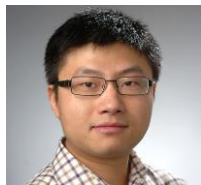
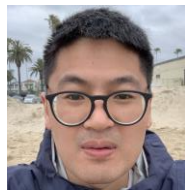


Ethical Challenges in Blockchain Network Measurement Research



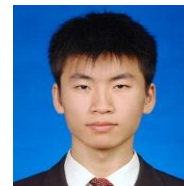
Yuzhe Tang



Kai Li



Yibo Wang






Jiaqi Chen

Outline

- Introduction
- Case Studies
- Open Challenges
- Conclusion

Introduction: Why Measure BKC?

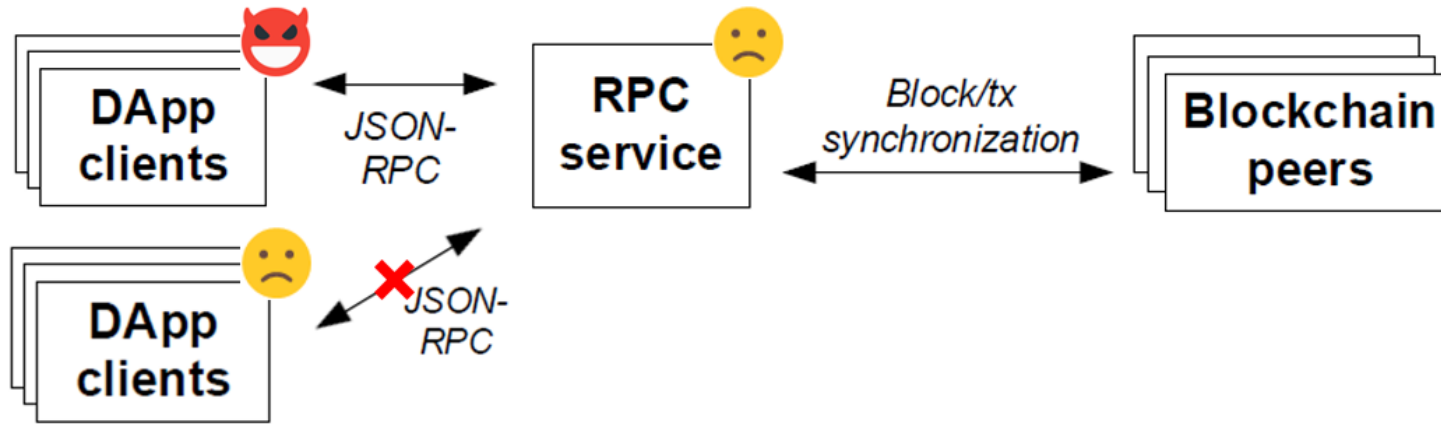
- Cryptocurrency a trillion-\$ business
- Info. transparency by design
- Many measurement studies on BKC nets

# ▲	Name	Price	Market Cap ⓘ
1	 Bitcoin BTC Buy	\$23,801.33	\$459,378,032,721
2	 Ethereum ETH Buy	\$1,648.88	\$201,779,859,162
3	 Tether USDT	\$1.00	\$70,697,935,453

Introduction: Ethical Challenges

- Blockchain networks: mainnet and testnet.
- mainnet is preferable measurement target
 - holds the ground truth of deployment features.
 - but proactively measuring mainnet poses ethical concerns.
- RQ: How should researchers conduct ethical measurement of blockchain networks?

Case 1: RPC Exploitability [NDSS21]



- Running smart contract for free on RPC service nodes.
- Measuring the exploitability of deployed RPC services on the Ethereum mainnet.

