Project Gulliver

Alin Dobra
Computer Science Department

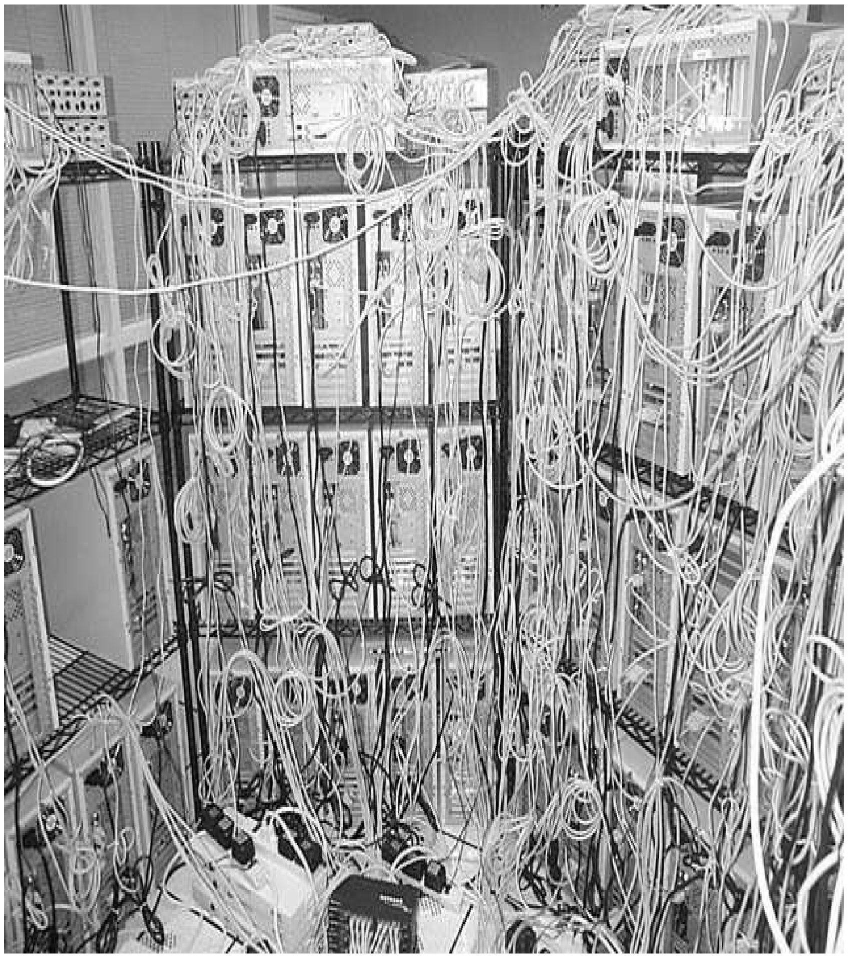
Beowulf systems

- Idea: use standard on−the−shelf PCs and Fast Ethernet to build "supercomputers"
- Project initiated by NASA in 1994
- Very good price−performance ratio.
- Good solution for applications that do not need high degree of parallelism (moderate speed message passing is reasonable).

Avalon (Los Alamos National Laboratory)

