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Project: FPGA Telephone Exchange
Date: 21 Oct 2016

Abstract (Revised)

I plan to interface an FPGA to a set of landline telephones and/or headsets and build a dial telephone exchange. The system will consist of an ordinary landline telephone connected to the labkit's audio input/output ports through custom telephone line interfacing circuitry. This circuitry supports powering the phone, detecting the hookswitch state, and sending/receiving audio over the line. For simplicity, it will not support high-voltage ringing (a piezo buzzer can be used instead to provide an indication of ringing). On the other end of the call will be a headset connected to the labkit's headset port. Upon picking up the phone, the labkit will emulate a real telephone network by playing dial tone into the phone lines and waiting for a number to be dialed. Dialed numbers are displayed on the VGA screen. It will then connect the call digitally by passing audio samples between the phones using the on-board AC'97 codec. Should there be enough time to expand the project further, several stretch goals are possible. (not necessarily ordered by priority)

1. Add voicemail: If the called party does not answer, allow the calling party to make a brief recording stored in the labkit's memory. The called party can later review voicemails by dialing a special extension.
2. Add an additional telephone line: The labkit has enough audio I/O to support a second landline, bringing the total number of devices up to 2 landlines and 1 headset.
3. Implement digital DTMF dialing: Newer telephones dial by playing two superimposed tones that correspond to a particular digit. Implement code on the labkit to digitally detect these tones and extract the dialed number from the audio stream.