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**JOINT OPTIMIZATION OF MULTICAST ENERGY IN DELAY-CONSTRAINED MOBILE WIRELESS NETWORKS**

**ABSTRACT:**

This paper studies the problem of optimizing multicast energy consumption in delay-constrained mobile wireless networks, where information from the source needs to be delivered to all the k destinations within an imposed delay constraint. Most existing works simply focus on deriving transmission schemes with the minimum transmitting energy, overlooking the energy consumption at the receiver side. Therefore, in this paper, we propose ConMap, a novel and general framework for efficient transmission scheme design that jointly optimizes both the transmitting and receiving energy. In doing so, we formulate our problem of designing minimum energy transmission scheme, called DeMEM, as a combinatorial optimization one, and prove that the approximation ratio of any polynomial time algorithm for DeMEM cannot be better than (1/4) lnk. Aiming to provide more efficient approximation schemes, the proposed ConMap first converts DeMEM into an equivalent directed Steiner tree problem through creating auxiliary graph gadgets to capture energy consumption, then maps the computed tree back into a transmission scheme. The advantages of ConMap are threefolded: 1) Generality- ConMap exhibits strong applicability to a wide range of energy models; 2) Flexibility- Any algorithm designed for the problem of directed Steiner tree can be embedded into our ConMap framework to achieve different performance guarantees and complexities; 3) Efficiency- ConMap preserves the approximation ratio of the embedded Steiner tree algorithm, to which only slight overhead will be incurred. The three features are then empirically validated, with ConMap also yielding near-optimal transmission schemes compared to a brute-force exact algorithm. To our best knowledge, this is the first work that jointly considers both the transmitting and receiving energy in the design of multicast transmission schemes in mobile wireless networks.