# Evaluation of the Altera™ DE2-70 Education Platform for EECS150

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## Goal

The goal of this evaluation is to find a viable upgrade to the CaLinx2+ currently in use for EECS150. We would like to have a newer FPGA as well as updated peripherals to prepare students for the future. This report is evaluating the Altera™ DE2-70 as a possible upgrade using these criteria.

## Details

Table 1 outlines FPGA and the peripherals on the DE2-70 versus the CaLinx2+.

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| --- | --- | --- |
|  | **DE2-70** | **CaLinx2+** |
| ***FPGA*** | Cyclone II EP2C70 | VirtexE XCV2000E |
| ***LUTs/LEs*** | 68K LEs (4LUTs) | 43K (4LUTs) |
| ***RAM*** | 1Mb | 655Kb (Block)  614Kb (Distributed) |
| ***On Board Clocks*** | 3 × 50MHz  1 × 28.63Mhz | 1 × 27MHz  1 × 25MHz |
| ***Memory*** |  |  |
| ***DRAM*** | 2 × 32MB SDRAM | 2 × 256MB SDRAM |
| ***SRAM*** | 2MB | None |
| ***Flash*** | 8MB | None |
| ***Removable (Flash)*** | SD Card | CompactFlash (SystemACE) |
| ***User Level I/O*** |  |  |
| ***Slide/DIP Switches*** | 18 | None |
| ***Dip Switches*** | None | 16 |
| ***Push Buttons*** | 4 | 8 |
| ***7-Segment Display*** | 8 | 8 |
| ***LEDs*** | 18 × Red  9 × Green | 8 × Red |
| ***LCD*** | 16 × 2 Character Matrix | 16 × 2 Character Matrix |
| ***Ethernet*** | 1 × 10/100 (MAC Interface) | 4 × 10/100 (PHY Interface) |
| ***USB*** | 1 × Host  1 × Device | 1 (PHY) |
| ***RS232*** | 1 | 2 |
| ***PS/2*** | 1 | 2 |
| ***Video In*** | 2 × TV In (NTSC) | 1 × TV In (NTSC) |
| ***Video Out*** | 1 × VGA (10 bit) | 1 × TV Out (NTSC)  1 × S-Video Out (NTSC) |
| ***Audio In*** | 1 × Mic  1 × Line In (Stereo) | 1 × Mic  1 × Stereo |
| ***Audio Out*** | 1 x Line Out (Stereo) | 1 × Stereo |

Table 1 - Comparison of DE2-70 against CaLinx2+

## Expansion Boards

The DE2-70 has two 40-pin expansion ports.

The DE2-70 comes packaged with a DC2 module and a LTM module.

* DC2
  + 1.3 megapixel digital camera
  + Supports full resolution frame rate up to 15 fps
  + Outputs data in RGB Bayer Pattern format
* LTM
  + 4.3 Inch LCD touch panel
  + Supports 800×480 resolution
  + Has a 24-bit parallel RGB interface

Each of these modules takes a 40-pin expansion port.

## Conclusion

From the above observations, the Altera™ DE2-70 is comparable to the CaLinx2+. For that reason, and ones that follow, the Altera™ DE2-70 is not an upgrade from the CaLinx2+.

* **Older, Low-cost FPGA**

The Altera™ Cyclone II is an older generation, low-cost FPGA, equivalent to Xilinx’s Spartan series, which has been suggested to be not enough for this course. It’s not clear if the Cyclone II chip is a step backward, but it certainly is not a step forward.

* **I/O Downgrade**

The DE2-70 offers a similar selection I/O as the CaLinx2+. For example, it has VGA Video Out, which is different from the CaLinx2+, but it has the same NTSC Video In. In keeping with the spirit of keeping up with updated I/O, NTSC seems like a dated standard; it would have been better if it had a newer interface (i.e. DVI). We also loose Ethernet bandwidth by having only one Ethernet port. Finally, the downgrade in available DRAM seems a poor tradeoff to gain SRAM and Flash memory, neither of which is particularly fascinating to EECS150.

* **Geared to Embedded Systems**

The DE2-70 seems to have a heavy focus on embedded design, requiring the use of a soft-core processor (Altera™ NIOS II). For example, the Ethernet interface of the DE2-70 is a MAC interface, which is absolutely a non-hardware friendly interface, and possibly quite detrimental to EECS150.

* **Solutions Released**

Other schools (i.e. Cornell University) have release full solutions to the firmware of the board, therefore making solutions to projects readily available.

Overall the Altera™ DE2-70 is a good board, but its only benefit above the CaLinx2+ boards is the fact that it is a commercially available and inexpensive board. Otherwise, it offers, at best, roughly the same features as the CaLinx2+, and at worst a severe downgrade. The lack of PHY level Ethernet in particular is quite jarring. Coupled with the cost of changing the lab, and losing much of the existing course work, the Altera™ DE2-70 is not an upgrade for EECS150 and would be extremely costly in TA and instructor time, independent of any support from Altera™.