

We consider the problem of computing shortest paths in hybrid networks, in which nodes can make use of different communication modes. For example, mobile phones may use ad-hoc connections via Bluetooth or Wi-Fi in addition to the cellular network to solve tasks more efficiently. However, the different communication modes may differ considerably in range, bandwidth, and flexibility.

We build upon the model of Augustine et al. [SODA '20], which captures these differences by a local and a global mode. Specifically, the local edges model a fixed communication network in which $O(\log n)$ messages of size $O(\log n)$ can be sent over each edge in synchronous rounds. The global edges form a clique, but nodes are only allowed to send and receive a total of at most $O(\log n)$ messages over global edges, which restricts the nodes to use these edges only very sparsely.

We demonstrate the power of hybrid networks by presenting algorithms to compute Single-Source Shortest Paths and the diameter very efficiently in sparse graphs. Specifically, we present exact $O(\log n)$ time algorithms for pseudotrees (i.e., graphs that contain at most one cycle), and 3 -approximations for graphs that have at most $n + O(n^{1/3})$ edges and arboricity $O(\log n)$. For these graph classes, our algorithms provide exponentially faster solutions than the best known algorithms for general graphs in this model.