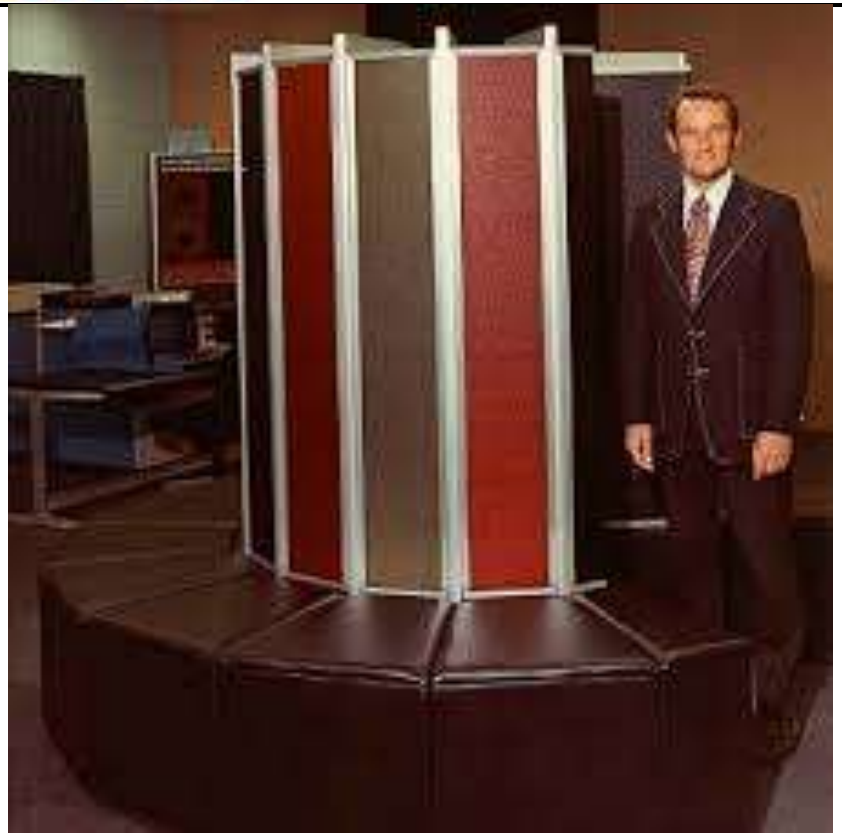
Disruptive technologies

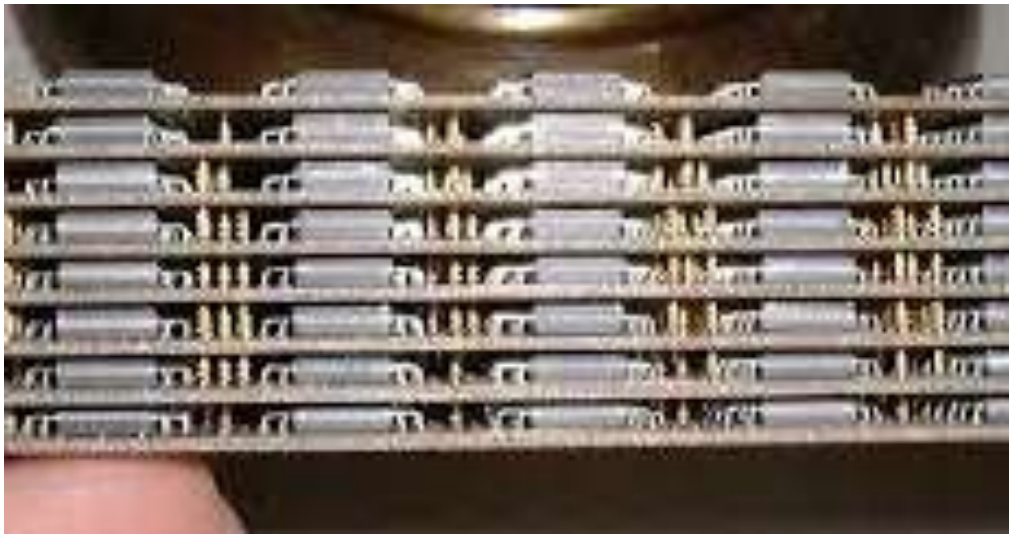
- Small, fast memory + large, slower memory (RAM+SSD)
  - 1969
  - CDC 7600
  - Small core memory + word or block addressable large core memory

