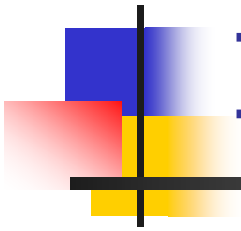
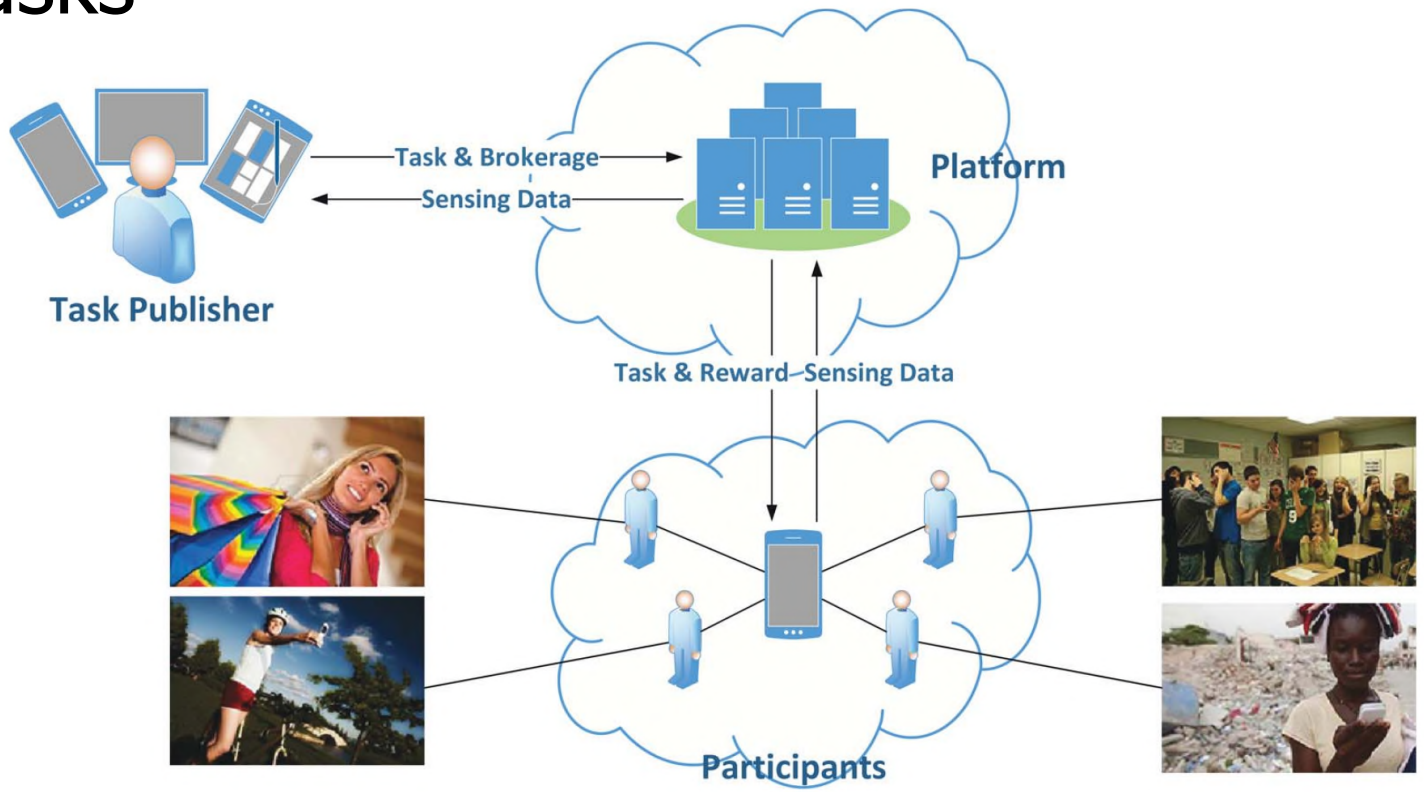


