Field Programmable Gate Arrays (FPGA)

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Why me?

- Taught an FPGA undergraduate lab way back in 1999-2002 when I was in graduate school.
- Did a sabbatical in 2015 with PixelVelocity, a company based in Ann Arbor that builds smart cameras that use FPGAs.

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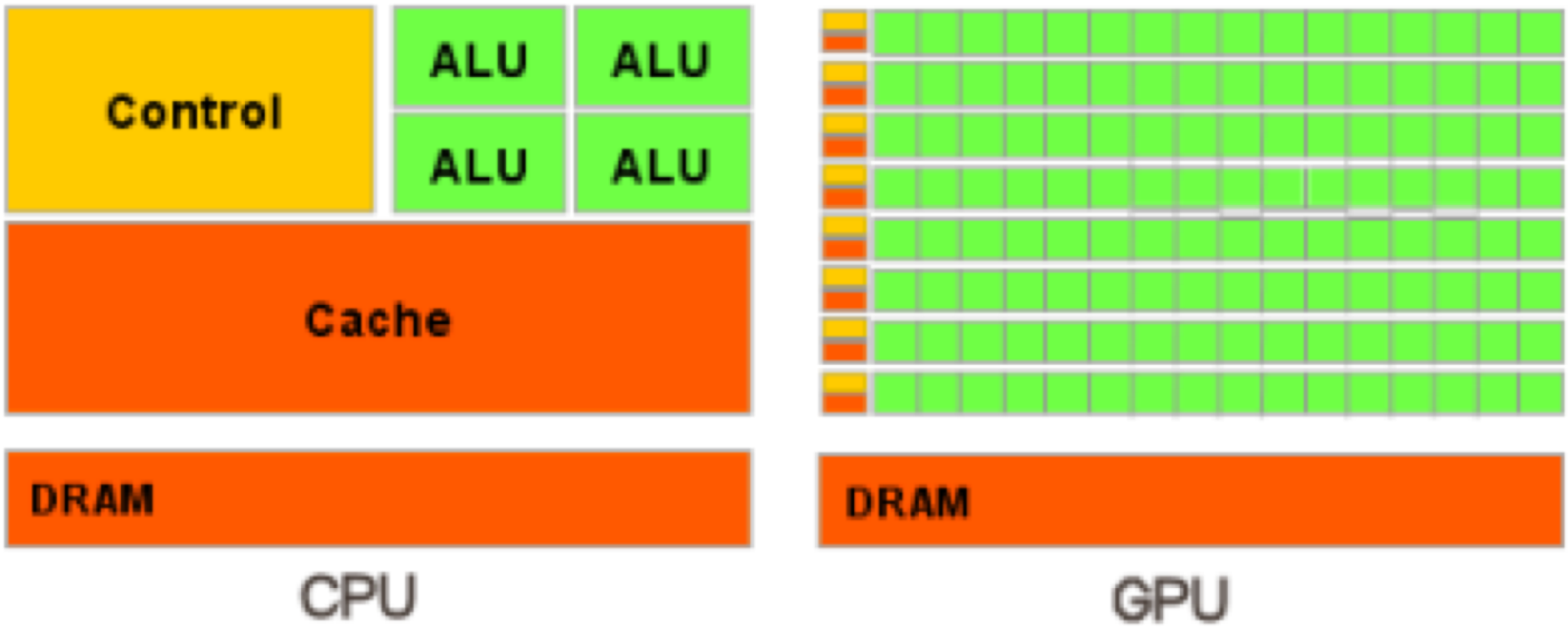
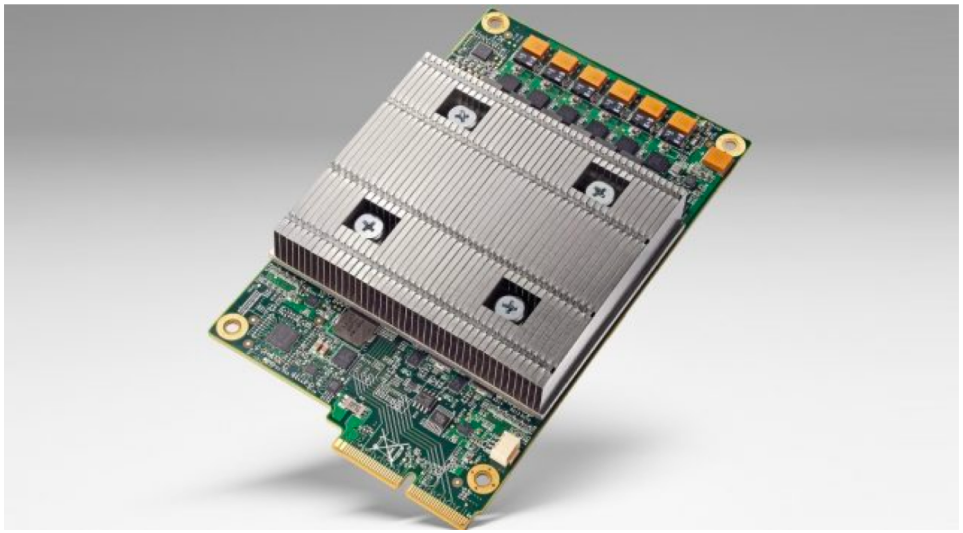
- Purchased 2 nodes with a total of 6 Altera FPGAs
- Started a FPGA Taskforce for interested researchers
- Working with a Graduate Student on an independent study related to an optimization problem (function fitting) on FPGAs
- This fall we plan to conduct a Graduate Course to benchmark and test the 7 dwarves algorithms

