Selected Challenges in Multi-attribute Procurement

1. Simplify the Principal's Articulation of Preferences with Yardstick Prices
2. Addressing the Insider Threat with Secure Multiparty Computation

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The Procurement Setting

- Procurement of a commodity described by:
  - One total price (x)
  - Multiple attributes (y)

- The players
  - N sellers submit multi-attribute offers
  - The Principal selects a single winner

- A simple case:
  - Wired Ethernet Service
  - x = price
  - y = Mbit/s

Asymmetric Information

Agents (the sellers)

- Agents possibilities are private information

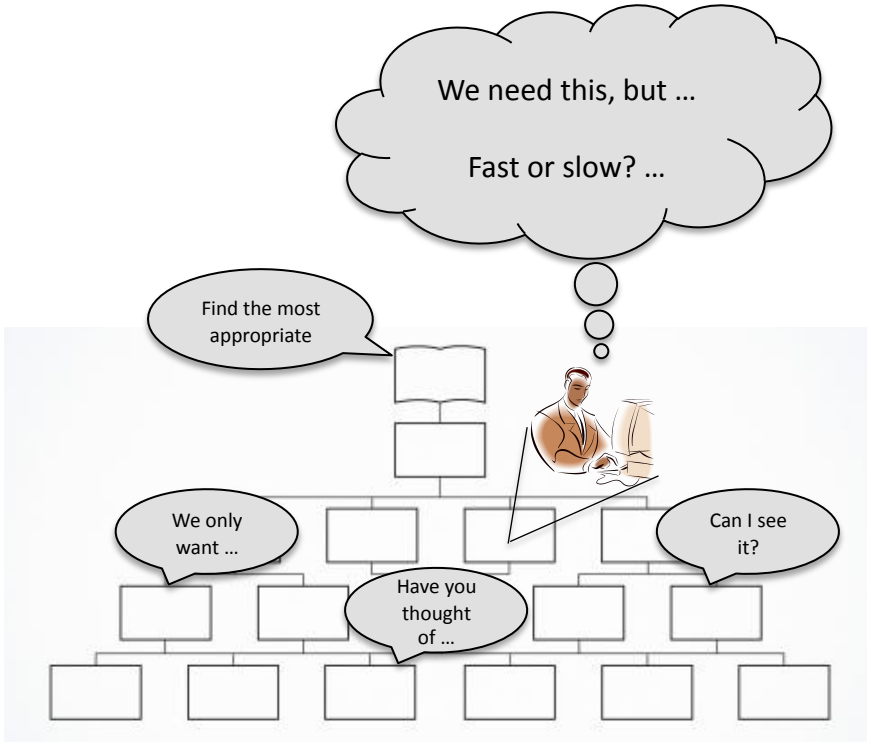
Principal (the buyer)

