



University of  
**BRISTOL**



**New wireless technology for 5G**

**Reduces network congestion by providing more channels in the same spectrum**

**Offers enhanced quality and additional services, such as localisation**

# Massive MIMO

More efficient sharing  
of wireless channels

## About

Virtually all of us have experienced poor performance whilst using our wireless devices at major cultural or sporting events, although we have five bars of signal. The problem is often not signal strength, but insufficient network resources to support your request. This frustrating experience is becoming all too familiar for today's wireless users. If predictions are correct, we will require 1000 times more capacity by 2020 to accommodate new applications such as Virtual Reality (VR), autonomous driving and the Internet of Things (IoT).

Massive MIMO is a game changing technology which allows us to pack more information into a limited bandwidth by exploiting spatial signal processing. An easy way to consider the Massive MIMO concept is to compare it with human hearing. Having two ears allows us to discern not only the intensity of sounds, but also the direction and approximate location of the sources. A Massive MIMO base station could be regarded as having in excess of 100 ears, or antennas, which give it the ability to identify its spatial relationship to multiple devices with unprecedented accuracy.

## Let's Get Technical

Massive Multiple-Input Multiple-Output (MIMO) is an evolution of the Multi-User (MU) MIMO technique which exploits multipath scattering to increase system capacity.

Here in Bristol, we are demonstrating a system with >100 individual digital signal processing chains to separate 12 simultaneous devices using the same radio channel at the same time. The algorithm is more complex than beamforming, as we jointly pre-code the amplitude and phase weighting of each chain so we can unravel the spatial signatures of each user, even when they are in close proximity.

The theory was first introduced in 2010, and through a collaboration with Lund University and National Instruments, we have taken this concept from the chalkboard to the radio mast. Using this hardware, we have demonstrated unsurpassed rates in Spectrum Efficiency as well as addressing the use of this technology under real operational conditions.

## Smart Internet Lab

The Smart Internet Lab at the University of Bristol is a hub for internet research, which aims to address grand societal and industrial challenges. We perform cutting edge research on optical and wireless communications, offering a unique holistic approach to hardware and software co-design, solving critical problems in the global internet evolution.

## 5G Research

We are world leaders in fibre, wireless, and 5G convergence research. We have created a unique 5G Trial Test-Bed for a Smart City, Campus, Region and Telecom Industry.



## EPSRC

Engineering and Physical Sciences Research Council



EPSRC Centre for Doctoral Training in Communications



A key **enabling technology** for 5G, unleashing hidden capacity for **sub-6GHz wireless connectivity**