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An Online Mechanism for Ridesharing in Autonomous Mobility-on-Demand Systems

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AMoD Systems

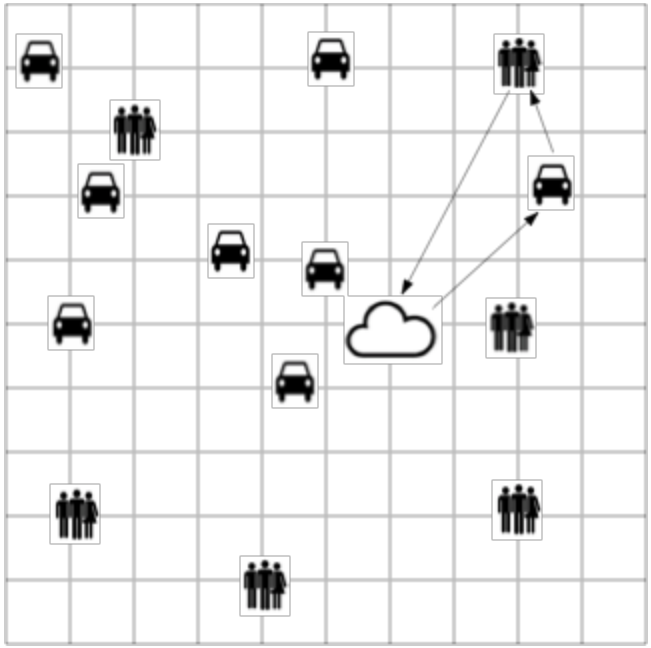
Components:

A fleet of electric, driverless cars

Information Center (Dispatch center)

Passengers (Demand)

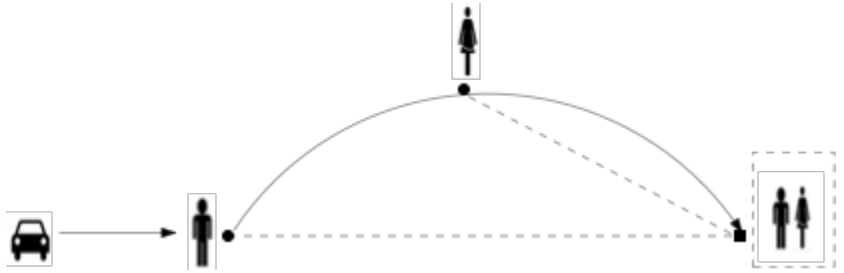
Environment (Infrastructure)



Objective:

To satisfy passengers' mobility demand with limited resources

Ridesharing in AMoD Systems



Characteristics:

- No drivers

Challenges:

- Truthful demand information needed
- Passengers may not cooperate

Limits of Existing work

Key Limits:

- require passengers to directly reveal their valuation
- need additional constraints to satisfy desirable properties
- do not work in online settings