Incentives

How to Ensure Participation

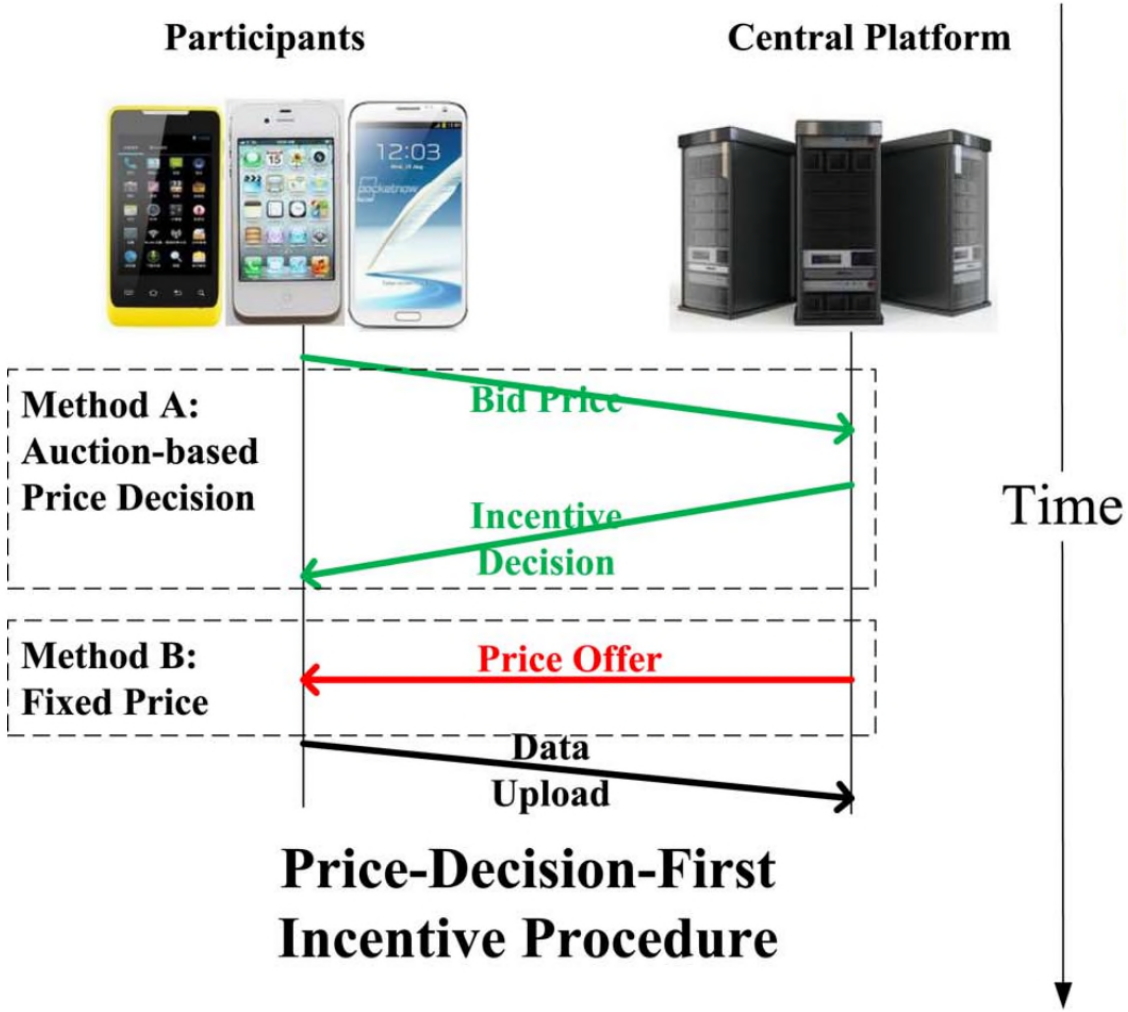
The Participatory Sensing Model

- Platform (aggregator), participants, and tasks



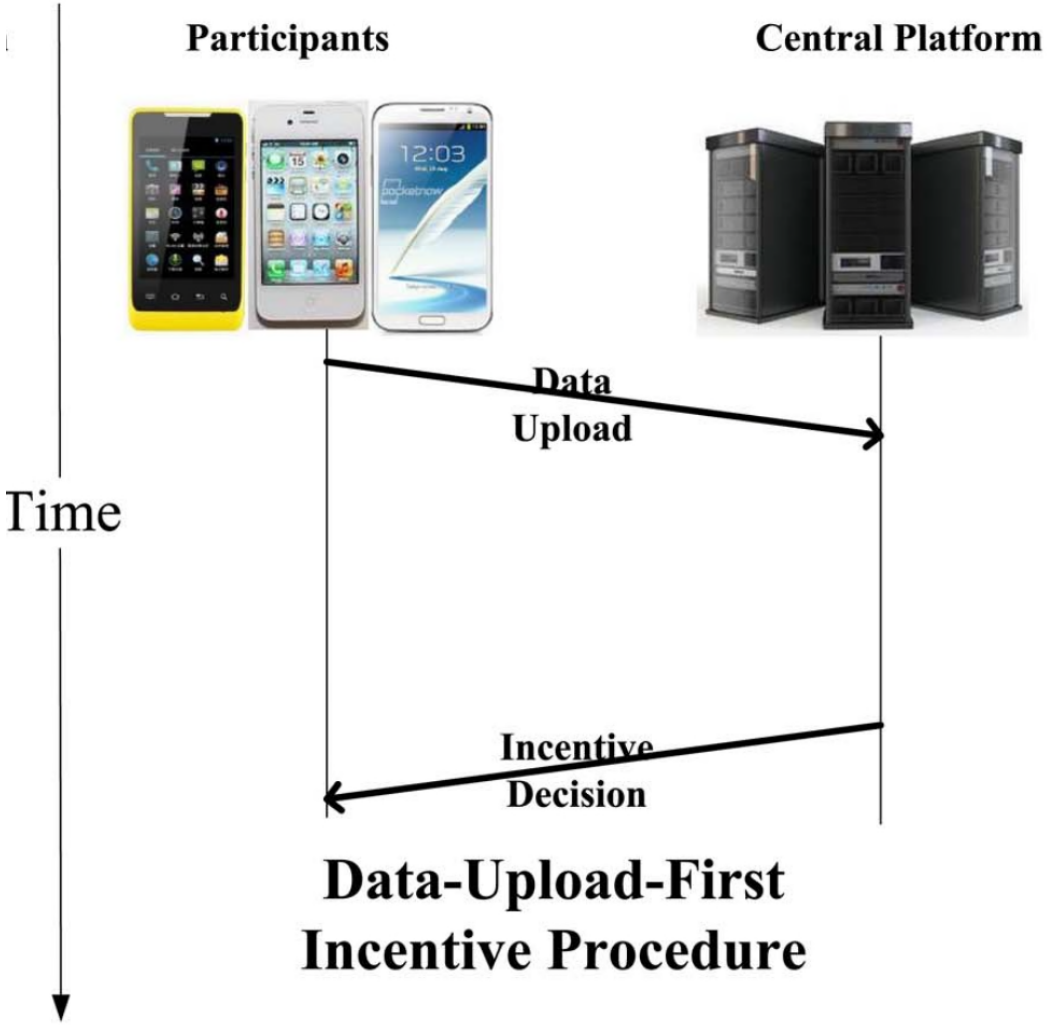
Incentive Negotiation Mechanisms

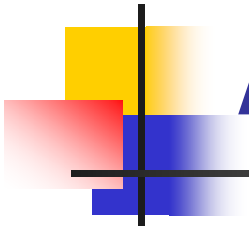
- Price-first



Incentive Negotiation Mechanisms

- Data-first



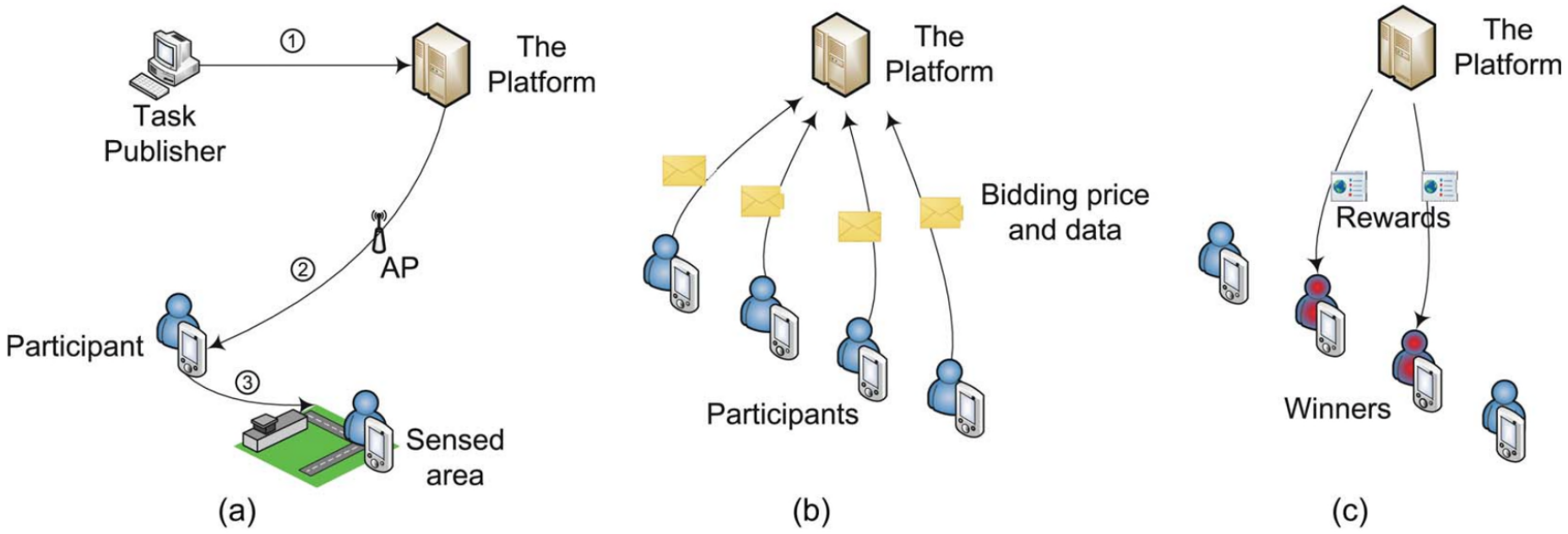


A Data Market

- What factors affect “data price”?

Reverse Auction-based Approaches

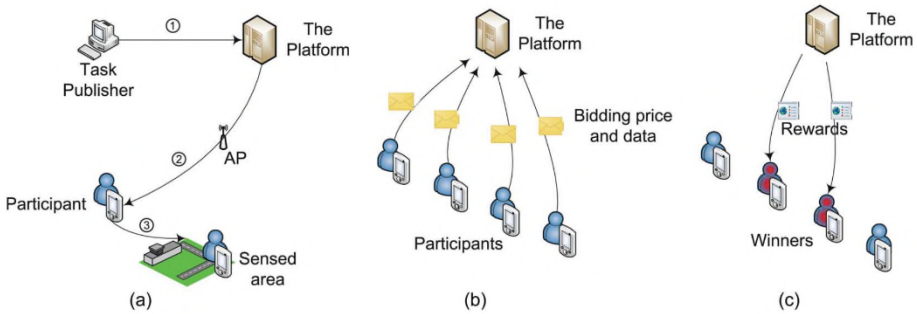
- Users send bids. Platform selects winners.



