Programming the Tekbots FPGA board with the Tekbots Universal Programmer using urjtag.

Programming the FPGA directly:

1. This option will write your program to volatile memory. This means that your program will be erased when the FPGA is powered down. If you want your program to persist after loosing power, use the PROM configuration option. Programming the FPGA directly is significantly faster than programming the PROM.

2. Generate an svf file for the Spartan XC3S400 using Xilinx Software

   Open a terminal and run:

   `jtag`

3. You should get a prompt that says "jtag>"
   At the jtag> prompt type:

   `cable usbasp`

4. You should get a single line message:

   `Initializing TekBots Universal Programmer`

   If you get any errors at this point you have a problem with the Universal programmer is installed on or connected to your computer

5. If you haven't set up your user account with priveliges to access the Universal Programmer usb device, you will get the following error:

   `Error: usbasp_transmit: error sending control message: Operation not permitted`
   `Error: Cable initialization failed!`

   A quick fix for this is to run urjtag as root (use `sudo jtag)`. A better solution is to properly set up usb privileges so your account can access the device.

6. Once the cable configuration finishes, run:

   `detect`

7. You should see something like:

   ```
   IR length: 14
   Chain length: 2
   Device Id: 00000001010000011100000010010011 (0x000000000141C093)
     Manufacturer: Xilinx
     Part(0):        xc3s400
     Stepping:    0
     Filename:    /usr/local/share/urjtag/xilinx/xc3s400/xc3s400
   Device Id: 11110101000001000101000010010011 (0x00000000F5045093)
     Manufacturer: Xilinx
   ```

```
Part(1):           xcf02s
Stepping:      0
Filename:          /usr/local/share/urjtag/xilinx/xcf02s/xcf02s
```

8. These two devices are the FPGA and the prom. We want to program the FPGA so run:

    part 0

    to select the xc3s400

9. Now run:

    svf <filename.svf>

    to program the FPGA with your file.

10. The svf command will take a few minutes to run. Once the it finishes running, the fpga is programmed.

Programming the PROM on the fpga board to configure the FPGA on power up:

This option writes your program to a PROM chip on the FPGA board. Every time the board is powered up, the PROM chip will load your program onto the FPGA.

1. Generate a svf for the prom using Xilinx

2. Follow steps 1-7 above

3. Now instead of selecting the FPGA, select the prom (xcf02s) by running:

    part 1

4. Run:

    svf <filename.svf>

5. Insert all of the configuration select jumpers (M0-M2). This tells the PROM to load your program onto the FPGA every time it starts up.

6. Now, the data on the prom will be written to the FPGA every time the board is powered on or the force configuration button is pressed.