Disruptive Technologies



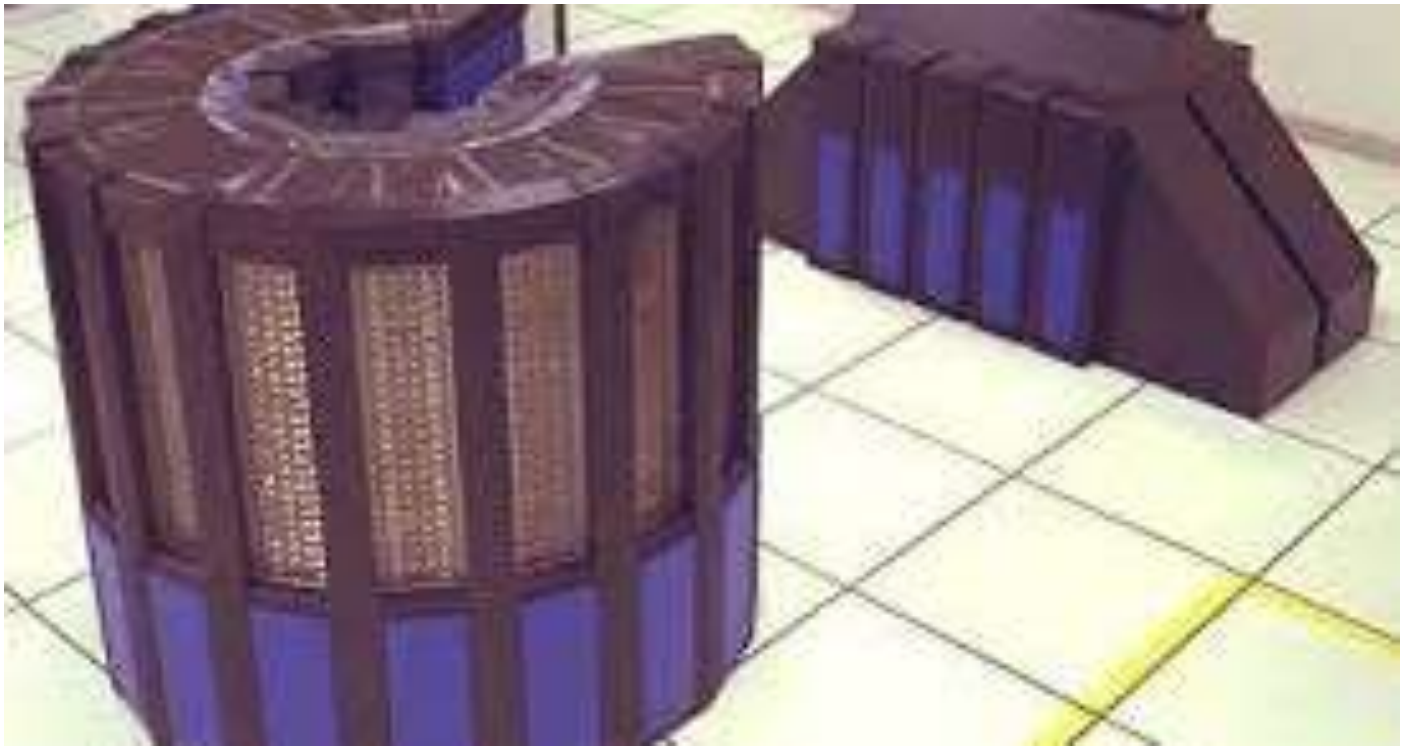
- Scalar & SIMD processor with equal high speed to same RAM'
  - 1976
  - Cray-1

