Blockchains: Some Challenges for Economic Design

Jens Leth Hougaard

Center for Blockchains and Electronic Markets

Funded by the Carlsberg Foundation
## Who are we?

<table>
<thead>
<tr>
<th></th>
<th>KU</th>
<th>AU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lead</strong></td>
<td>Prof. Jens Leth Hougaard</td>
<td>Prof. Ivan Damgård</td>
</tr>
<tr>
<td><strong>Core staff</strong></td>
<td>Prof. Peter Norman Sørensen Ass. Prof. Kurt Nielsen</td>
<td>Prof. Jesper Buus Nielsen Ass. Prof. Claudio Orlandi</td>
</tr>
<tr>
<td><strong>Junior staff</strong></td>
<td>PhD student (not named) Post doc (Jens Gudmundsson) Post doc (not named)</td>
<td>PhD student (not named) Post doc (not named) Post doc (not named)</td>
</tr>
<tr>
<td>(directly funded by BCM)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Overview of BCMs research agenda and methodology:
The Ledger - keeping track of transactions:

Traditionally, a trusted third party validates the ledger.
- think of MobilePay

A decentralized network uses a consensus mechanism.

• Proof-of-Work, Proof-of-Stake, or something else?

• Security: a main issue in computer science.
The Ledger: some focus areas of economic design.

How are miners incentivized to authorize blocks?

• Can incentives be optimized through appropriate design of the reward scheme? (Hougaard, Moreno-Ternero, Østerdal, 2019)

• Does PoW provide incentives to maintain a single “longest” chain, or can forks occur in equilibrium?

• The longest chain is a Markov perfect equilibrium in a stochastic game played by the miners, but there also exist equilibria where forks occur (Biais et al, 2019)

• Allocation issues: to mine a block is like winning a lottery. How can miners smoothen out their income?

• Reallocation in mining pools – how do we provide incentives to share the reward?
  • Centralized vs. Decentralized mining pools
Smart Contracts and Apps - guiding economic interaction:

• To what extent can decentralized mechanisms replace the functions of traditional firms and organizations?

• Example: [https://covee.network](https://covee.network) – decentralized self-organizing teams.

• Staking mechanisms ensure coordination and motivation along with a mechanism that distributes the common revenue among network members based on relative evaluations of the others performance (strategy-proof but not group strategy-proof!)
Smart Contracts and Apps cont’:

• Designing market platforms (typically for computational agents).
  • Economists have recently gained experience with market design (Roth and others)
  • “On-line” auction and matching mechanisms.
  • “On-line” allocation rules.
  • The assumptions of Game Theory fit well with computational agents!

• Operational issues (mechanisms should be able to run in practice) – how does that influence/restrict mechanism design?
Privacy Measures - making sure private information stays private

• Privacy measures make computations heavy:
• To what extent can we minimize the use of private information in mechanism design while maintaining certain market functionalities and characteristics of the market outcome: like efficiency, stability, fairness, etc?
Conclusion

• Lots of challenges liking Economics and Computer Science.

• Bright future for Economic Design - hereby also the tools of game theory/mechanism design.

Thanks!