SISTEMI EMBEDDED
AA 2012/2013

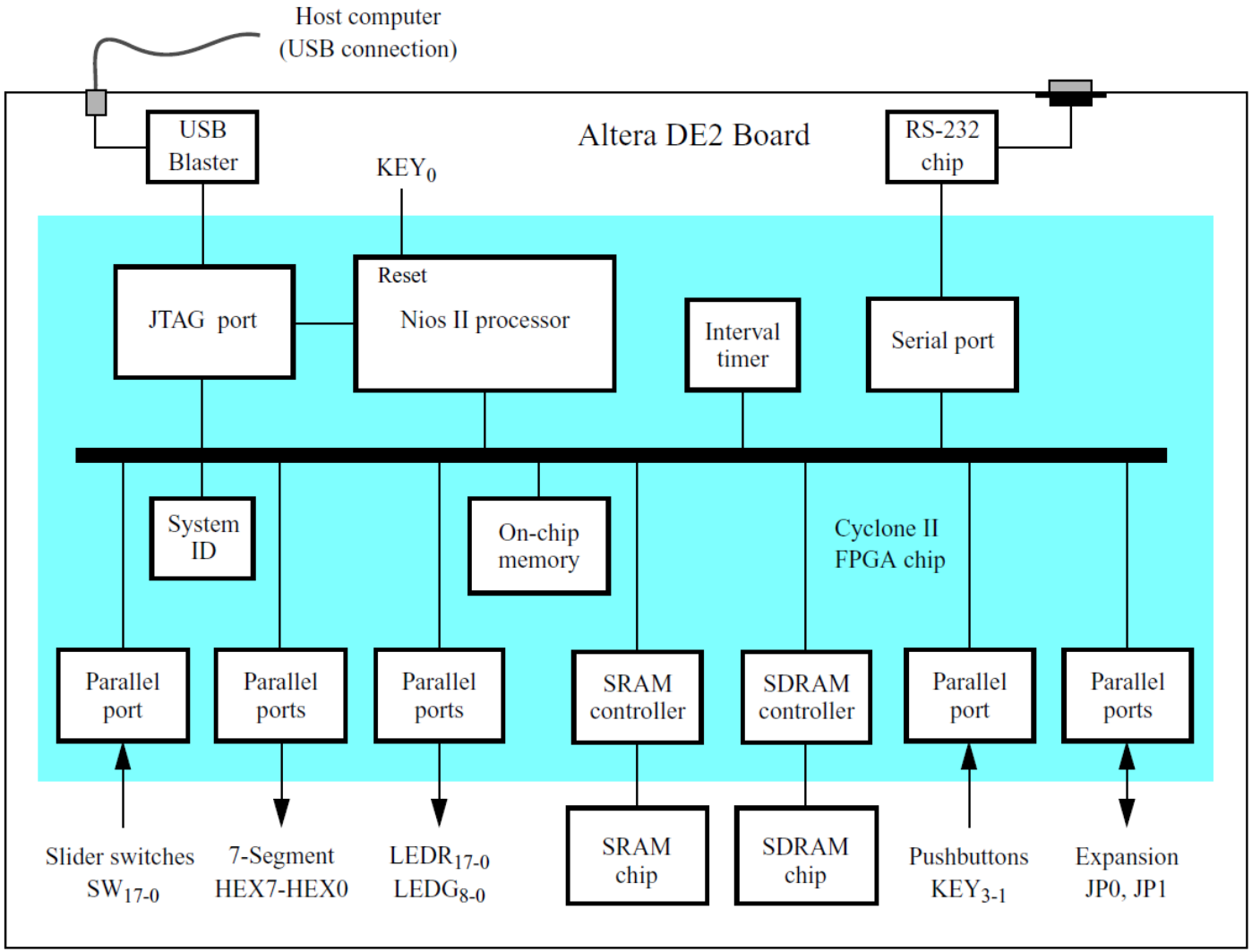
SOPC DE2 Basic Computer

Parallel port

DE2 Basic Computer

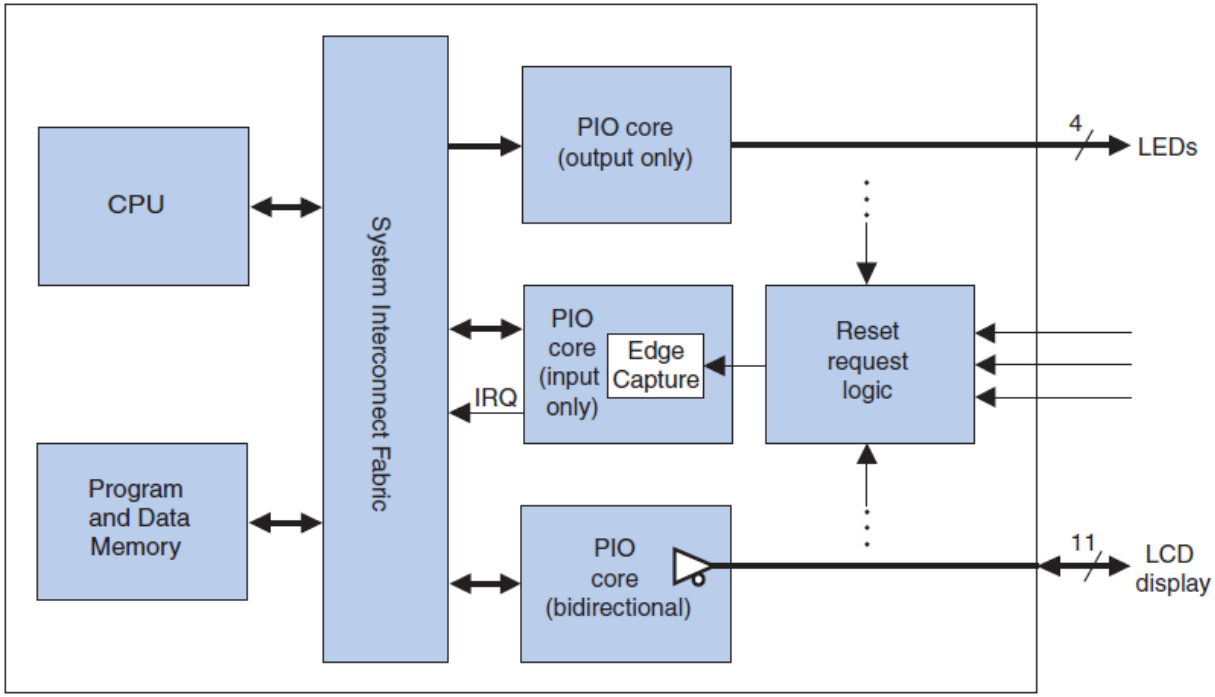
- Nios II configuration provided by Altera University Program
  - Core: Nios II/e
  - Memory: SDRAM, RAM, On-chip memory
  - Parallel ports: Red_LEDs, Green_LEDs, HEX3_HEX0, HEX7_HEX4, Slider_switches, Pushbuttons, etc.
  - Other peripherals: JTAG UART, Serial_port, Interval_timer, sysid

DE2 Basic Computer (cont.)



Parallel port (1)

- Interface for general purpose I/O
  - Based on Altera's PIO core customized for DE-series boards
  - Controlling LEDs, acquiring data from Switches, etc.



Parallel port (2)