- Principal's preferences are private information

Principal's Preferences

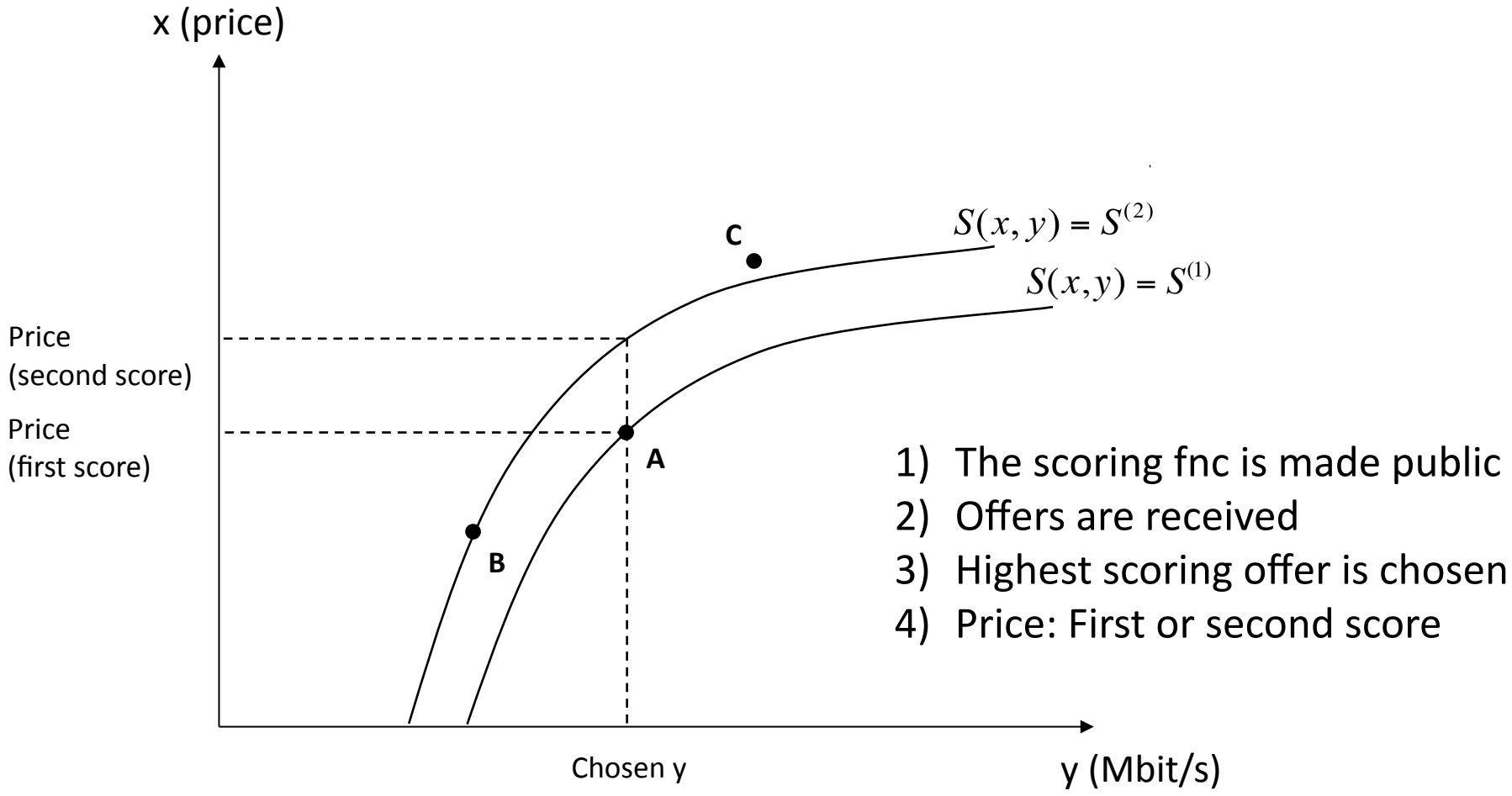
Intrapersonal conflict

Interpersonal conflicts



In either case it is **costly** to state proper preferences

