Optical ‘LiFi’ Could Alleviate Spectrum Woes, Hit 1Gbps Wireless Speed

The advent of high-speed, low-power wireless radio technology over the past decade has been one of the great technology stories of the early 21st century. As wireless devices have proliferated, however, total demand for frequencies in the relevant portions of the electromagnetic spectrum have skyrocketed. Balancing the current and future needs of corporations, citizens, and the government without kowtowing to protectionism or risking the performance of current systems is extremely difficult. [1]

That’s where Harald Haas, a German physicist and professor with the University of Edinburgh, hopes to make a difference. Rather than attempting to balance the convoluted technical requirements of an increasing array of radios, Haas proposes we use light. His company, PureVLC (Visible Light Communication) is working to commercialize LED [2] systems that transmit data through variations in light intensity that Haas claims are undetectable to the human eye and will one day be capable of hitting 1Gbps [3].

Let there be light

In theory, this approach could solve a lot of problems. The visible light spectrum is 10,000x larger than the radio spectrum, it wouldn’t interfere with the operation of other devices, and data connections would be inherently more secure. In a TED talk last year, Haas demonstrated a system prototype [4], and used a desk lamp (retrofitted with the appropriate LED equipment) to stream an HD movie in real time.

Haas’ achievements are impressive, but the technology isn’t quite as futuristic as it seems. The first VLC system was invented by Alexander Graham Bell in *1880*. On February 19, 1880, Bell transmitted the world’s first known wireless signal some 700 feet away. Bell considered the Photophone his finest achievement and believed it would eventually outshine the telephone, which he’d (arguably) invented four

years before.

Bell's invention doesn't diminish Haas' idea, but the Photophone's failure to catch on explains some of the problems facing any modern VLC system. For example, the very nature of VLC systems means they require line-of-sight. This poses certain challenges on the small and large scale. Any outdoor VLC apparatus would need to contend with atmospheric pollution, inclement weather, and minute variations in antenna position created by high winds. This is not a showstopper, given that existing network protocols are designed to cope with dropped packets and the need to re-transmit data, but it's a significant design issue. Transmission towers would need to be low-maintenance and the LEDs themselves would need protective covers that were extremely resistant to any type of change that would degrade the efficacy of the system.

Small-scale deployments avoid these issues, but create problems of their own. One of the points of owning a wireless device is the ability to carry it from room to room without worrying about losing a signal. Creating an equivalent line-of-sight light network would be virtually impossible.

This doesn't mean LiFi is useless [5], but it suggests certain inherent limits for the technology. LiFi may not be able to replace conventional radios altogether, but it could turbocharge the development of wireless television and make it easier to throw a wireless signal across an entire house. At present, finding the ideal position for a wireless router is something of a divine art. If the signal could be passed via VLC from Point A to Point B inside a home, small local routers at both points could create local fields with less chance of overlapping and interfering with each other. Large scale areas that are saturated with radio signals or that don't permit them for security reasons could use LiFi as an alternate high-speed wireless network solution.

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