An Introduction to Lab2

Lecture 3 for Information Processing

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What is in this lab?

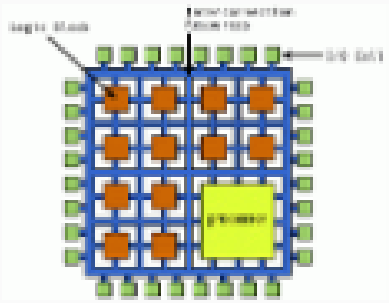
- Design a NIOSII system.
- Understand the design process of a NIOSII system.
- Program the Max 10 FPGA chip on the DE10-Lite board with your soft processor.
- Write code that runs on the NIOS processor to display a message on a terminal.
- Explore and test the capabilities of your NIOS II system design.

Soft Vs. Hard processors

- Hard processors normally have a fixed architecture
- NIOSII is a soft processor
  - customizable (*eg.* size, performance)
  - add or remove certain features (*eg.* floating-point units)
  - custom instructions or extensions of the instruction set
- Soft processors are normally on FPGAs, running at a slower clock rate

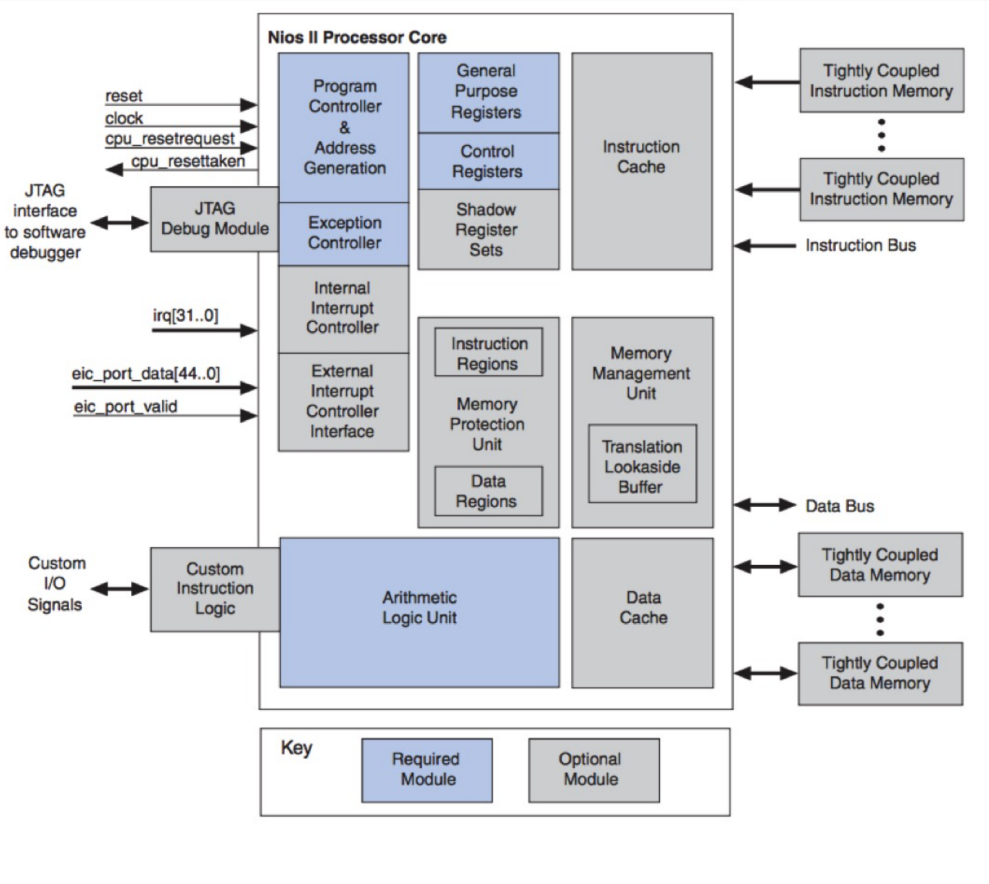
Hard Processors (eg. Intel, ARM, AMD)

Soft Processors (MicroBlaze, NIOS II)



Processor architecture

- Register files
- Arithmetic logic unit (ALU)
- icache and dcache
- instruction bus and data bus ...



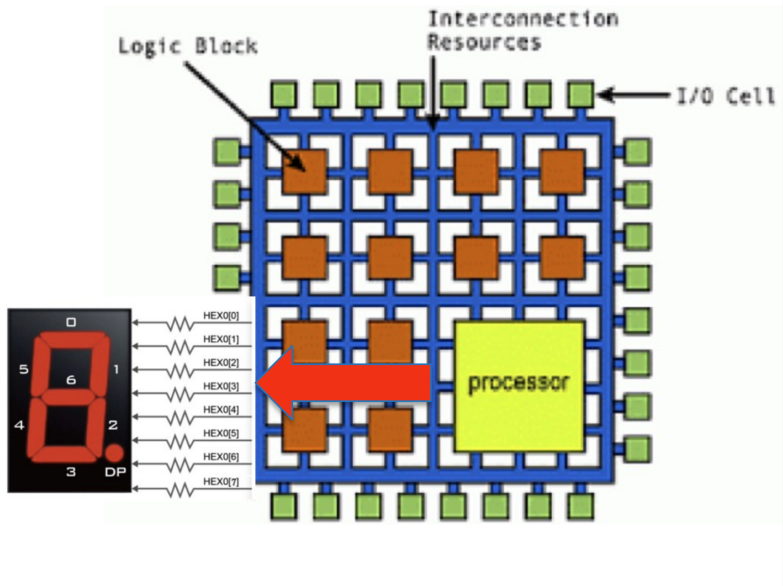
Processor implementation

- A NIOSII implementation is a set of design choices
- A functional unit (i.e. fp-mult) can be implemented in
  - hardware
  - emulated in software
  - omitted completely...
- Another example is division support

What do you do in Lab2?

- Control the lighting sequence on LEDs through the NIOSII processor

```c
int main()
{
  int switch_datain;
  alt_putstr("Hello from Nios II!\n");
  alt_putstr("This is my first application!\n");

  char msg[20];

  /* Event loop never exits. */
  while (1){
    switch_datain = IORD_ALTERA_AVALON_PIO_DATA(BUTTON_BASE);
    switch_datain &= (0b0000001111);

    if (switch_datain==0)
        alt_putstr("both switches pressed\n");
    else {
    if (switch_datain==3)
        alt_putstr("no switches pressed\n");
    if (switch_datain==1)
        alt_putstr("first switch pressed\n");
    if (switch_datain==2)
       alt_putstr("second switch pressed\n");
    }

    int i;
    for (i=0; i<300000; i++)
        msg[0]='2';

    IOWR_ALTERA_AVALON_PIO_DATA(LED_BASE, switch_datain);
    IOWR_ALTERA_AVALON_PIO_DATA(HEX0_BASE, switch_datain);
  }
```



Questions?

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