The Traditional Score Auctions



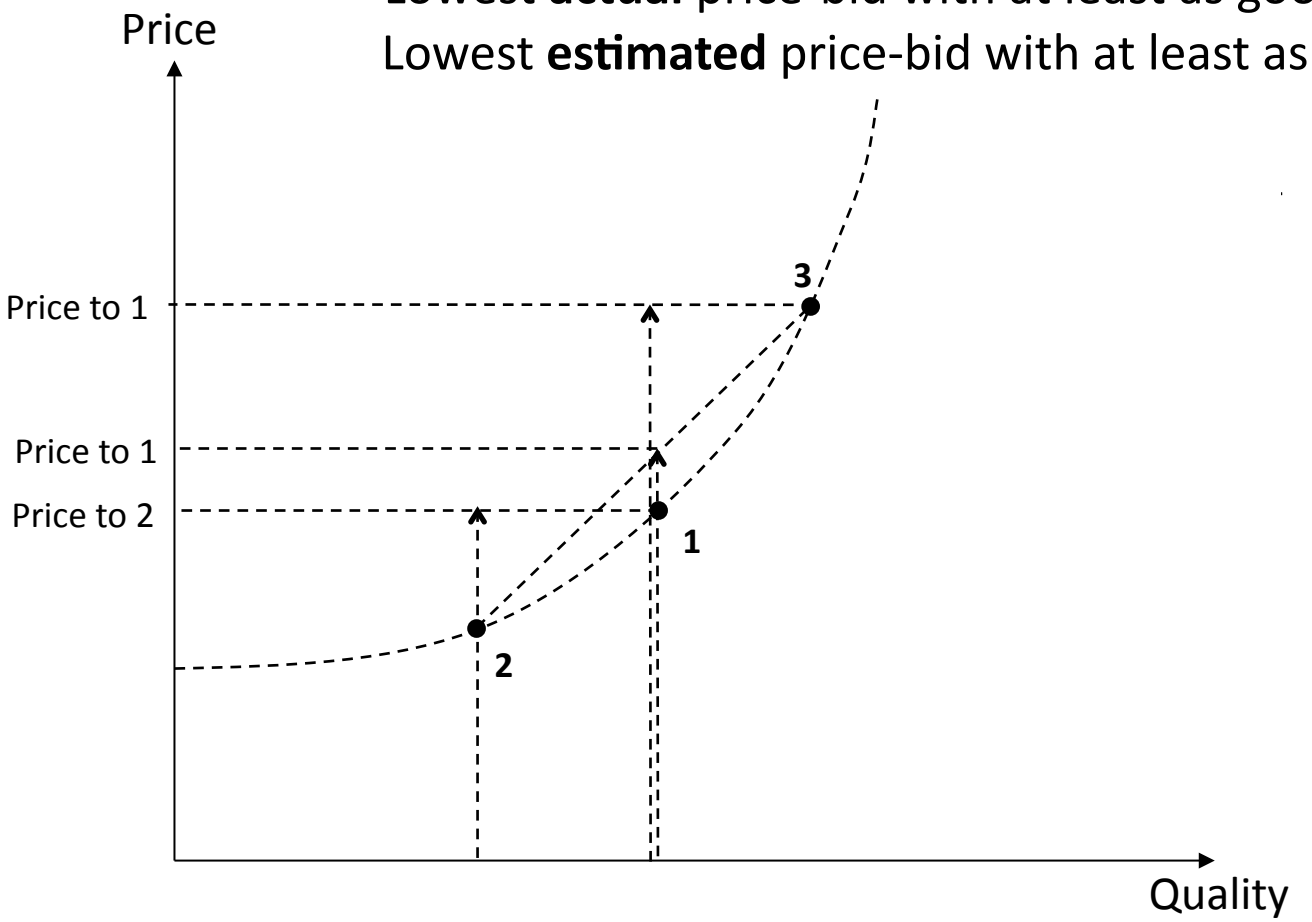
1) The scoring fnc is made public
2) Offers are received
3) Highest scoring offer is chosen
4) Price: First or second score

(For more see e.g. Che 1993)

