ClariNet: Audible Wireless Networking

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What are the characteristics of audio as a digital communication channel?

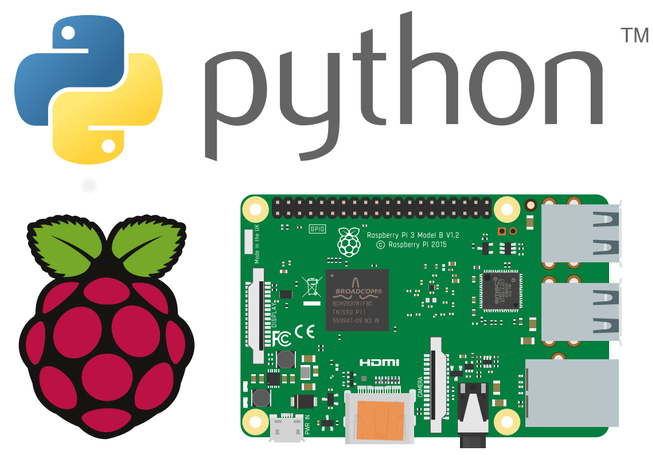
Motivation

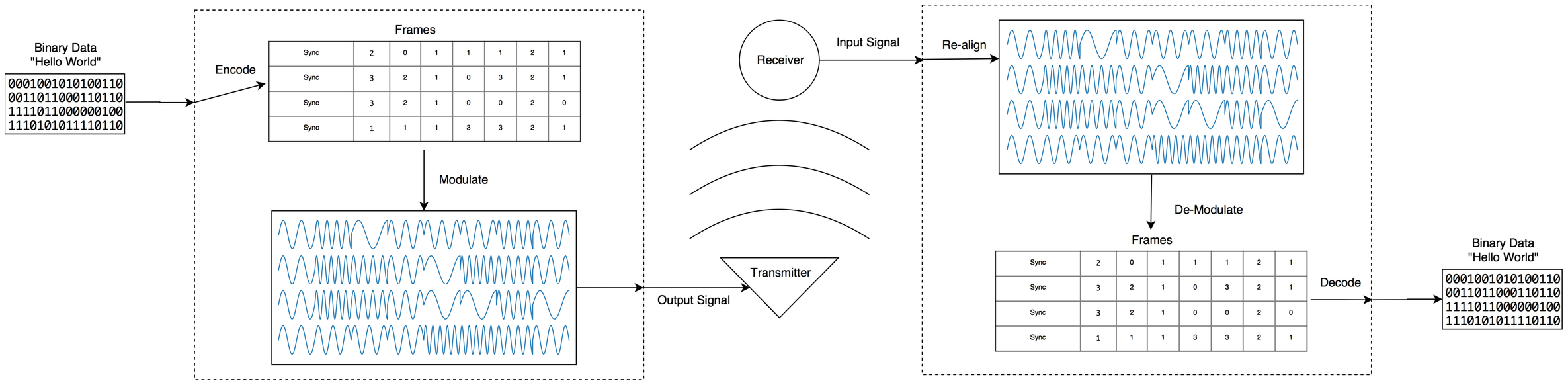
Audio hardware is embedded in most personal computing devices making an audible wireless network easily deployable to a **large number of platforms.** Low-cost audio hardware makes possible the development of **embedded audible networking applications.** Audible networking incurs **no spectrum license fees**, unlike comparable RF networking technologies. Audible communication is **perceptible without the use of external tools.**

These properties give audible networking the potential to have an unrivalled versatility with regards to application development and deployment.

Deliverables

- ▷ Extensible audible networking library built with Python for prototyping and evaluating audible network configurations.
- ▷ Proof of concept audible networking application running on a Raspberry Pi or similar low-cost, low-power device.





Challenges

The challenge of this project is in transmitting a signal such that it can easily and accurately be demodulated upon receipt. The signal is constructed from a sequence of symbols, each of which represents a distinct value. For example, the value 1 may be represented as a sinusoidal wave of frequency 1000Hz.

The quality of the signal when received depends upon the characteristics of the transmitter, the environment, and the receiver. These characteristics decide the transfer limits of the channel. In the case of audio, a typical low-cost channel has a far greater Signal to Noise ratio than a typical WiFi channel of similar costs, and the bandwidth of an audio channel (20kHz) is orders of magnitude smaller than a WiFi channel (20MHz).

This project is also a software engineering challenge. Both the library and embedded application must be robust and well tested to avoid runtime failures. The library must be built to allow for flexibility in network design.

Project Status

The Python library has been developed, making extensive use of linting, profiling, testing, and code coverage tools. It can send and receive 4-FSK audible transmissions in real-time.

Future Work

- ▷ Apply coding theory to acheive Forward Error Correction
- ▷ Empirically evaluation of network performance
- ▷ Runtime Optimisations