We aimed to develop a radio protocol which will adapt its method of transmission based on whether there is noise present.

Objective

The DARPA Spectrum Challenge is a competition to demonstrate a radio protocol that can make best use of a given communication channel in the presence of other dynamic users and interfering signals.

The Challenge is not focused on developing new radio hardware, but instead is targeted at finding strategies for guaranteeing successful communication in the presence of other radios that may have conflicting co-existence objectives.

Introduction

Our main focus is a condition where the allocated bandwidth is split into an upper and lower spectrum and noise is only present in one of the halves at a time.

The design we came up with uses one of these halves for communication at a time. When noise is present in the half the radio is using, the protocol will switch the radio pair (transmitter and receiver) to communicate using the other half that is clear of interference.

The protocol may also delay the transmission of packets till the noise switches to the other half and the spectrum is clear of interference.

Network Topology

The structure of the radio pair is quite simple; two nodes, one transmitter, one receiver with a bi-directional (half-duplex) wireless connection between them.

Additionally, a data server is needed to feed packets to the transmitter and accept the packets that the receiver obtained.

Software Implementation

We use computer hosted software radios called USRP (Universal Software Radio Peripheral) coupled with the GNU Radio software which is a toolkit that has a python framework.

In order to implement our adaptive radio design, we needed to have a half-duplex foundation for the radio pair. They needed to be able to talk to each other, bi-directionally.

Next, a check sum system needed to be employed in order to detect when packets were lost and thus detecting interference.

When the transmitter sends a packet, it waits for an acknowledgement from the receiver before sending the next packet.

If the ‘ack’ is negative or the transmitter times-out, our protocol tries to resend the last packet. If it fails again, the radio pair is switched to the second frequency spectrum and then tries to resend the packet once again.

Additional Information

The Darpa Spectrum Challenge Website:

The Orbit Lab Website:
http://www.orbit-lab.org/

The Rutgers University WINLAB Website:
http://www.winlab.rutgers.edu/