

Parallel and Distributed Computing

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1 Fugaku Supercomputer

Fugaku is the fastest supercomputer and ranked number one in the world. The Fugaku supercomputer project was initiated by the Ministry of Education, Science and Technology of Japan in 2014 to set new standards for high performance computing[1]. This system was manufactured by Fujitsu. The URL to the project is [here](#) . The Fugaku supercomputer uses the A64FX 48C 2.2GHz processor and has 5,087 TB of memory and also has 7,630,848 cores making it process huge amount of data in a split of a second. The components of this huge computer is interconnected by the Tofu interconnect D. It is capable of executing task at a Linpack performance of 442,010 TFlops/s and a can reach a theoretical peak of 537,212 TFlops/s. This performance has a huge toll on the power consumption because the Fugaku supercomputer computer consumes 29,899.23 kW and when optimised its consumption is reduced to 26,248.36kW. The Fugaku supercomputer runs on the Red Hat Enterprise Linux OS and uses the FUJITSU Software Technical Computing Suite V4.0 for portable message-passing.

2 Summit Supercomputer

In 2018, the Summit by IBM power system was ranked number one supercomputer in the world before it was before it was put in the second place by the Fugaku Supercomputer[1]. The Summit can be located in Oak Ridge, USA and it boasts of 8,801,664 GB of memory and 2,414,592 cores. The Summit is powered by the IBM POWER9 22C 3.07GHz process and its components connected by Dual-rail Mellanox EDR Infiniband gives it the ability to process data at a Linpack performance of 148,600 TFlop/s and can reach a theoretical peak of 200,795 TFlop/s. Since the Summit has less process power than the Fugaku supercomputer, it also consumes less power than the Fugaku at 10,096kW. The Summit runs on the RHEL 7.4 OS and uses Spectrum MPI for message-passing. The URL to the machine is [here](#).

3 Sierra Supercomputer

Ranked third best supercomputer in the world, the Sierra super computer manufactured by the IBM and can be located at Lawrence Livermore National Laboratory in the USA[1]. This supercomputer is powered by the IBM POWER9 22C 3.1GHz and has 1,383,400 GB of storage and 1,572,480 cores making it capable to process data at a Linpack Performance of 94,640 TFlop/s and reach a theoretical peak of 125,712 TFlop/s. Its components are interconnected with the Dual-rail Mellanox EDR Infiniband. With the limited computing power of the Sierra, it consumes 7,438.28kW which is less power than its elder brothers in computing power. Unlike its sibling Summit, the Sierra runs on Red Hat Enterprise Linux OS but use the same IBM Spectrum MPI for message-passing. The URL to the machine is [here](#).

4 Sunway TaihuLight Supercomputer

The NRCPC's Sunway TaihuLight is ranked the fourth most powerful computer in world can is found China. The machine is powered by the Sunway SW26010 260C 1.45GHz processor and has a memory space of 1,310,720 GB and 10,649,600 cores which are all interconnected by Sunway. These components make the Sunway Taihulight capable of processing data at a Linpack Performance 93,014.6 TFlop/s and can attain a theoretical peak of 125,436 TFlop/s. The system consumes 15,370kW which is more power than the two second most powerful computers consume. This computing tank runs on the Sunway RaiseOS 2.0.5 operating system. The URL to the machine is [here](#).

5 JUWELS Booster Module Supercomputer

The JUWELS Booster ranked 7th most powerful supercomputer was manufactured by Atos in Germany. With the AMD EPYC 7402 24C 2.8GHz processor, 628,992 GB memory and 449,280 cores, this supercomputer can process data at a Linpack performance of 44,120 TFlop/s and can theoretically reach a peak of 70,980 TFlop/s. Its components are interconnected with Mellanox HDR InfiniBand/ParTec ParaStation ClusterSuite and this system runs on CentOS operating system. The JUMELS consumes 1,764.22kW of power. The URL to the machine is [here](#).

6 LENGAU in South Africa

The Lengau is the a High performance computer manufactured by Dell Emc and can be found at the the Center for High Performance Computing in South Africa. Its latest rank is 494th most powerful computer in the world. The Lengau has 32,856 cores, has 175,232 GB of memory and is powered by the

Xeon E5-2690v3 12C 2.6GHz processor. Its components are linked by the Infiniband FDR. It has Linpack Performance of 1,029.32 TFlop/s and can reach a theoretical peak performance of 1,366.81 TFlop/s. With its processing speed, it consumes 685.00kW of power and runs on the CentOS and uses Intel MPI for messaging parsing. The URL to the machine is **here**.

7 HPC in Ghana

Application of HPC in Ghana

There are numerous problems in Ghana that could have been solved using High performance computers. HPC could have been used to direct and manage traffic in the most busiest cities of Ghana by analysing the data from the roads.

HPC in Ghana could have helped Ghana research and discover groundbreaking drugs to cure diseases in Ghana and beyond.

Challenges

Ghana does not have much skilled personnel to manage High Performance computers.

Managing an HPC center is expensive and Ghana does not have that kind of money to maintain such a system.

A supercomputer consumes a lot of power and will need a reliable power supply to power such a system. With the current power crisis in Ghana, it will be impossible to run the supercomputer smoothly without any power interruption.

References [1] TOP500 List - November 2020, “<https://www.top500.org/lists/top500/list/2020/11/>”