Improving Congestion in an Efficient & Robust manner using smart Virtual Queuing at Airport Security

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We show that the efficiency of the security process at airports can be significantly improved by adoption of a virtual queue where passengers are able to book a time slot. This time slot allows passengers to get priority access at the given time for security. We show that a simple load balancing heuristic already guarantees that participants have minimal waiting time while at the same time reducing the average waiting time of all passengers.

Our proposed method is able to reduce the waiting time even further. Furthermore, our approach specifically takes into consideration the uncertainty in the arrival pattern and security capacity at the moment the time slots need to be allocated. Therefor, it can guarantee minimal waiting time in all scenarios for participating passengers. Furthermore, this approach leads to significantly lower wait time for non-participants than the baseline heuristic or having no virtual queuing at all in almost all scenarios.

Our numerical experiments show that our approach reduces the sensitivity to the uncertainty in the arrival behavior of passengers and the security capacity.