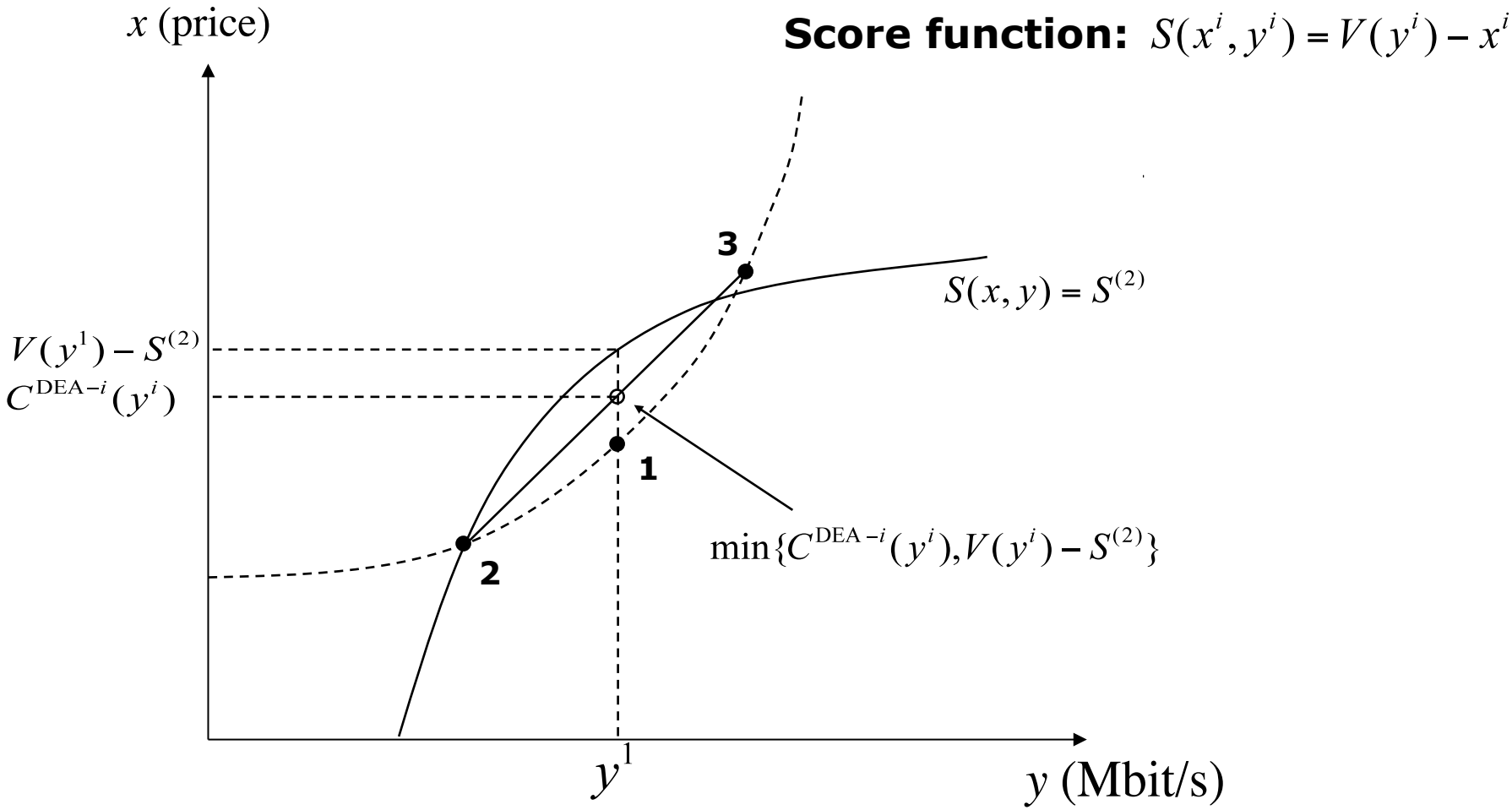
Introduce Yardstick Prices

Lowest **actual** price-bid with at least as good quality

Lowest **estimated** price-bid with at least as good quality



… And Get It Cheaper



(For more see Bogetoft and Nielsen 2008)