Disruptive technologies



- 3-D stacked memory
  - 1984
  - Cray-2

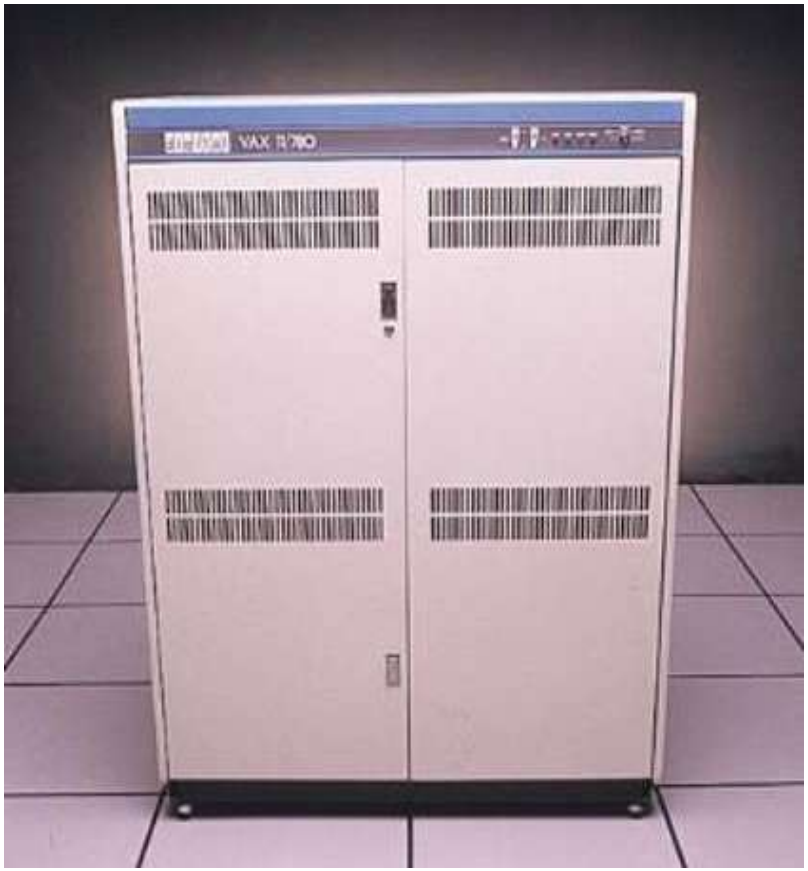
Disruptive technologies



- Liquid cooling
  - 1984
  - Cray-2

10,000 years of progress

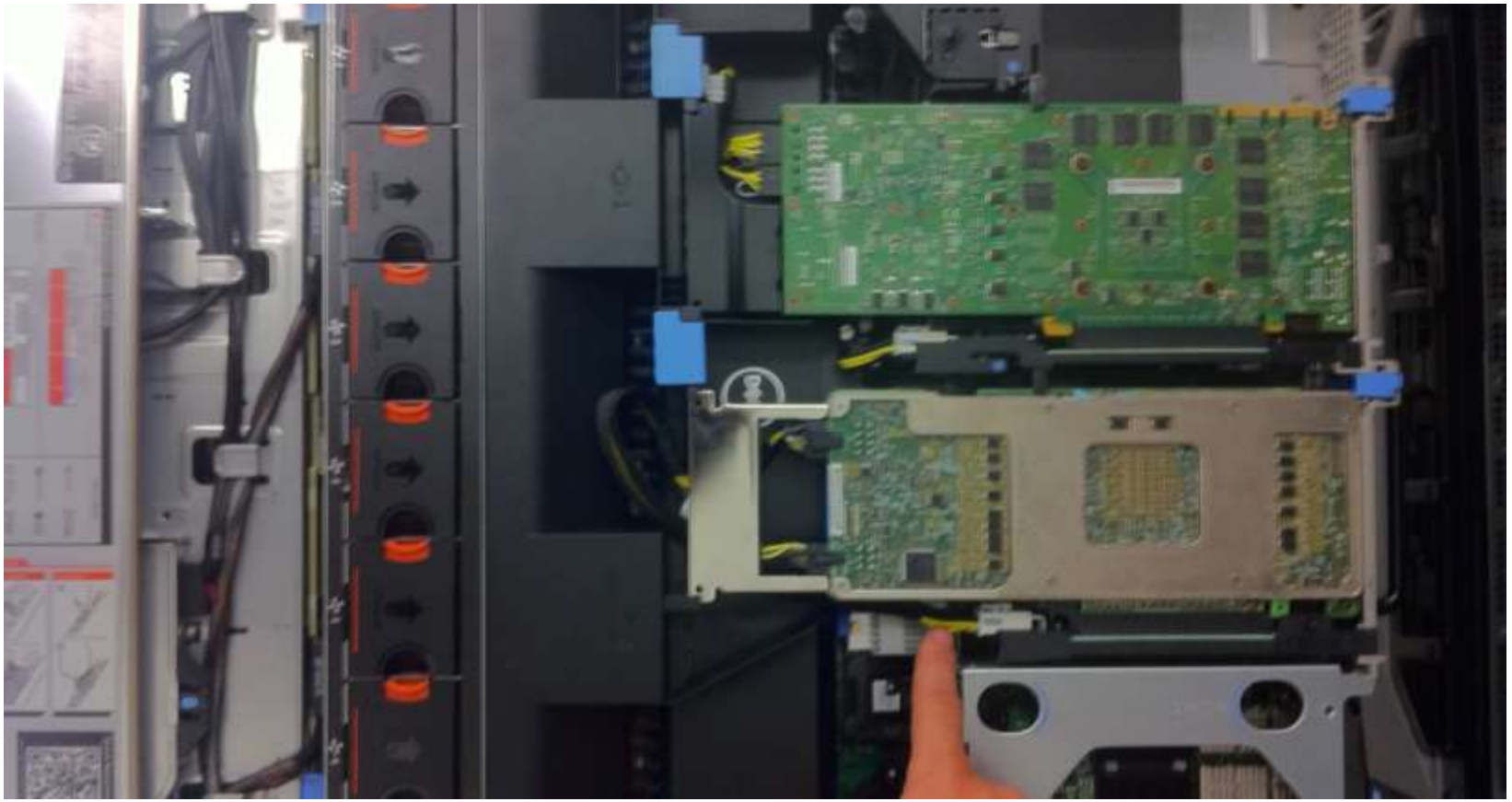
Accelerators: 1984



DEC VAX 11/785
One to two 7.2 MHz processor
32-bit word

Floating Point Systems FPS-164
12 MFLOP/s
64-bit word

Accelerators: 2014



16 Sandy Bridge cores (2.2 GHz per core)
1 NVIDIA Kepler K20 (1.17 Teraflops)
1 INTEL Phi (1.2 Teraflops)

Software

1984

- Fortran

2014

- Fortran, C, C++, Python
- CUDA, OpenCL, OpenACC
- Global arrays/shmem/PGAS
- OpenMP
- OpenMPI

Editorial comments

- Big increase in hardware performance
- Big decrease in hardware cost
- More software layers and programming complexity
- Now need to be even more cognizant of the underlying hardware layers
- Cars will drive themselves (with errors not allowed) before it gets easier to write HPC applications