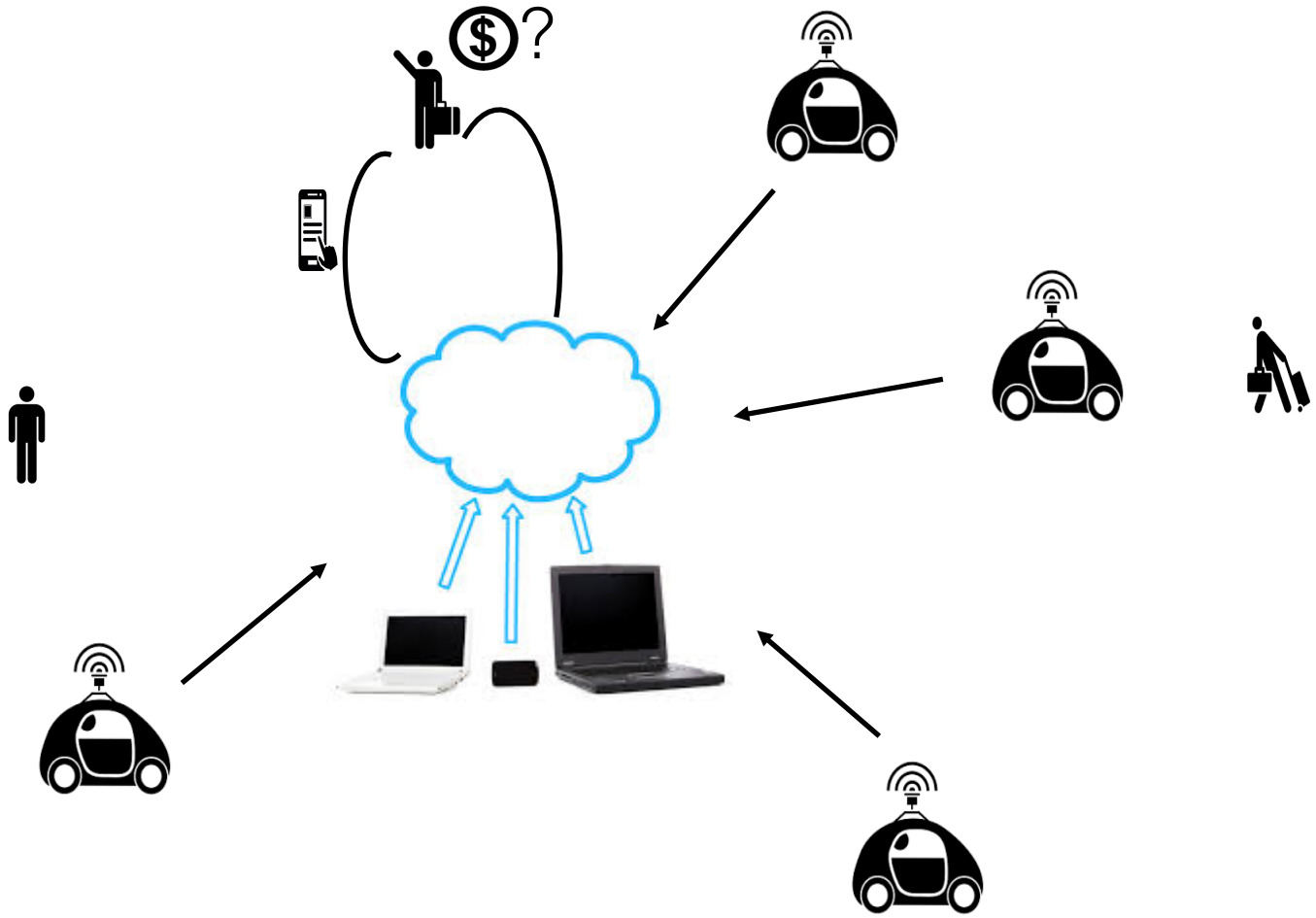
(For a complete list, see the introduction in Shen et. al., 2016)

Integrated Online Ridesharing (IORS) Mechanism

An Overview :