To make it simple for the Principal …

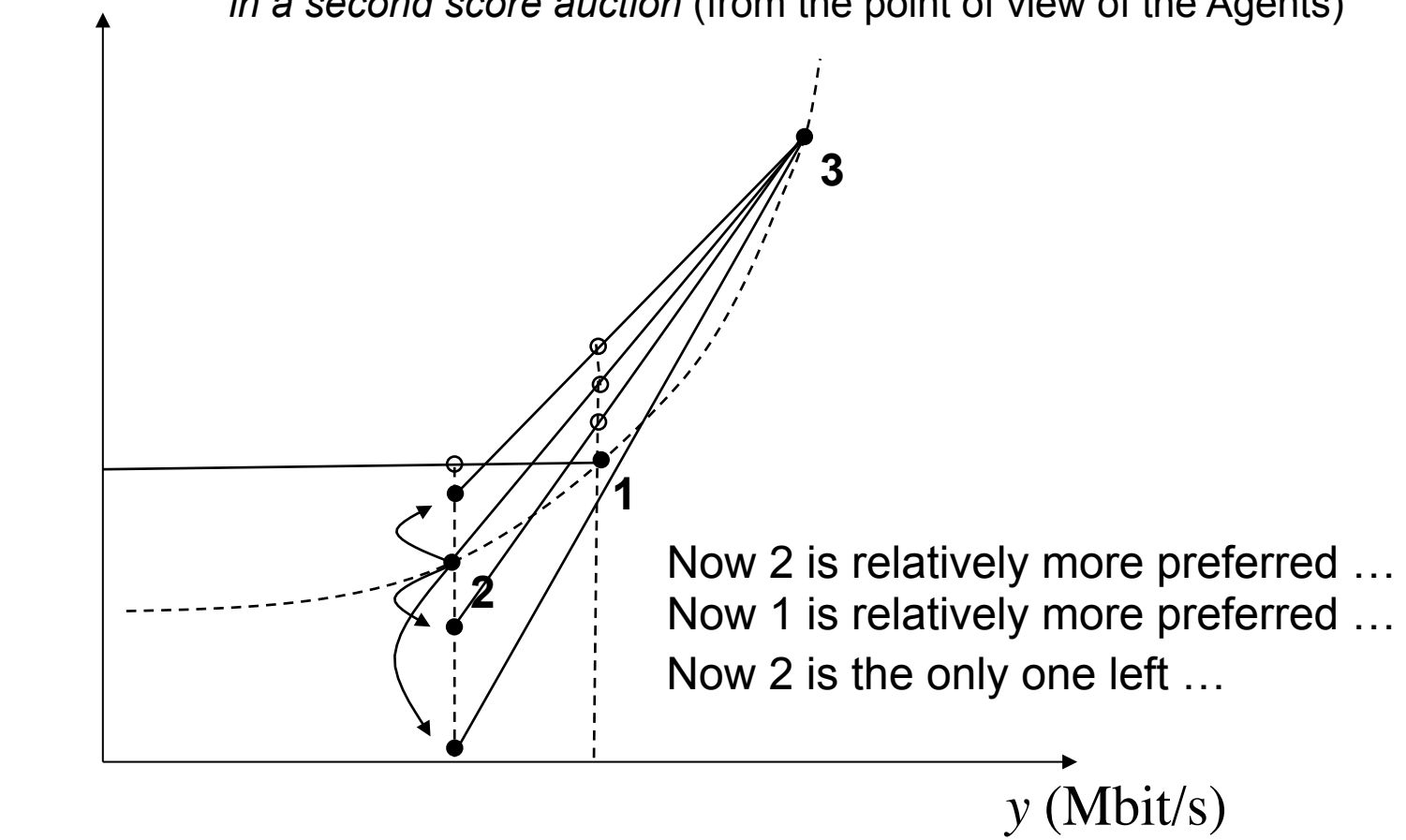
POSTPONE THE SCORING

No Preferences only Yardstick Prices

Some strategic deviations from truth-telling

Equivalent to:

The Principal commits to select the most preferred linear scoring function in a second score auction (from the point of view of the Agents)



On Limiting the Strategic Bidding

- Improve actual or believed representation of the "possibility set":
  - High participation rate, multiple bids per bidder, multiple Principals (exchange)
- Mechanism design:
  - Yardstick Clock auction
  - Endogenous scoring (next slide)

