

Optical modules were replaced with copper

Article Overview

Optical modules are not being replaced by copper; instead, copper and optical technologies are coexisting, with optics dominating long-distance interconnects and copper remaining essential for short-range, in-rack connections.

Current Role of Copper and Optical Modules

Copper cables continue to play a critical role inside AI server racks due to their low latency, zero power consumption, and high reliability, making them indispensable for short-range connections within a single rack, especially in high-density GPU nodes . Optical modules, on the other hand, are primarily used for long-distance interconnects between racks, where copper's signal attenuation and crosstalk become limiting factors .

Technical Drivers for Optical Adoption

The rise of AI workloads has dramatically increased data rates and rack densities. Modern GPUs, such as NVIDIA's latest architectures, require multi-terabit per second interconnects, which exceed the practical limits of copper over longer distances . Optical fibers provide higher bandwidth, longer reach, and lower signal loss, making them essential for connecting multiple racks and data center backbones . Innovations like hollow-core fiber further reduce latency and nonlinear distortion, enhancing optical performance in AI-centric environments .

Coexistence Strategy

Industry leaders, including Nvidia, emphasize a dual-era approach where copper and optical modules coexist. Copper will remain dominant inside racks at least until 2027, while optical modules gradually penetrate in-rack connections with future platforms like Nvidia's Feynman system expected around 2028 . This approach allows data centers to balance power efficiency, latency, and bandwidth requirements while scaling AI infrastructure.

Market and Supply Implications

The demand for optical fibers and modules is growing rapidly, driven by AI data centers. Investments by companies like Nvidia and Meta in optical fiber manufacturing indicate a long-term expansion of optical capacity, but copper supply chains remain critical for in-rack connectivity . The transition is not a replacement but a specialization based on distance and performance needs.

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Conclusion

Copper will not replace optical modules, nor will optical modules fully replace copper in the near term. Instead, the future of data center interconnects is a hybrid model, where copper handles short-range, high-reliability connections, and optical modules manage high-bandwidth, long-distance links. This coexistence ensures optimal performance, energy efficiency, and scalability for AI-driven data centers .

Any fault in an active backplane system would require a complete strip down in order to replace it, something which is

The Rise of Co-Packaged Optics (CPO) In recent years, optical transceiver technology has been steadily shifting

Fiber optics vs. copper: the shift in data center infrastructure For many years, copper cabling

As optical connections work their way deeper into the data center, a debate is underway. Is it better to use pluggable

Fibre optic communications were launched in the 1970s, though the first fibre optic telecommunications networks were not installed

o LRO (Linear Receive Optics / Half-Retimed): A variant where only the transmit or receive direction is retimed,

AI data centers are hitting limits with copper interconnects, leading to a shift towards optical links for faster, denser

OFC 2025 made one thing clear: The transition to Co-Packaged Optics (CPO) switches in data centres is inevitable,

A couple of purchases (and days) later, I had new-to-me networking cards and active optical cables to replace the

The first R, REDUCTION, is closely linked to fibre optics, which consumes less energy than copper, breaks down less

Copper cables transmit data using electrical signals, while fiber-optic cables use light to

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Optical interconnects present a compelling alternative to copper, offering much higher bandwidth density and greater

Co-packaged optics (CPO) technology, a key enabler for next-generation data center architectures, promises

As technology develops at the speed of light communication companies started to use fiber optic. Here's why fiber

BT's shift from conventional copper to cutting-edge fibre optics promises up to 10x faster speeds, fortifying the UK's

NVIDIA presents its upcoming AI computing rack design which establishes a new standard by employing optical

Web: <https://in-au.co.za>

