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Optimal Aggregation Throughput is Nearly Constant

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One of the most fundamental tasks in sensor networks is the computation of a (compressible) aggregation function of the input measurements. What rate of computation can be maintained, by properly choosing the aggregation tree, the TDMA schedule of the tree edges, and the transmission powers? This can be viewed as the convergecast capacity of a wireless network. We show here that the optimal rate is effectively a constant, under the physical model of interference. This holds even in arbitrary networks, where nodes are arbitrarily located in the plane. This compares with previous bounds that are logarithmic (e.g., Omega(1\log n)). Namely, we show that a rate of Omega(1/log^* Delta is possible, where Delta is the length diversity (ratio between the furthest to the shortest distance between nodes). This is achieved using the natural minimum spanning tree (MST). Surprisingly, this barely non-constant bound is best possible for MSTs.

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