whether they be in Africa or Scotland!) relates to the provision of electrical power for the radios and associated equipment. Many villages in Africa are 'off grid', meaning that they have no mains electricity supply. This necessitates the use of renewable energy sources to power the radio equipment.

The University has previously developed



SOLAR-POWERED 'INTERNET HUT'.



SOLAR PANELS BEING FITTED FOR SELF-POWERED 'INTERNET HUT'.

prototype self-powered radio masts, based on a combination of wind power and solar power, and these were used in the Bute White Space trial. In Kenya, it suffices to use just solar power, and this typically involves the installation of a solar panel on the roof of a hut or container which acts as the focal point for the public to visit in order to access to the Internet. (The solar-generated electricity in these huts is also used to provide power for charging stations which the public can use to charge their phones, tablets, and other portable devices.

The use of White Space represents a completely new way of managing radio spectrum, and it is creating new opportunities and applications that will improve people's lives in rural parts of both the developed world and the developing world. In many cases, the benefits are genuinely life-transforming, creating new livelihoods and incomes that would otherwise be completely beyond reach.