Beyond Binary Failures in Networks

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ABSTRACT

Fiber optic cables are the workhorses of today's Internet services, but they are an expensive resource and require significant monetary investment. Their importance has driven a conservative deployment approach with redundancy baked into multiple layers of the network under the assumption that links have a constant reliability status and operate at a fixed capacity. In this work, we take an unconventional approach and argue that link failures should not be always considered binary events; this approach enables the foundation of a framework for network links with dynamic capacity and reliability. We investigated this idea by conducting the first ever large-scale study of operational optical signals, analyzing over 2,000 channels in a wide-area network for a period of three years. Our analysis uncovered several findings that enable cross-layer optimizations and smart algorithms to improve traffic engineering, increase capacity, and reduce cost. For instance, we show the capacity of over 90% of wide-area links can be augmented by at least 50 Gbps, leading to an overall capacity gain of more than 100 Tbps. This means we get higher capacity and better availability using the same links. Based on work published at [1] Rachee Singh, Monia Ghobadi, Klaus-Tycho Foerster, Mark Filer, and Phillipa Gill. 2017. Run, Walk, Crawl: Towards Dynamic Link Capacities. In Proceedings of the 16th ACM Workshop on Hot Topics in Networks (HotNets-XVI). ACM Press, Palo Alto, CA, 143–149. DOI:https://doi.org/10.1145/3152434.3152451

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