

We study the optimal resource allocation in the wireless powered underground sensor network (WPUSN) for throughput maximization. The WPUSN is a new networking paradigm where underground sensors can be replenished by a radio frequency energy harvesting technique and transmit geological data to the nearby aboveground access point in real time. In this paradigm, the underground portion of the wireless communication link suffers from severe path loss. Moreover, different underground sensors may have diverse data traffic demands. In this paper, we formulate an optimization problem to maximize the throughput in WPUSNs with the quality of service (QoS) consideration in terms of communication reliability and diverse data traffic demands. Specifically, we map the QoS requirements to signal-to-noise ratio thresholds and transform our problem into a convex optimization problem with linear constraints. We then present a closed-form solution for the transformed problem through a problem decomposition of the Karush-Kuhn-Tucker conditions. Our closed-form solution uncovers the insights that how the wireless channel states, reliability requirements, and data traffic demands affect the optimal resource allocation in the WPUSN. Finally, we demonstrate the effectiveness of the proposed scheme by running simulations.