FSO-based Reconfigurable Networks in Data Centers and Picocell Backhaul

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FSO-based Data Center Networks. There has been recent interest in "reconfigurable" (all wireless) datacenter network architecture based on steerable FSO links, wherein the network topology can be changed in real-time to best handle prevailing traffic pattern. The indoor and short-range (25-50m) setting of DC alleviates many traditional (outdoor) challenges that plague FSO communications. The main benefits of such FSO-based DC networks are: minimal cabling complexity, incremental expandability, and possibly reduced equipment and power costs. The challenges that must be addressed in this context: (i) Design of small-size and cost-effective high-bandwidth transceivers, (ii) Steering mechanisms optimized for performance parameters, (iii) Design of minimal-size ATP mechanisms for short-range (25-50m) links to handle rack vibrations/disturbances, (iv) Creative architecture designs (e.g, [3]) to facilitate line-of-sight in a DC setting, and (vi) a system to achieve automatic acquisition and alignment of FSO links.

FSO-based Picocell Backhaul. FSO communications can have a strong potential in creating a wireless backhaul for small-cell cellular (picocell) networks, due to their high-bandwidth potential and the fact that many outdoor challenges become manageable at shorter distance (100 m) of picocell networks. In a recent work (MobiCom 2017), a viable architecture based on steerable FSO links has been proposed which relies on a "backbone subnetwork" of short-range links with sufficient link margin. However, there is room for much improvements and alternative choices in architecture design and techniques, e.g., comprehensive analysis of key cost-size-performance trade-offs in short-range (100-500 m) FSO links and ATP mechanisms. Can we design efficient FSO networks tailored to dierent weather and outdoor conditions? Or more interestingly, reconfigurable networks that *adapt* to different weather conditions. A somewhat generalization of our approach could be to design multi-tier FSO networks with say high-bandwidth but less-reliable subnetwork backed up a low-bandwidth but very reliable subnetwork.