

Applicationguide, IOControlDemo

This demo demonstrates the most basic use of the BAR hardware interface and the driver / application. It provides access to the leds, pushbuttons and an 8 kB blockram on the Spartan3 PCI Express Starter kit, by using I/O requests from a user-mode application to a kernel-mode device driver.

Files used

The files used for this application can be found on CD1 in:

- FPGA Design: “*Source\FPGA_Design\IOControlDemo*”
- Windows device driver and applications:
“*Source\Windows_Device_Drivers_and_Applications\IOControlDemo*”
- Linux device driver and applications:
“*Source\Linux_Device_Drivers_and_Applications\IOControlDemo*”

The FPGA design

The *IOControlDemo* builds on the *Empty* design. It includes the BAR module from the original demo design, which can access the buttons and leds on the Spartan3 PCI Express Starter kit board as BAR0, an 8 kB blockram as BAR1 and a PIPE core with BARs setup to match this. BAR0 uses the following mappings (DWORD-addressing is used, the bits used in each DWORD are specified for each register):

- *Register 0 (0x00)*: Retrieves and sets the state of the single user-led (bit 0).
- *Register 1 (0x01)*: Retrieves and sets the state of the eight leds (bit 7-0).
- *Register 6 (0x06)*: Retrieves the state of the DIP-switches (bit 3-0).
- *Register 9 (0x09)*: Retrieves the state of the user push-buttons (bit 1-0).

The rest of the addressing space of BAR0 is not used. Writes to these addresses are ignored, and reading will return an unspecified value.

The blockram at BAR1 is simply created as an 8 kB dualport blockram with a 32 bit databus and an 11 bit addressbus, which provides read/write access to 2048 DWORDS. It is connected to an inverted version of the 62.5 MHz transmission clock signal, to ensure correct timing.

The driver

The driver used is the sample driver with added functionality for reading and writing directly to a specified register, as described in journal 3.

The applications

Three applications can be used with this demo – the sample application that comes with the Spartan3 PCI Express Starter kit (Windows only), the simple driver test application used in journal 3, and the *mmap* test applications used in journal 5.

The sample application

The sample application is installed by running *setup.exe* in the *GUISampleApplication* subfolder of the Windows *IOControlDemo Application* folder. After this, the application can be started from the start-menu. It presents a GUI through which the leds and pushbuttons on the board can be controlled.

The simple driver test application

The simple driver test application, *IOControl*, first opens and creates a handle to the driver. It then writes alternating 0's and 1's to the led bank, and reads and prints the state of the two pushbuttons.

The mmap test applications

Two *mmap* test applications are available, *mmap_read* and *mmap_write*. Both open and create a handle to the driver, and then map BAR1 (the 8 kB blockram) to a DWORD array. *mmap_read* reads and prints a number of memory locations from the blockram, while *mmap_write* first sets the value of each location in the blockram to the address of the value. It then reads some of the values back, and prints these to the console.

Usage

Load the design into the FPGA (synthesize/implement if necessary), install the driver, and run one of the applications.