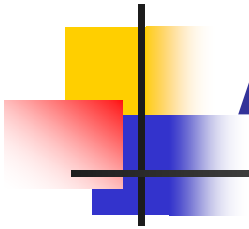
- Problems with this mechanism?

Reverse Auction-based Approaches

- Users send bids. Platform selects winners.
  - Retention: Participants with a higher data price will "starve" (and might stop participating).
  - Truthfulness: Does the mechanism ensure that bidding your actual cost produces profit?
  - "Winner" takes all. Others lose time and effort.
  - Ignores data quality

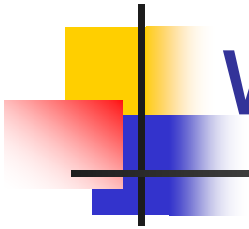


Reverse Auction-based Approaches



- Users send bids. Platform selects winners.
  - Retention: Participants with a higher data price will "starve" (and might stop participating).
    - Give virtual credit for losing. Subtract virtual credit from bid price (RADP-VPC)
  - Truthfulness: Does the mechanism ensure that bidding your actual cost produces profit?
    - Give participant highest price that could win auction (MSensing)
  - "Winner" takes all. Others lose time and effort.
    - Reward top-K for participation
  - Ignores data quality
    - Multi-attribute auction

What if Bids Arrive Dynamically with Short "Deadlines"?