Endogenous Scoring

On making it simple for the Principal

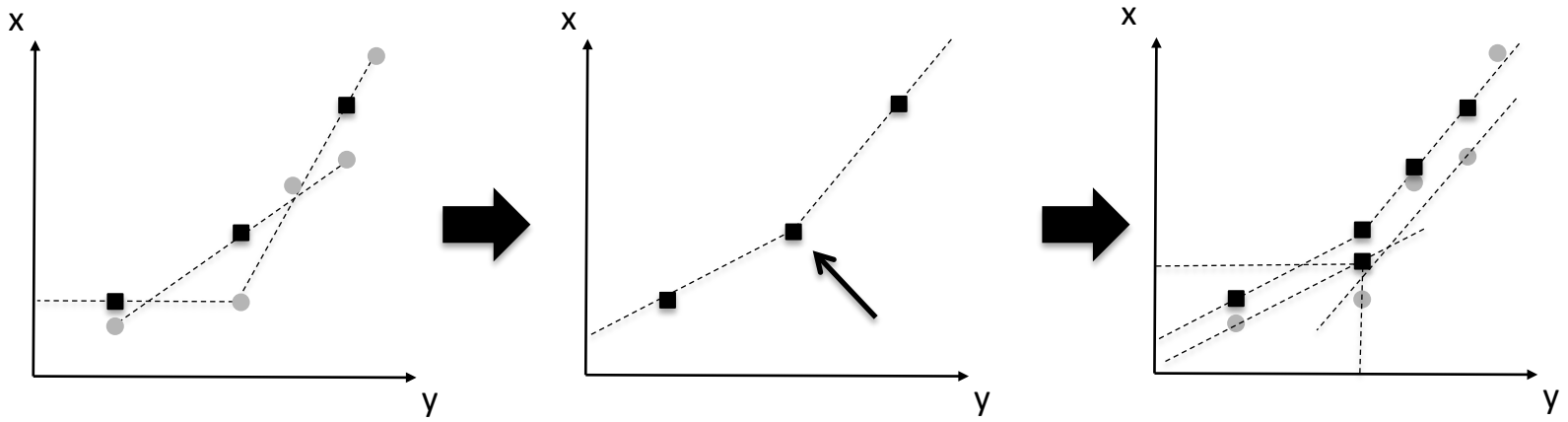
Work in progress

- Revelation and estimation of linear scoring functions
- Second score with multiple scoring functions

1. Computing yardstick bids

2. The Principal's choice (*k* linear scoring fnc)

3. Scoring and Pricing (one or more winning bid)



The Economics of Corruption with Secure Multiparty Computation

ADDRESSING THE INSIDER TREATH

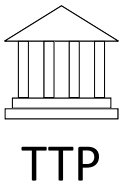
The Insider Threat

- Cost of corruption: $200 billion in public procurement alone (World Bank 2004)
- New Airport in Berlin: Winner had knowledge of second best bid

