Maximizing Throughput with Routing Interference Avoidance in RIS-Assisted Relay Mesh Networks

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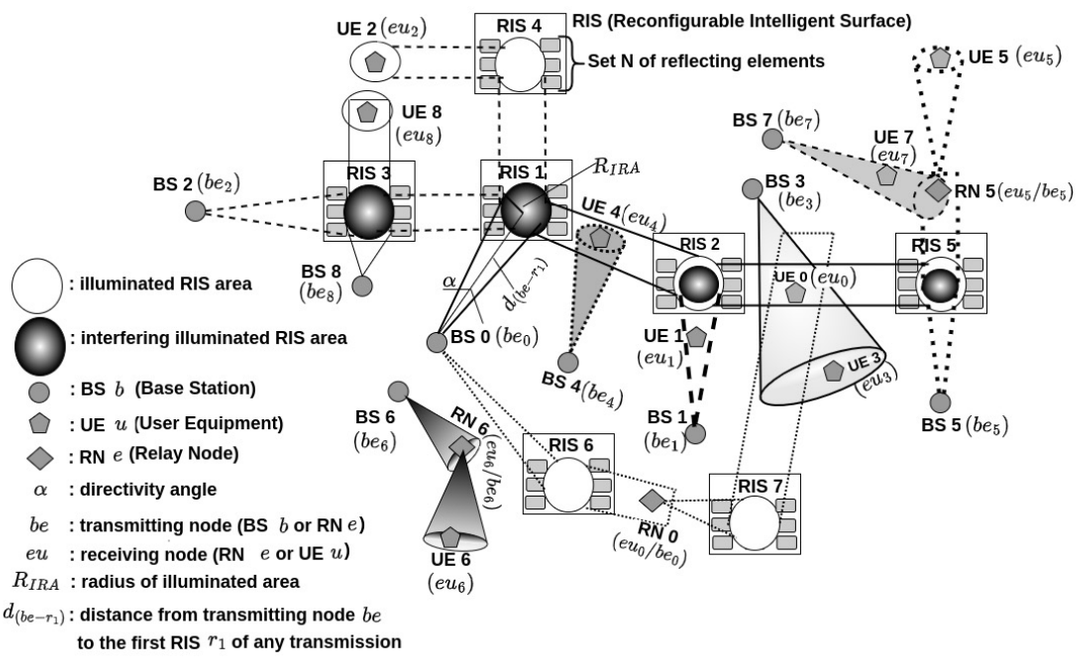
How do the beam shapes from Base Stations (BSs), Reconfigurable Intelligent Surfaces (RIS), Relay Nodes (RNs) look like in THz mesh networks? How do these beam shapes have the impact on Signal-to-Interference-Noise Ratio (SNIR) values of User Equipments (UEs)? How can SNIR aware scheduling transmission and path allocation solutions be designed to maximize throughput?



Analysis of conical and cylindrical beam shapes, which can occur from BSs, RISs, RNs, results in: a) Interference model on the UE → SNIR per transmission path; b) Efficient transmission scheduling → Eliminate interference among paths; c) Throughput optimization model with various path computation methods.

KEY FINDINGS

): In the modern landscape of wireless communications, multi-hop, high-bandwidth, indoor Terahertz (THz) wireless communications are gaining significant attention. These systems couple RIS and relay devices within the emerging 6G network framework, offering promising solutions for creating cell-less, indoor, and on-demand mesh networks. This work presents an in-depth, analytical examination of how path allocation impacts interference within such networks. We develop the first model which analyzes interference based on the geometric parameters of beams (conic, cylindrical) as they interact with RIS, UE, and relay devices. We introduce a transmission scheduling heuristic designed to mitigate interference, alongside an efficient optimization method to maximize throughput. Our performance results elucidate the interference's effect on communication path quality and highlight effective path selection strategies with throughput maximization.

C. V. Phung, A. Drummond, and A. Jukan, "Maximizing throughput with routing interference avoidance in RIS-assisted relay mesh networks," in arXiv, Feb. 2024. [Online]. Available: https://doi.org/10.48550/arXiv.2402.08825.