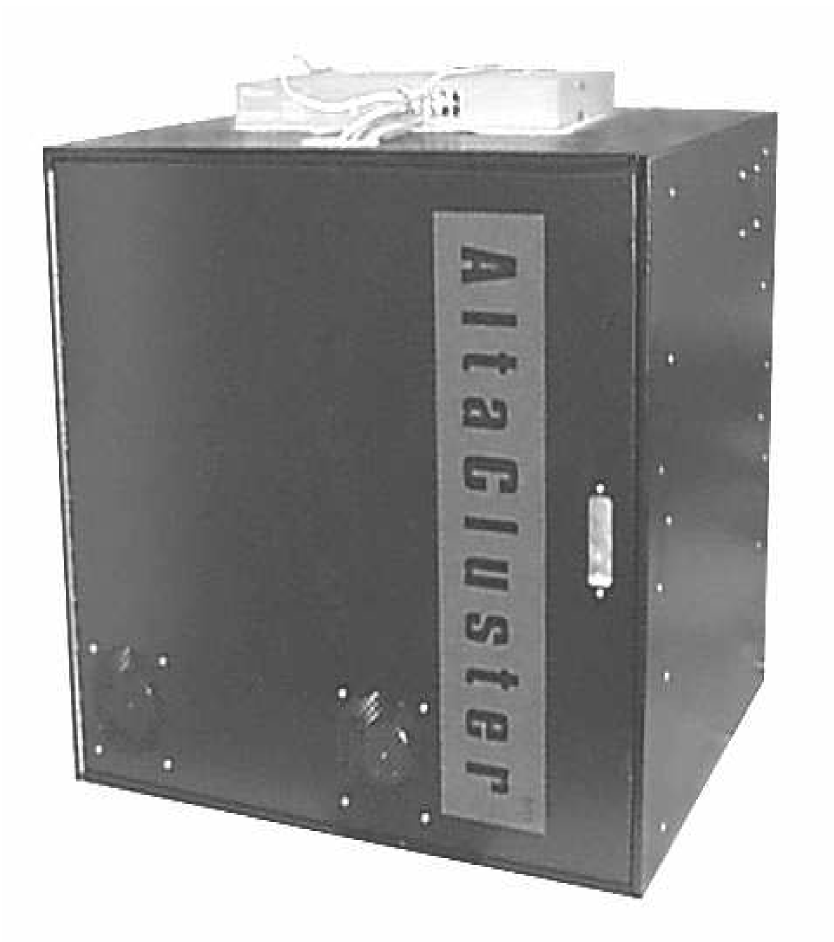
- 140 AlphaPC machines interconnected with Fast Ethernet
- Position 113 in the list of supercomputers (Cornell Theory Center supercomputer is position 98)
- Price: 313,000$ (an 64 processor SGI machine with half the computational power costs 1.8 mil $)
- Time spent to build the system: 3 days
- Operating system: Linux
- Used for gravitational simulations

Bunch of PCs solution



- 1200−1500$ per PC (Pentium II 400MHz, 128MB RAM)
- 4500−7000$ a 36 channels Fast Ethernet switch
- take up a lot of space, possible problems with the cooling
- takes some time to set up the machine
- the best price/performance ratio
- most of the current systems are of this type.
- most of the systems run Linux, some run Windows NT

The Alta Cluster



Characteristics of Alta Cluster

- Power Sequencing
- Power On/Off of Individual nodes
- Temperature Monitoring of Individual Processors
- Remote Reset of Nodes
- Disk Cloning Capabilities
- Additional Switched AC outlet for Auxiliary Equipment (e.g. fans, Ethernet switches, etc).
- GUI Interface
- Keypad and LCD

