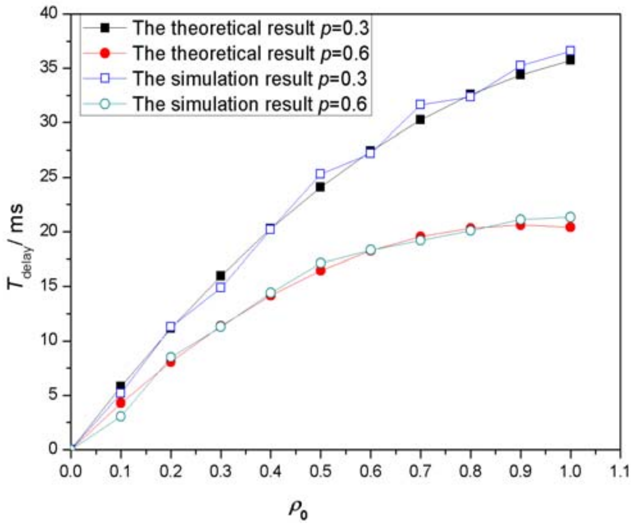

Figure 6. Average event delay obtained by the model and simulation under different probabilities.

At last, we utilize a simulation tool on OMNeT++ to verify our theoretical analysis, which is called MiXiM [16]. We employ Simple Path-Loss Model [15] as wireless channel attenuation model, the carrier frequency is 2.4 GHz, and the media access control (MAC) layer is the carrier sense multiple access (CSMA) scheme. We use a base scenario, where 30 hosts are deployed in 500 m×500 m region in uniform distribution, and the hop count between source node and destination node is 8 hops. In order to evaluate the average event delay through a route path, we increase the traffic intensity of source node (denoted by ρ_0) step by step from 0.1 to 1 over several simulations. We set p=0.3 and p=0.6, respectively, to compare the results under different probabilities. From Figure 6, we conclude if the p is smaller the delay is also smaller; moreover, the event delay increases largely as ρ_0 increases. The simulation results show that our analysis result is suitable for such kind of event-driven wireless sensor networks.

VI. CONCLUSION AND FUTURE WORKS

This paper focuses on the event delay in event-driven WSN data transmission, and builds an M/G/1 vacation queueing model with multiple priorities. We get the event delay in a single node that changes with varying probability of event arrival, find the block probability that related to the packet loss is determined by the traffic intensity and buffer size, and also derive the total average event delay through a route path under several limitations such as channel contention. The results showed that the probability of event arrival significantly affects the event delay in a node.

To simplify our research, we only consider the arrival probability of an event is a constant. It is widely acknowledged the arrival probability of an event should be followed by certain distribution as the randomness of an event occurring. So the next work we would perform is to analyze the event delay when the arrival probability of an event is Gauss distribution or Normalized distribution. These research works should provide a guidance for understanding the event delay and future designing more flexible event-driven WSN routing protocols.

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