Traditional Programmable GPUs and CPUs



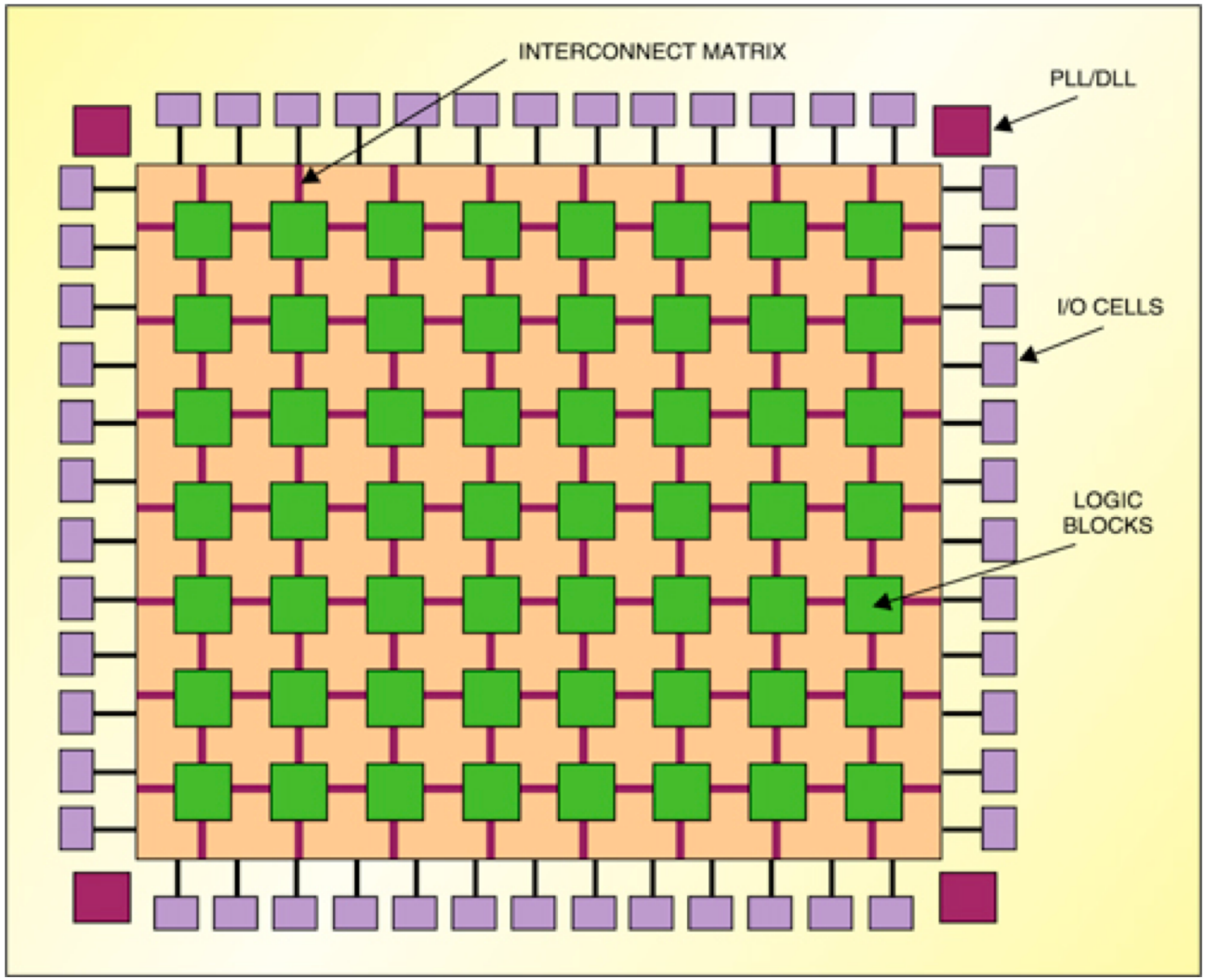
Application Specific Integrated Circuit (ASIC)



Neural Networks
Tensor Processing Units (TPU)

Molecular Dynamics
GRAvity PipE (MDGRAPE)

Field Programmable Gate Array (FPGA)



Notes about FPGAs

- For some applications speeds may be significantly faster than GPU/CPU. However, they will probably never be faster than ASICs.
- Key to FPGA's success will be flexibility.
- FPGAs make the problem of optimization much more complex. You now can change both the hardware and the software. (I,.e. you may be trading human time for
- Configuring the Hardware is Tricky. You have basically three options:
  - Draw the circuits yourself using (HDL)
  - Write code using a version of OpenCL
  - Download existing hardware "images"

Questions:

- How practical will it be to implement your technology topic in an HPC/CI center with 5-10 staff?
- In which research domains is this technology most applicable?
- How can smaller HPC/CI centers gain access to this technology?
- How easily can the training material for these technologies be implemented by CI center staffs of various sizes?
- What is your technology topic's potential for disruption? Could it create a technology research divide?