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6.111 Final Project Checklist

Base Goals (Commitment)

1. **Basic Interaction with a landline telephone**: Hardware connects to a telephone for detecting pick-up (hookswitch) and receiving pulse-dial digits. Phone call audio is not handled by the labkit AC'97, but rather entirely in analog. Ringing is handled by piezo buzzers.
2. **FPGA state machine for processing calls:** FPGA process the signals from the phones to keep track of dialed numbers, call progress, etc. State machine controls hardware analog switches to connect and phone lines to make calls.
3. **LED State Display:** Information regarding the current system status is displayed on the labkit LED displays.

Expected Goals

1. **Full Digital Audio**: Special circuitry provides an audio input / output per phone line (see breadboard). The labkit AC'97 ADCs sample the inputs and DACs play audio back into the phone. Phone connections are made digitally by passing samples between combinations of inputs and outputs.
    a. Audio Router module creates a virtual switchboard where audio sources and sinks can be mapped to each other.
    b. Analog interfacing circuitry required to convert the two-wire phone line into a four-wire in/out connection.
2. **Call Progress Tones**: Users hear deal dial tone, busy tone, and ringing tones as they make calls. The system sounds like a real phone network. The tones are stores in block memory and played back through the AC'97 at 8KHz.
3. **VGA State Display**: The VGA screen shows basic textual information about each phone's status. Custom icons are used for icons.
4. **At least two phones**: Two phones are used to allow users to have a complete telephone conversation.

Stretch Goals

1. **Additional Phones**: A third extension (such as the labkit headset or another landline phone) could be added, but requires additional hardware or cleverness due to the AC'97 having only two concurrent output channels. Ideas for overcoming this limitation will be discussed in the final report.
2. **Voicemail System**: If a called party does not answer, allow the caller to record a message that the called party can later retrieve by dialing "0". The messages can be recorded in ZBT RAM.