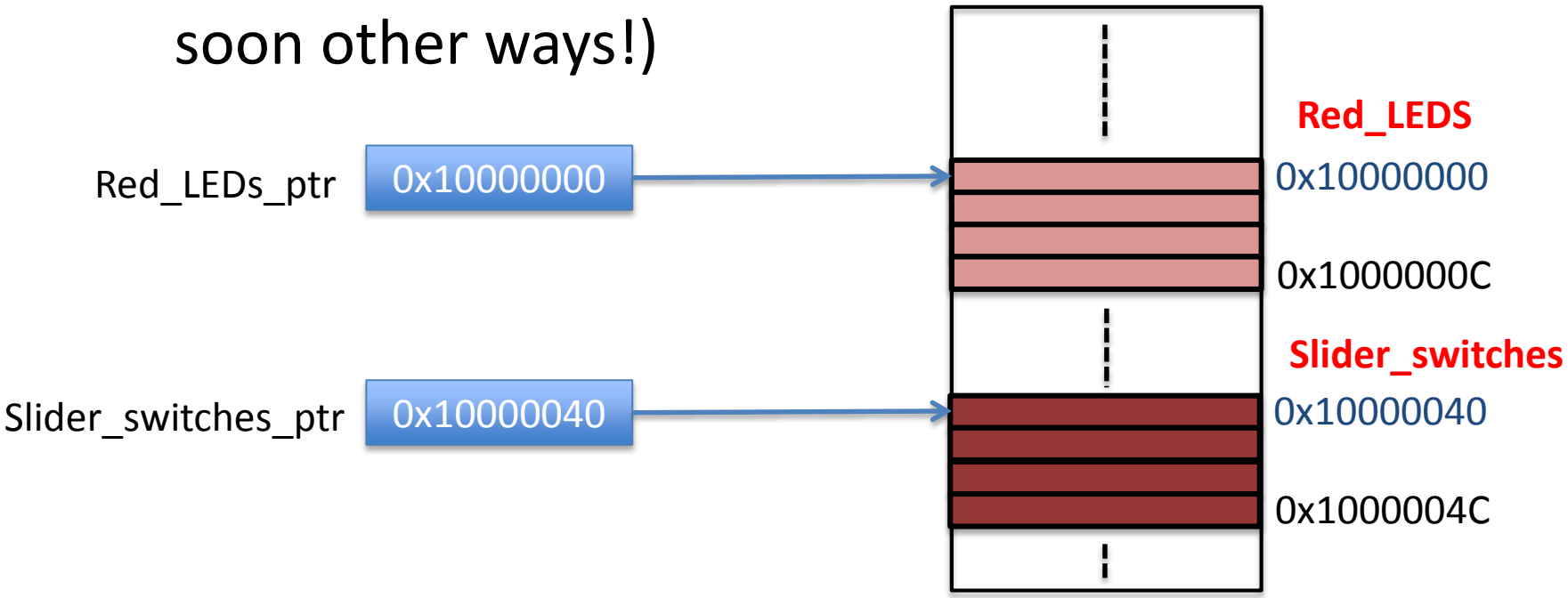
- 4 32-bit memory-mapped registers
- *n* actual number of I/O pins

Table 2. Parallel Port register map

Offset in bytes	Register name		Read/Write	Bits $(n-1)\ldots 0$
0	`data`	Input	R	Data value currently on Parallel Port inputs.
		Output	W	New value to drive on Parallel Port outputs.
4	`direction`		R/W	Individual direction control for each I/O port. A value of 0 sets the direction to input; 1 sets the direction to output.
8	`interruptmask`		R/W	IRQ enable/disable for each input port. Setting a bit to 1 enables interrupts for the corresponding port.
12	`edgecapture`		R/W	Edge detection for each input port.

Parallel port (3)

- Managing PIO in C program:
  - Use of pointers to int initialized with PIO base memory address (we'll learn soon other ways!)




```
volatile int *red_LED_ptr = (int *) 0x10000000;// red LED address
volatile int *slider_switches_ptr = (int *) 0x10000040;// SW slider switch address
```

Parallel port (4)

- Why **volatile** attribute?
  - I/O registers may change even if the program does not modify them!
    - The peripheral hardware may modify their contents
  - **volatile** say to the compiler do not make any optimization to the code involving an object declared with the **volatile** attribute

Parallel port (5)

- Reading/Writing I/O registers:

```
*red_LED_ptr = *Slider_switches_ptr;
```

- Let's start our first program with Nios II
  - Control each DE2 red LED through the corresponding slider switch ($LEDR_i = SW_i$)
- To go on:
  - Display the status of (SW_{15}-SW_0) on HEX3_HEX0 as a hexadecimal number

References

- Altera “Basic Computer System for the Altera DE2 Board”
- Altera “Parallel Port for Altera DE-Series Boards”