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Title: Scalable Multi-wavelength Internet Routing

Abstract

Most of the internet traffic worldwide is carried by optical communication networks. The rapid increase in traffic-volume results in unsustainable growth in energy consumption and threatens to overload the existing infrastructure. An efficient use of resource is paramount for moderating the expected growth in infrastructure and energy. One of the key questions to address is the routing of multi-wavelength beams across this complex heterogeneous network in a way that optimizes a given objective, be it low latency, high throughput or resilience.

Communication requests are routed over the network using a large number of different wavelengths. The routing problem is itself computationally hard, but in this context becomes much harder due to the constraint that different routes cannot use the same wavelength over the same fibre-segment. Moreover, both the numbers of requests and wavelengths are very large. We developed a scalable and readily applicable routing algorithm, based on passing probabilistic messages between network constituents under these conditions and constraints. Numerical tests demonstrate the efficacy of the algorithm on both generated and real networks, such as the US and UK backbone optical communication networks.

Reference: Yi-Zhi Xu, Ho Fai Po, Chi Ho Yeung, and David Saad, "Scalable node-disjoint and edge-disjoint multi-wavelength routing" arXiv:2107.00609.