

Server Sky - Computation in Orbit

<http://server-sky.com> keithl@server-sky.com

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The problem: Data centers consume almost 3% of US electrical power, and this fraction doubles every 5 years. The demand for computing and internet services grows faster than efficiency improvements. Power generation is not growing to meet this increase in demand, and utilities are delaying service to some new data centers, and limiting growth of others. *The power just is not there.*

The sun produces 384 trillion terawatts. Less than a billionth reaches earth. Earth power is already claimed by the biosphere. Why rob nature, when far more power is wasted, just above the sky?

Server Sky converts space solar power into computation with arrays of thousands of small solid-state satellites. Each paper-thin server-sat is 20 cm across, 50 microns thick, and weighs 3 grams. Each is powered by a large solar cell, propelled and steered by light pressure, networked and located by microwaves, and cooled by black body radiation.

Server-sats are stacked by the thousands in solid cylinders, and launched into *6400 kilometer altitude* equatorial orbits. They are deployed into precisely located and actively stabilized three dimensional arrays, with spacings of about 10 meters. A large array may contain a *million server-sats*, with *megawatts* of power for computation and radios. Phased array transmitters are synchronized to produce narrow beams to hundreds of kilometer-sized receiver footprints simultaneously. Thousands of arrays communicate with ground receivers and each other.

Electrochromic windows on the corners switch from transparent to reflective, changing light pressure thrust. This positions and turns the server-sat, maneuvering it like a sailboat in the light from the sun. Optical thrust is slow, but fuel is unlimited.

Recent advances in HfO/SiO₂ gate oxides, RAZOR error detection and correction, electrochromic materials, and solar cell production automation lead to reliable, long-life, ultra-thin, unshielded server-sats.

The opportunity: Server-sats can be mass produced with existing semiconductor technologies. Highly automated solar-cell manufacturing plants, such as Solar World in Oregon, are uniquely capable of handling 50 micron thick server-sats. Other Oregon companies such as Merix, Intel, Triquint, Maxim, and others can provide substrates, processors, flash memory, radios, power control, and other chips to be bonded to the server-sat. As the economic downturn deepens, server sky provides new markets with unlimited growth potential, providing jobs while protecting the environment.

Server-Sat

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