See Straight Through Data Center Bandwidth Limitations with X-Rays

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ABSTRACT

As data center network demands increase, supporting the requisite bisection bandwidth is a challenge. 10 Gbps Ethernet is becoming the default, with 100 Gbps on the horizon. Recent work has augmented scale-out topologies with wireless links using 60 GHz transmitters [1]. These links can be used to provide additional bandwidth to "hotspots", or congested paths, in the network.

Although deployable, 60 GHz wireless supplies a bandwidth of only a few Gbps. To meet future data center bandwidth demands, a much faster wireless link technology will be needed: X-Rays, which operate in the 3.0×10^{10} GHz range. Using on-off keying with a modulation efficiency of 1% (the same as 1550nm optics), each X-Ray link could support 40 Petabits/sec. NASA has recently demonstrated an X-Ray data modulator [3], although at less than 1 Mbps. Further engineering may close this gap. However, the higher power of X-Rays means that they require significantly more joules per transmitted bit than 60 GHz wireless. For data centers where bandwidth is critical, this tradeoff may be worthwhile.

The problem with X-Ray networks is that exposure to them is fatal; while X-Rays can be collimated to an extent, dispersion over hundreds of meters would make their use in free space unsafe for humans, at least during times that operators are present. There is a potential for silicon-based waveguides to confine the rays [2], similar to how glass fibers confine laser light in optical networks, although adopting this approach would prevent their use in reconfigurable topologies.

BODY

Reconfigurable wireless X-Ray links in data centers could deliver 40 Pb/sec, but would have to be turned off while operators are present.

REFERENCES

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