

Adaptrum

Case Study: Oxford Flood Network



Machine-to-machine TVWS network enables early flood warning

Adaptrum's solution powers IoT network connecting river level sensors in Oxford

Overview

Oxford boasts dreamy spires and classical architecture. On a summer's day, punting sedately along the River Isis, life in the City seems good. However, in common with many cities worldwide, Oxford faces serious sustainability challenges. One of these is a risk of flooding following periods of intense rain. Often residents are poorly informed before the flood hits—there's little time to prepare for the worst. The risk has been present for as long as the city has existed, but TV White Space (TVWS), along with low cost sensors, are providing useful new tools to help manage it.

The Internet of things (IoT) brings together the capability of distributed devices and cloud computing to tackle diverse challenges. Real-time processing of potentially vast amounts of live data can yield timely and effective intervention to make the systems we depend on more efficient and more responsive; but requires significant bandwidth and low latency in the data links between sensors and cloud systems.

Eventually billions of devices may participate in the IoT, all depending on a reliable connection to the internet. Their connectivity requirements are likely to be as diverse as their applications, but wireless will be the predominant connection medium. And for many applications, like the Flood Network, TV White Space provides the ideal connectivity for building machine-to-machine networks

“ We see TV White Space as a key enabler to the much talked about Internet of Things ”

Simon McCalla, CTO of Nominet



Summary

Love-Hz partnered with Nominet to deploy Adaptrum's TV White Space solution for connecting water level sensors as part of an early-warning flood system.

Requirements

A solution that provides affordable coverage to sensors across wide areas and through trees and obstructions.

Solution

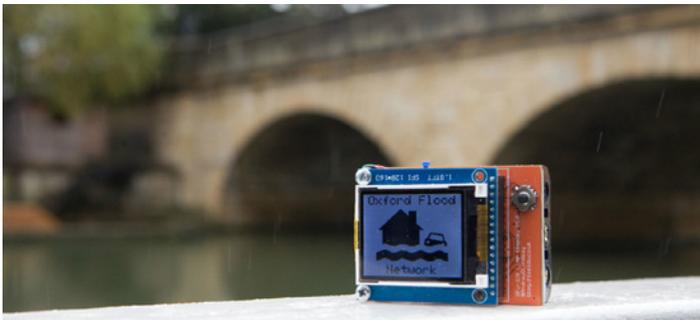
Love-Hz deployed Adaptrum's ACRS2 systems to backhaul aggregated sensor data

Benefits

- Reliable long-range Non-Line-of-Sight (NLOS) wireless connectivity
- High performance wireless connectivity to support current and future broadband IoT applications
- Zero cost of unlicensed TVWS spectrum eliminates barrier to entry for community-based systems

Results

Love-Hz and Nominet developed a live flood monitoring map by connecting water level sensors over TVWS. Now the residents of Oxford can get early warning of imminent Isis overflow.



Introduction to the Oxford Flood Network

The River Isis appears serene as it flows through the center of Oxford, with punts setting forth from college landings dotted along its calm waters. However the river can rise to quite high levels after periods of intense precipitation in the surrounding countryside. The punters may not be seriously affected, but water flooding from overflowing river banks can threaten life and property while saturate the surrounding land.

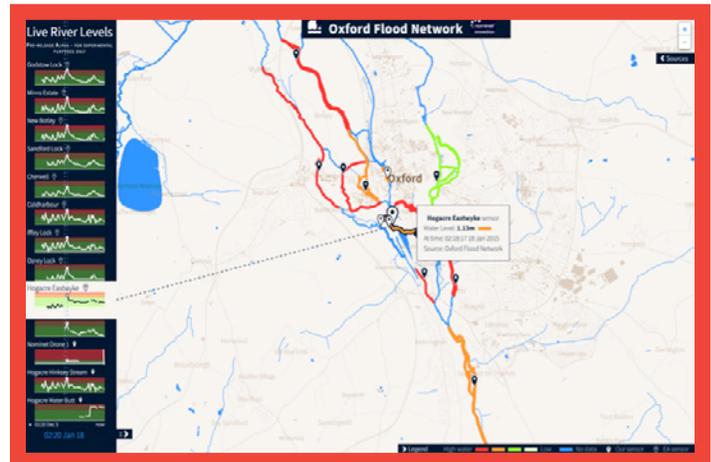
“TV White Space lets us reach into rural areas where there’s no connectivity”

Ben Ward, Founder of Love-Hz

Love-Hz, a local wireless technology startup led by Ben Ward, saw an opportunity to do something about the issue leveraging TV White Space. Ben recognized that the great propagation characteristics of signals in this frequency range (the UHF band) would enable data to be gathered cost effectively from widely distributed water level sensors. Such data could be

used to provide advanced warning of rising river levels allowing local authorities and property owners to take early mitigating action.

Love-Hz teamed up with Nominet, Adaptrum’s UK TV White Space spectrum database partner, to create an IoT-based solution to the problem. Using sensors mounted on fixed platforms, such as bridges, water level data is collected around Oxford.



<https://map.flood.network>

At present, the sensors use narrow band wireless communications technology to link them to a local communications hub. The sensor data is aggregated at each hub and backhauled over TV White Space channels using Adaptrum ACRS 2.0 devices. Data is then analyzed and visualized in the form of a live Flood Map. All residents in the area now enjoy the benefits of advanced flood warning.

Where does TV White Space fit in the Internet of Things?



IoT technical requirements are as diverse as its applications. At its heart, however, is a need for ubiquitous low cost connectivity and cost effective cloud processing capacity. The lower the cost of connecting up the IoT, the more applications that can embrace its power.

There are a number of competing standards for wireless IoT connectivity, most are focussed on low data rate requirements. Among these, LoRa and other LP-WAN technologies are being used for low rate applications such as remote meter reading, for utilities.

But not all applications can use low data-rate connections. Remote video monitoring, for example, needs much higher capacity. TV white spaces (TVWS) transceivers, such as the Adaptrum ACRS 2.0 can meet a much wider range of capacity requirements, dynamically tapping into available spectrum on demand through an online spectrum database, such as that provided by Nominet. As well as serving high bandwidth IoT applications, TVWS links can be used to backhaul multiple narrowband data streams from sensors. This is the scenario implemented in the Oxford Flood Monitoring Network.

The network has been designed as a community-based initiative. The water level sensors are assembled from kits and mounted by local residents. Similarly, TVWS offers a community approach to building a machine-to-machine network. Unlike mobile data networks—which cost millions to implement and are ill-suited for low-cost experimentation, TV White Space has an incredibly low cost of entry.

Running since October 2014, the Adaptrum's ACRS2 radios have reliably supported the Flood Network providing broadband non-line-of-site connectivity to remote sensors. "I'm pleased to say the Adaptrum radio hardware has been steady, performing at around 13Mbps non-line-of-sight through several rows of houses, many trees and a railway line," said Ben Ward of Love-Hz. "It's ideal for a site which only has mains power, but requires CCTV, sensor backhaul, or broadband."



Looking ahead, the current TVWS network provides the broadband bandwidth needed to future-proof the solution for higher data rate IoT applications. And as Adaptrum's TV White Space technology advances, it will be able to deliver the low power demand and compact footprint required for sensor integration. But there's no need to wait, since ACRS2.0 enables access to the power of TV White Space connectivity today, in a modular, flexible, and future-proof way.

About Adaptrum

Driving both technical and regulatory innovations, Adaptrum has pioneered the use of previously underutilized TV White Space spectrum. Founded by leading experts in wireless communications, our creative and experienced team is committed to leading the charge in wireless technology innovation and enabling universally available and affordable connectivity for people and things.