How to make information fresh in IoT system?

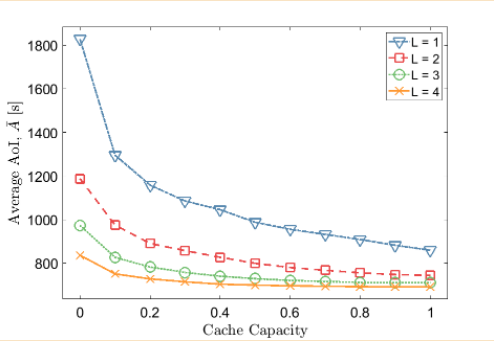
AoI aware Update Scheduling and Caching in IoT system

どんな研究？

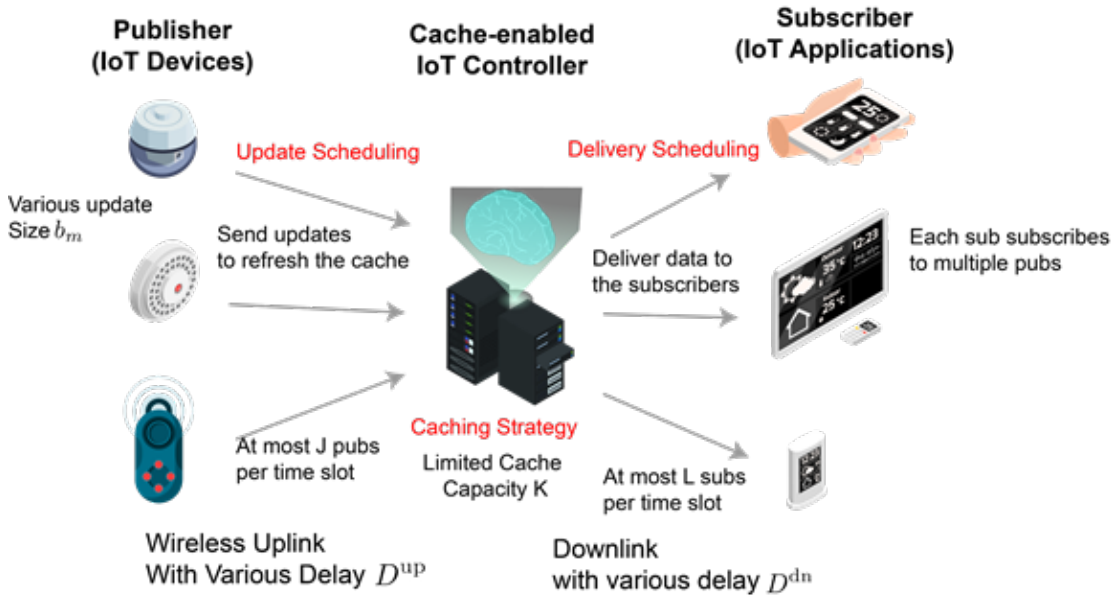
We consider a IoT system consists of multiple IoT devices that collecting information, an IoT controller that has a limited capacity of cache and multiple IoT applications with heterogeneous AoI requirements. We describe this IoT system using a publisher-subscriber model and formulate a discrete time decision problem to find a transmission scheduling and cache replacement policy that minimizes the weighted average AoI at the subscribers.

何がわかる？

- Simulation results show that our algorithm can achieve near optimal performance
- In case where the downlink has a limited capacity, caching on the IoT controller can effectively reduce the AoI of the subscribers



状況設定



研究内容

We divide this problem into the a update scheduling problem and a caching and delivery problem. We propose a low-complexity heuristic algorithm that decide the update schedule based on the weighted popularity of the subscription. And we determine the caching and delivery based on objective gain, which is the weighted difference of AoI between the cache and the subscriber.

Update

Weighted popularity

$$p_m = w_m \sum s_{nm}\, c_n$$

Use *Deficit Round Robin* to choose the publishers to update according to the weighted subscription popularity p_m

Caching and Delivery

Objective Gain: weighted difference of AoI between the cache and the subscriber

$$G_{nm} = c_n\, w_m\, s_{nm}\, (\Delta_{nm} - A_m)$$

Greedily select the cache and subscriber with respect to objective gain G_{nm}