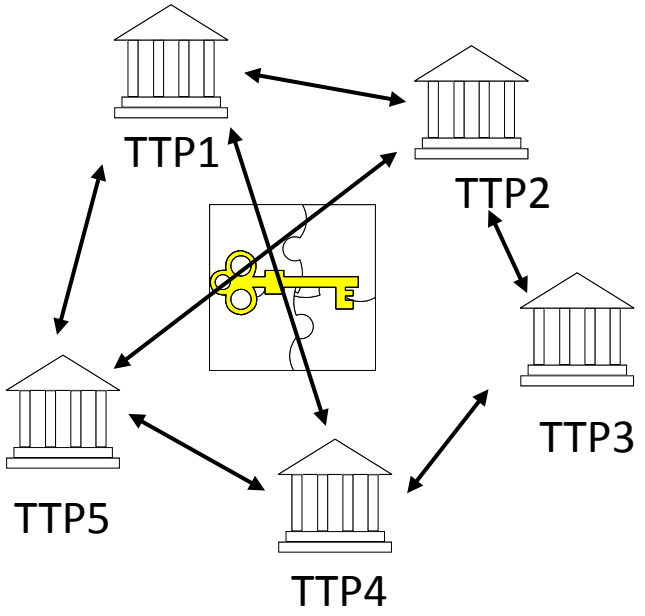
On How to Split the Key

When Using Secure Multiparty Computation

- Traditional trust
  - Trust in a single organization or person

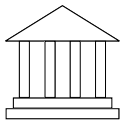


- Secure Multiparty Computation
  1. **Majority required**
  2. **All required**



Majority Trust and Deviation

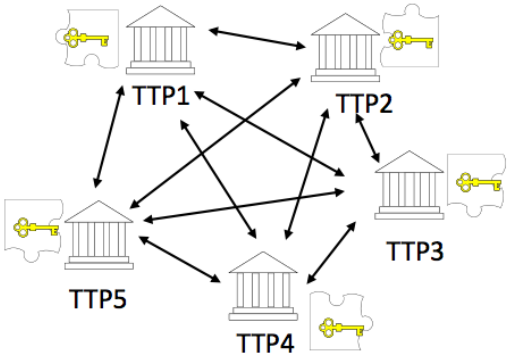
- Gain 15 for a honest TTP job



TTP

Counteract by:
- Less costly
- Scalable

- Gain 15 for a honest TTP job
- Getting 3 each



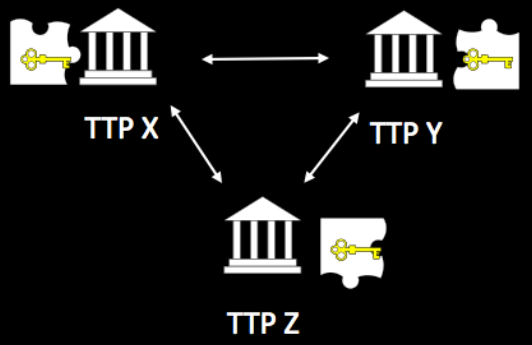
Any 3

- Gain 10 from collusive behavior

TTP

Counteract by:
- Coordination
- Choice of TTPs

- Gain 10 from collusive behavior
- Getting 3 1/3 each



All Shares Required: No Trust in Others

Caveat: All have the last share of the key

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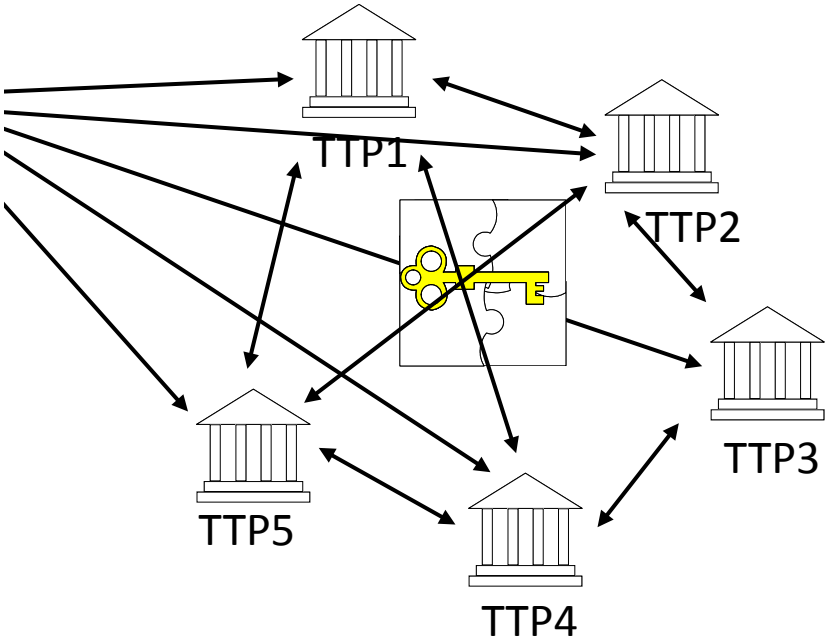
Halpern and Teague (2004): No one is submitting their share.
They all play on getting private access to the sealed information

Number of papers relax this problem of lack of cooperation in repeated games …



result

CONCLUDING REMARKS

Concluding Remarks

Two CFEM research agendas:

1. Procurement mechanisms based on yardstick competition:
   - Postpone scoring
   - Looking for fully incentive compatible solutions
   - Have reasonable solutions that limit strategic bidding
2. Applying Secure multiparty computation:
   - More on the economics of corruption with secure multiparty computation
   - More efficient computations (including LP solvers)

QUESTIONS?