RUTGERS
WINLAB | Wireless Information Network Laboratory

Software-defined Radio Time Division Multiple Access

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Project Objectives

Using USRPs from ORBIT and software-defined radio techniques to construct a cluster of cooperative radios based on TDMA to enable optimal channel usage.

Design a tightly-synchronized and rate-adaptive TDMA Protocol

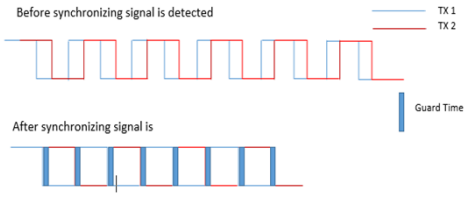


Figure 1 algorithm graphical presentation

Background Definitions

Software-defined radio: a communication system where components are partially implemented by software as opposed to hardware traditionally
ORBIT: a cluster of 20x20 radio nodes designed to achieve reproducible experimentation, while also supporting evaluation of protocols and applications in real-world settings.
USRP (Universal Software Radio Peripheral): a hardware platform for software radio commonly used with GNU radio
TDMA (Time division multiple accesses): allows several users to share the same frequency channel by allocating different time slots to different users

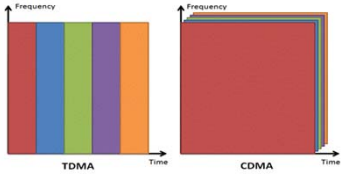
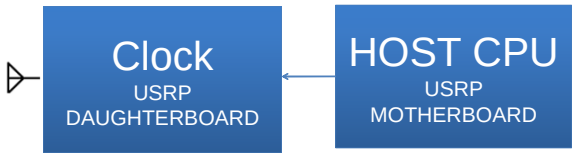


Figure 2 TDMA graphical presentation http://www.ni.com/white-paper/7107/en/

Technical Challenges

1. TMDA packets length are on the order of 1ms and the synchronization delay should be on the order of 10 us
2. The general purpose host processor that controls the USRP has a clock resolution of 1000 us and processing the packet to find synchronization signal takes will take a long time
3. The packet decoding and processing in the host is subject to interrupt-driven random delays on the order of milliseconds
4. Communication to the USRP through a packet interface introduces delays on the order of 100 us
5.Clock Drifting



Framework

The project framework is divided into three main parts:
•Generate synchronization signal
•Use USRP Hardware Driver(UHD) to transmit the synchronization signal
•Write a program that receives and processes the signal. Then, Starts synchronized transmission after successful detection

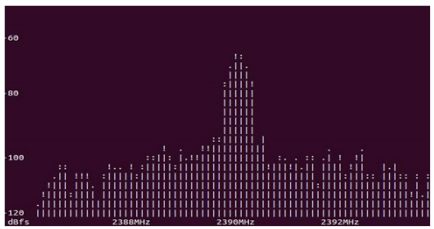
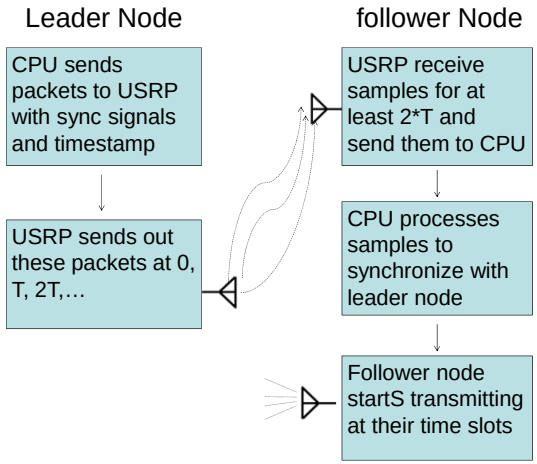
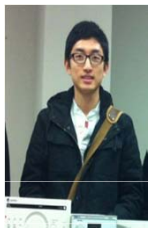


Figure 3 Plotting the transmission using the ASCII tool

Algorithm and Implementation



TDMA Team



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