- Fare Estimation
- Pickup Assignment
- Payment Calculation

Fare Estimation

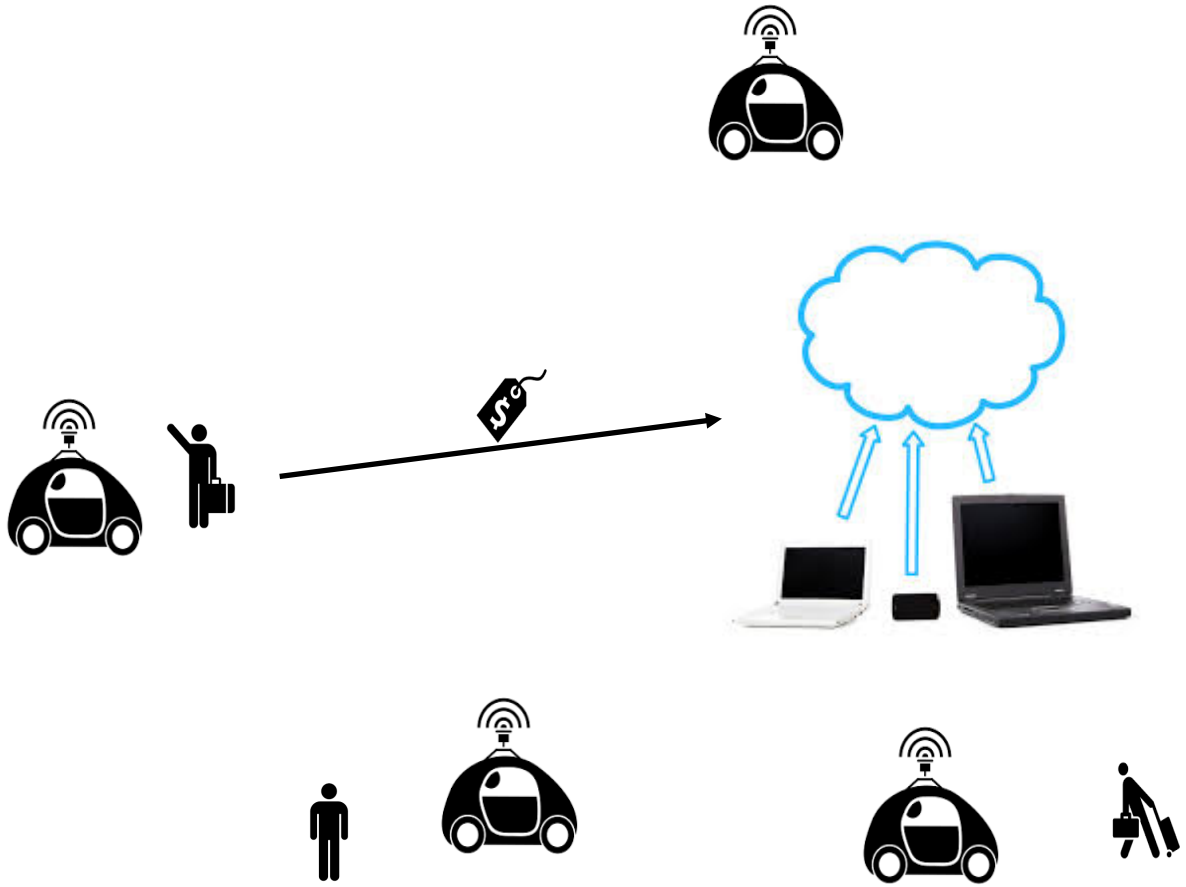


Providing an upper bound of the cost

Pickup Assignment

Computing the optimal pickup assignment

Payment Calculation



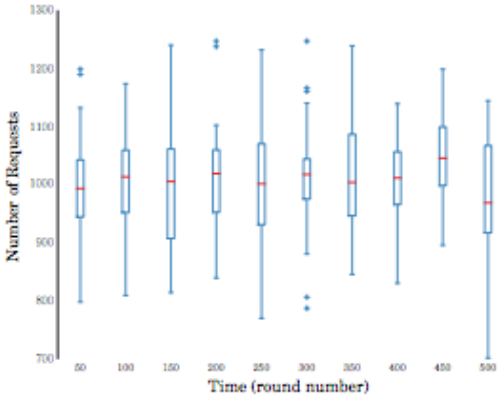
Calculating the final payment upon arrival

IORS is Desirable

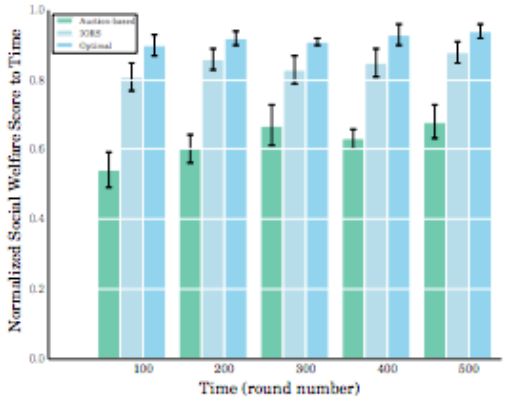
Properties:

- Ex-post Incentive compatibility
- Individual rationality
- Budget balance

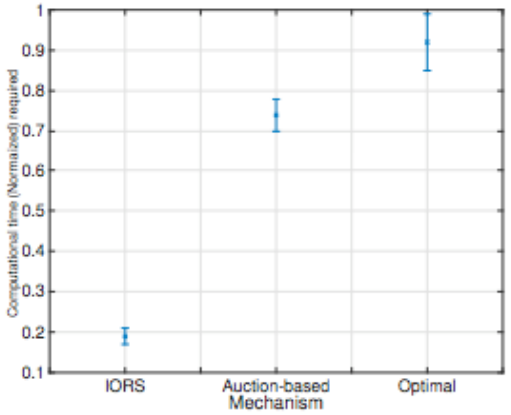
IORS is Competitive



(a) Demand distribution at each time.

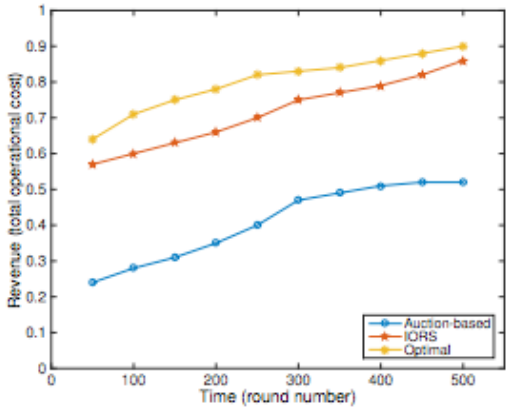


(b) Social welfare scores to time.

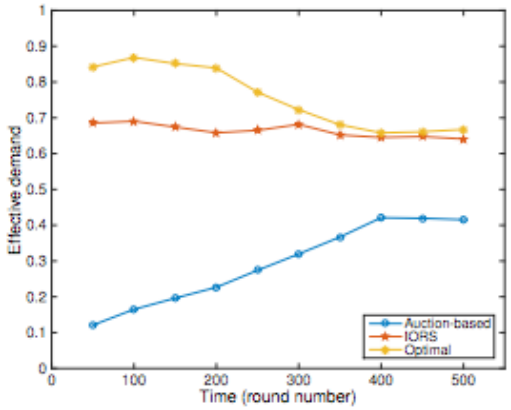


(c) Computational time.

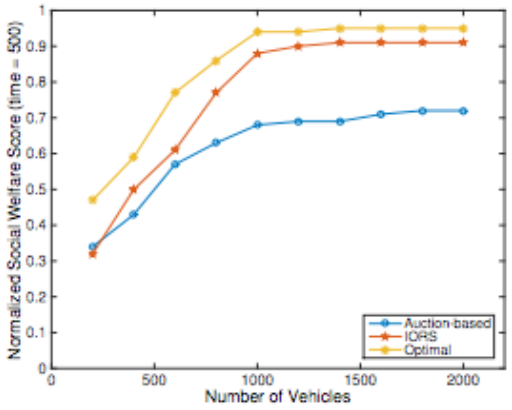
Figure 1: A comparison of demand distribution, the social welfare scores and computational time of a system with three different approaches: the IORS, an auction-based mechanism and the optimal solution.



(a) Revenue (total operational cost).



(b) Total effective unit demand.



(c) Varying the numbers of vehicles.

Figure 2: A comparison of the performance of a system with three approaches: the IORS, an auction-based mechanism, and the optimal solution.

Conclusion

Contribution:

- Introduce a posted-price, online mechanism (IORS)
- IORS is ex-post incentive compatible
- IORS is competitive

Future work:

- Distributed mechanisms
- Simulation platform

Thanks!

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