- Dilemma: Buy now or wait for more bids?
  - When do you know that you found the "best price" when the price distribution is unknown?

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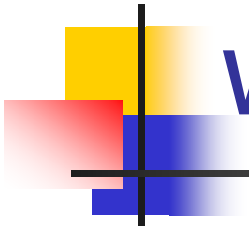

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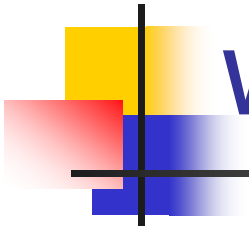

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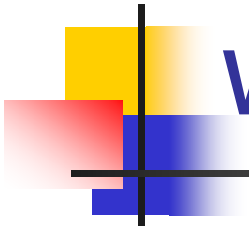

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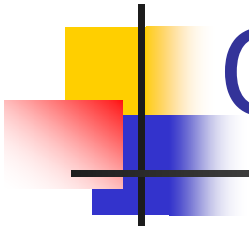
  - Answer: Look at the first N bids to compute a threshold (e.g., 90th percentile) then select the first future bidder to improve on it.
- Problems:
  - First N bidders get nothing
  - Memoryless: Could use results of previous tasks

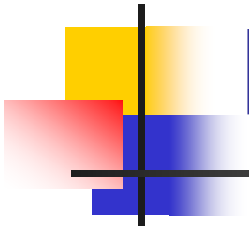
Other Selection Considerations?

- Besides cost bids, what else would you consider in participant selection?



Other Selection Considerations?

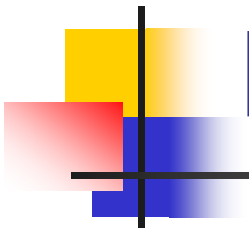
- Besides cost bids, what else would you consider in participant selection?
  - Data quality
  - Distance from point-of-interest
  - Reputation/reliability
  - Agreement with other data
  - Effort/size



Recruitment incentives

- Participants are paid for their data and (a fraction of) data of those they recruited

Experiment: Finding 10 Red Balloons in the Continental US

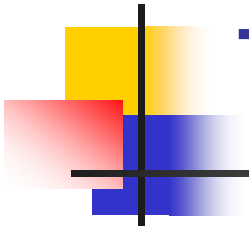


- You have $40,000 and about 4,000 volunteers. How to incentivize them to find 10 red balloons placed in arbitrary locations in the continental US?

Experiment: Finding 10 Red Balloons in the Continental US

- Winning team (MIT):
  - Completed the competition in (less than) 9 hours
  - Incentives: $4,000 to each of the 10 balloons.
    - $2,000 per balloon to the first person to send in the correct balloon coordinates.
    - $1,000 was pledged to whoever told the balloon-finder about MIT's reward.
    - $500 to whoever told that teller about the reward.
    - $250 to whoever told that taller, and so on.

    In this way, volunteers were both motivated to recruit others and to keep an eye out for the targets.



Truth Incentives

- TruCentive: Participatory platform for sharing parking availability:
  - If you advertise a free parking spot and someone "buys" it, they pay you a reward D
  - If someone confirms having successfully parked there, you get extra credit, X
  - If they were not able to park successfully, they get a refund, R
  - If they parked, they can later "sell" their slot for credit.
- How to set up the different credits and to discourage people from gaming the system?

Gamification Example: Paragliding

- Paragliders used to collect atmospheric data
- Navigation devices recorded flight GPS data and other sensory measurements
- Paragliders were ranked based on way points they visited (and noted for visiting never-previously-visited waypoints)
- "Competition" among paragliders (for fun) resulted in more data collection and better coverage

Intrinsic Incentives

- Fitbit/activity monitoring, weight-loss, etc.
- Idea:
  - Allow users to set milestones and measure their progress towards them to keep them motivated

Incentive Schemes