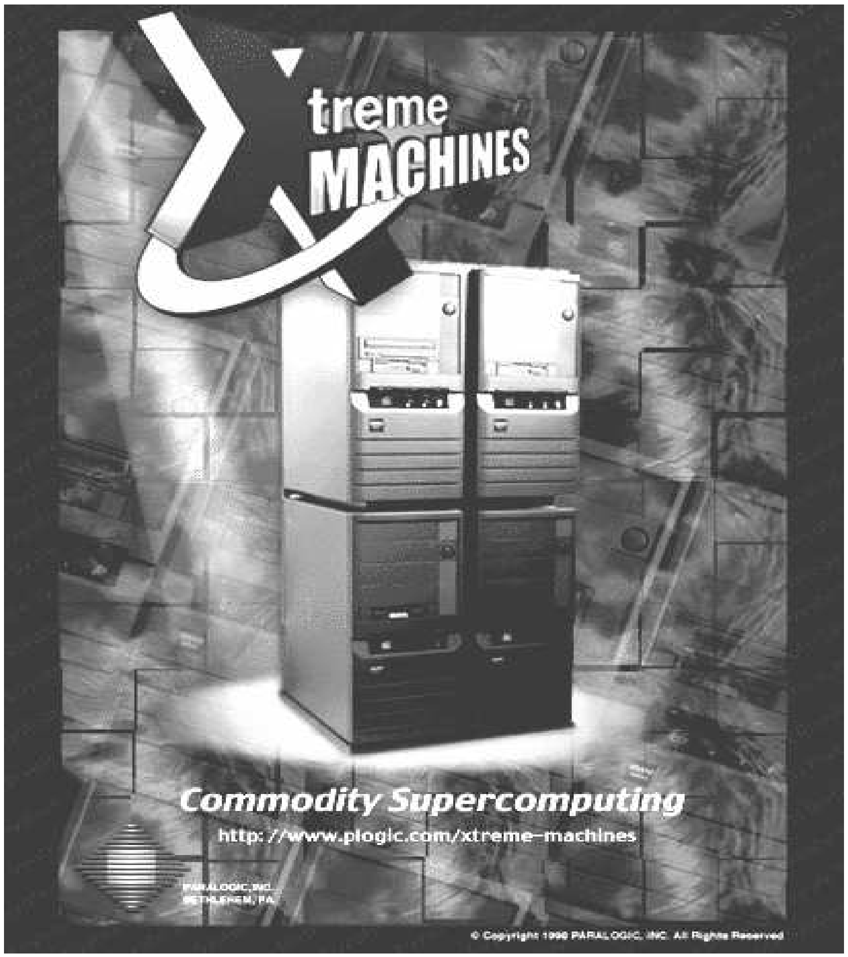
Alta Cluster (cont.)

- Standard configuration of Alta Clusters
  - 8 processing nodes each with 2 Pentium II (350,400 or 450 Mhz)
  - 128M RAM per processor
  - fast ethernet for interconnection
  - one switch per node
  - 4.3 GB UltraDMA EIDE hard disk drive
  - Software:Linux+PVM+MPI
- Alta Cluster prices
  - $23,950 for Pentium II 350MHz
  - $27,850 for Pentium II 400MHz
  - $34,250 for Pentium II 450MHz
  - 175$ for additional 128M RAM/processor
  - prices depend upon the current tendencies of the market
  - solutions with fast networks (Myrinet) are also possible

Paralogic's Xtreme machines

- 16 CPU Xtreme Annihilator System $26,798
- 1 Host Node: Dual PII–400/BX/256 MB RAM/9 GB SCSI/CDROM/Millennium II 8 MB/FDD/2 FE NIC(tulip)
- 7 Compute Nodes: Dual PII–400/BX/256 MB RAM/4 GB UIDE/FDD/VIDEO/2 FE NIC(tulip)
- 1 Fast Ethernet Switch/1 Master Console re–boot unit
- Industrial rack mount
- 16 CPU xtreme software bundle ($4,795 retail value)
- Aggregate specifications: 222 SPECint95, 174 SPECfp95, 2 GB RAM, 37 GB Storage, 22 Mbytes/sec Point to Point, 80 usec. Latency, +80 Mbytes/sec Cross–sectional bandwidth

Paralogic Xtreme machines (cont)



- Included software:
  - Red Hat Extreme Linux Distribution
  - BERT 77 Parallel Conversion/Optimization Software
  - Full Suite of GNU Compilers
  - Full Suite of Portland Group Workstation 1.7 Compilers (HPF, F90, F77, cc, c++)
  - PVM, MPICH, LAM−MPI Communication Libraries
  - Parallel BLAS Source Library
  - 2X Fast Ethernet Channel Bonding

Software for Beowulf systems

- PVM (Parallel Virtual Machine)
  - message passing, group communication and process handling
  - works from PCs to CRAY machines
  - powerful debugging and profiling capabilities
- MPI (Message Passing Interface): message passing standard.
  - Two freeware implementations: MPICH and LAM
  - no group communication, process handling not so good
  - debugging and profiling capabilities
- Modified Linux kernel to be more aggressive in networking
- Channel bonding
- DIPC (Distributed Inter Process Communication): a distributed version of System V IPC for Linux