Visualizing the Power of the World's Supercomputers

A supercomputer is a machine that is built to handle billions, if not trillions of calculations at once. Each supercomputer is actually made up of many individual computers (known as nodes) that work together in parallel.

A common metric for measuring the performance of these machines is **flops**, or **floating point operations per second**.
In this visualization, we've used November 2021 data from TOP500 to visualize the computing power of the world's top five supercomputers. For added context, a number of modern consumer devices were included in the comparison.

Ranking by Teraflops

Because supercomputers can achieve over one quadrillion flops, and consumer devices are much less powerful, we've used **teraflops** as our comparison metric.
1 teraflop = 1,000,000,000,000 (1 trillion) flops.

Rank	Name	Type	Teraf
#1	Supercomputer Fugaku	Supercomputer	537,2
#2	Summit	Supercomputer	200,7
#3	Sierra	Supercomputer	125,7
#4	Sunway Taihulight	Supercomputer	125,4
#5	Perlmutter	Supercomputer	93,75
n/a	Nvidia Titan RTX	Consumer device	130
n/a	Nvidia GeForce RTX 3090	Consumer device	36
n/a	Xbox Series X	Consumer device	12
n/a	Tesla Model S (2021)	Consumer device	10

Supercomputer Fugaku was completed in March 2021, and is officially the world's most powerful supercomputer. It's used for various applications, including weather simulations and innovative drug discovery.
Sunway Taihulight is officially China's top supercomputer and fourth most powerful in the world. That said, some experts believe that the country is already operating two much more powerful systems, based on data from anonymous sources.
As you can see, the most advanced consumer devices do not come close to supercomputing power. For example, it would take the combined power of 4,000 Nvidia

Titan RTX graphics cards (the most powerful consumer card available) to measure up to the Fugaku.

Upcoming Supercomputers

One of China's unrevealed supercomputers is supposedly named **Oceanlite**, and is a successor to Sunway Taihulight. It's believed to have reached 1.3 exaflops, or 1.3 quintillion flops. The following table makes it easier to follow all of these big numbers.

Name	Notation	Exponent	F
Quintillion	1,000,000,000,000,000,000	10^18	E
Quadrillion	1,000,000,000,000,000	10^15	F
Trillion	1,000,000,000,000	10^12	T
Billion	1,000,000,000	10^9	G
Million	1,000,000	10^6	M

In the U.S., rival chipmakers **AMD** and **Intel** have both won contracts from the U.S. Department of Energy to build exascale supercomputers. On the AMD side, there's **Frontier** and **El Capitan**, while on the Intel side, there's **Aurora**.

Also involved in the EL Capitan project is **Hewlett Packard Enterprise (HPE)**, which claims the supercomputer will be able to reach 2 exaflops upon its completion in 2023. All of this power will be used to support several exciting endeavors:

- Enable advanced simulation and modeling to support the U.S. nuclear stockpile and ensure its reliability and security.
- Accelerate cancer drug discovery from six years to one year through a partnership with pharmaceutical company, GlaxoSmithKline
- Understand the dynamic and mutations of RAS proteins that are linked to 30% of human cancers

Altogether, exascale computing represents the ability to conduct complex analysis in a matter of seconds, rather than hours. This could unlock an even faster pace of innovation