

High Performance Computing  
Homework 1 - Question 5

Focusing on the first few entries of the Green500 list, they tended to have fewer cores than the Top500 list with around 10-100 thousand cores on average. However, there is a much wider range in number of cores, and a few of the Top 10 supercomputers made it in the Top 20 Green supercomputers. Another major difference is that many of these green supercomputers use much less power overall, some consuming less than 100 kW compared to the Top 10 which were consuming 3-38 MW. This makes sense because the Green500 are chosen based on their energy efficiency. The top 10 most efficient computers on this list were achieving 60-70 GFLOPS/W. Similar interconnects were used on both lists (Slingshot 11 and Infiniband) and the AMD EPYC 64C (a commonly used CPU in the Top500 list) was also present on the Green500 list. One difference is that the NVIDIA Grace Hopper Superchip 72C was typically used on the top ranked green supercomputers, which I did not see on the top 10 supercomputers. Another similarity is that the Green500 supercomputers also tend to use Linux or a Linux-based operating system.

Compared to June 2013, where the highest rated green supercomputer (Henri) had an efficiency of 65.396 GFLOPS/W, the current Green500 list features a machine with 72.733 GFLOPS/W (JEDI). While this may not look like a large jump, high performance computing has reached a point where physical limits are becoming an important factor. Even a theoretically perfect machine, would not be able to attain an infinite energy efficiency. An 11% increase is still very significant, especially considering there are more than three times the amount of supercomputers operating above 50 GFLOPS/W now than in 2013. One I see between 2013 and 2025 is that the Green500 machines continue to have a large variation in number of cores, ranging from a few thousand to over a million. Additionally, both lists are full of computers from the US and western europe.