CSCI 5551 - Homework 3 – Team Assignment 2

**Reference:**

<http://www.cs.rpi.edu/~chrisc/COURSES/PARALLEL/SPRING-2013/papers/TianHe-1A-Supercomputer.pdf>

**Overall System Description:**

The system is based on 14,336 Intel Xeon CPUs, 2048 custom SPARC compliant “FT-1000” CPUs and 7168 Nvidia GPUs. The 7,168 computer nodes are organized such that 16 per rack that are connected directly via wired interface, these racks then communicate between each other via a fiber optic connection to other racks and ‘service’ nodes. Communication between nodes is completed either via direct memory access transfer to a NIC & off to another node or using a copy to the NIC itself like a tradition networking stack. Finally, work is coordinated via their proprietary ‘Kylin Linux’ distribution and HPUC task management system.

**Programming Languages:**

Standard linux, specifically referenced are: C/C++, Fortran, Java with OpenCL, CUDA libraries.

**Compare and Contrast with Covered Systems:**

This system is a standard modern heterogeneous processing system, it includes both complex fully capable CPUs like the Cray systems covered in class, but augments these with co-processors that are better for specific work types: GPU + FT-1000. This system also uses a semi-generic operating system (Linux) compared to the specifically developed OSes of the systems covered in class.

**Built:**

28 October 2010

**In Use Period:**

28 October 2010 - Current

**Applications:**

Weather simulation

‘Military Defense’ research

Aircraft simulation

Petroleum exploration

**Operating System:**

Custom Linux Distribution – Kylin

**Interconnection Network:**

Switched Crossbar locally and Tree overall

**Reference:**

<https://cug.org/5-publications/proceedings_attendee_lists/CUG10CD/pages/1-program/final_program/CUG10_Proceedings/pages/authors/06-10Tuesday/07-Bland-paper.pdf>

**Overall System Description:**

The system has gone through a ‘phased’ upgrade process bring up the core count and changing the connectivity. Currently the system is using ‘InfiniBand’ networking between racks and has a core count of 224,256. The system has 300 terabytes of RAM and 10,000 terabytes of storage spread over 13,440 disks. The individual nodes are in a dual socket SMP arrangement and communicating via AMD’s HyperTransport mechanism not only to each other, but also to the node’s InfiniBand NIC.

**Programming Languages:**

Standard Linux, referenced projects are: C++, & Fortran.

**Compare and Contrast with Covered Systems:**

This system is one of the last homogeneous processing systems, it is (as referenced) only based on AMD CPUs, and in this sense it is very close to ‘supercomputers’ of old. It is made by Cray and follows their tried and true pattern of a **lot** of very fast individual nodes. The system has multiple strengths not only in the number of CPU cores, but the relatively light / efficient power usage. Finally, there is a significant concentration on the ability to do disk I/O & issue output, which is a pretty drastic change from the primarily compute intensive tasks that the machines that have been covered in class thus far.

**Built:**

29 September 2008 (in form closest to referenced incarnation)

**In Use Period:**

28 October 2010 - Current

**Applications:**

Energy assurance

Climate modeling

Superconducting materials research

Bio-energy

Chemistry

Combustion

Astrophysics

Nuclear physics

**Operating System:**

Custom Linux Distribution – Cray Linux

**Interconnection Network:**

3d torus via Cray ‘SeaStar’ network interface