Case 1: RPC Exploitability

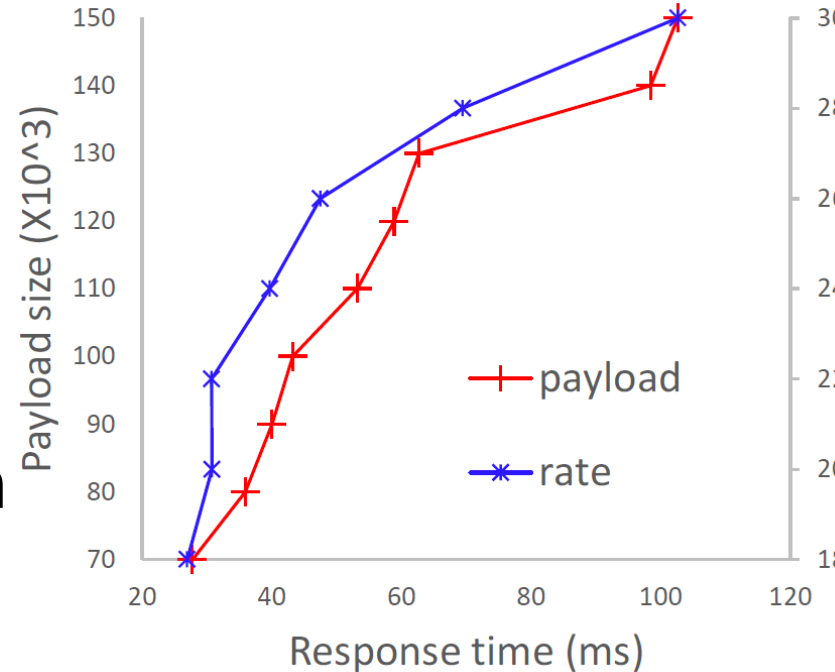
Dilemma: Scientific value vs ethical concerns

- Exploitability is deployment-specific feature
 - Load balancing on mainnet differs that in testnet
 - Has to be measured on mainnet
- RPC services run by small-business/startups
 - Lacking protection or bug bounty program
 - Even light measurement cause service interference

Case 1: RPC Exploitability

Ethical measurement strategies:

- Measure the trend (at low impacts), not the absolute value of the impacts.
- low impacts: Limit duration and payload size.



Case 2: ETH network topology [IMC'21]

- Goal: Uncover ETH network topology
 - Learn resilience to single-point failure
- Method: Active measurement methods by sending many txs/observing feedbacks
- Ethical concerns:
 - Interfere tx propagation on target nodes measured.
 - Topology may leak privacy/sensitive info.

Case 2: ETH network topology [IMC'21]

- Solution 1:
 - Avoid measuring entire networks in mainnet (costly).
 - Select a 18-node subnet in mainnet to measure.
 - 18 critical nodes serving top mining pools and RPC
- Solution 2:
 - Open-source datasets with anonymization.
 - Did not open-source measurement code.

Ethical Challenges: Common Practices

- Timely report of bugs to service operators.



...

- Get engaged in active conversation.
- Remove identifiable info. in publication to protect the service's reputation.

Ethical Challenges: Lack Guidelines

- Lack awareness or guidelines for handling ethical issues.
- Publications may intentionally hide the details on ethical issues.

Ethical Challenges: Dilemma to Request Approval

- Ethical measurement entails request of approval ahead of time.
- Service provider of no incentive to approve the request.
- Researcher lacks a clear mind on what and how to measure.

Ethical Challenges: Effectiveness of IRB

- No IRB in the researcher's institutions.
- Researchers unaware of IRB.
- IRB has no technical knowledge needed;
 - Need to educate IRB on technical terms.

Ethical Challenges: Limited Support for Bug Reporting

- Most BKC services are operated by small businesses.
- Leading BKC clients have bug bounty program, while smaller ones have no support..

	Geth	OpenEth	Besu	Nethermind
Private bug reporting	Yes	Yes	No	No
Responsiveness (days)	2	1	N/A	N/A
Bounty	Yes	Yes	No	No
Fix	Yes	No	No	No
Deployment in mainnet	83%	15%	1.5%	0.5%

Ethical Challenges: Responsible Result Release

- Releasing results may raise concerns, e.g., privacy leakage.
- Even anonymization measures are taken, sensitive information may still be recovered from the publications?
 - e.g., a small anonymity set of only 9 RPC services in the DoERS work [NDSS'21]

References

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- *Youngseok Yang, Taesoo Kim, Byung-Gon Chun, Finding Consensus Bugs in Ethereum via Multi-transaction Differential Fuzzing, **OSDI 2021***

Conclusion & Q/A?



Yuzhe Tang

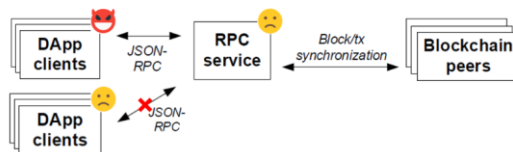
ytang100@syr.edu

Introduction: Ethical Challenges

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