DISTRIBUTED VERIFICATION OF SMART CONTRACTS

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BLOCKCHAIN

Cryptocurrencies—steady increase
Based on two technologies:

- Blockchain
- Distributed consensus protocol

Main appeal: no trusted central authority

Bitcoin: send money from A to B
Ethereum: smart contracts (Turing-complete language)

TheDAO Hack: June 2016, $60M lost

DISTRIBUTED PROOF MARKET

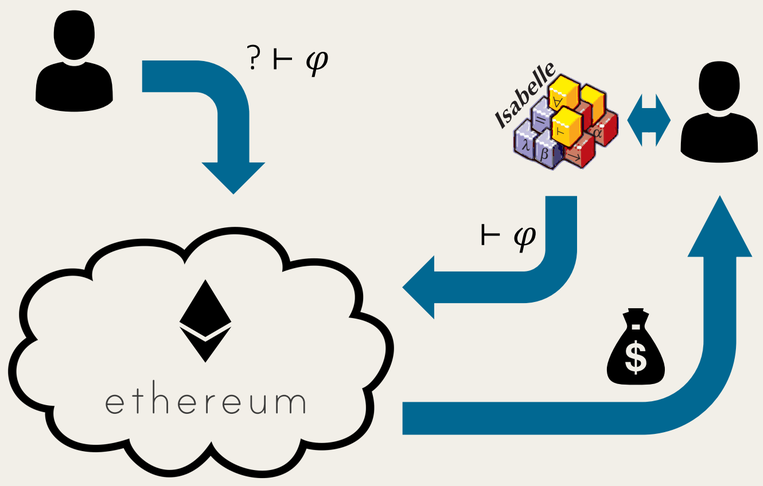
Writing proofs is difficult
Flyspeck:

- 500k lines of proofs
- 20 person-years

A lot of energy needed for:

- Finding manpower
- Organizing manpower

Solution: proof market
Makes sense only if decentralized
➔ smart contracts



CONTRACTS VERIFICATION

Contract in Isabelle/HOL
(shallow embedding)

Prove high-level properties
(“clients can’t loose money”)

Refine to a low-level specification
(Refinement Framework)

Prove low-level properties
(“the stack can’t overflow”)

Ethereum bytecode
(deep embedding)

The contract = simple proof checker
+ commitment scheme

Metamath’s proof checker:

- 300 lines in Python
- 20k top level lemmas = 100M string operations
- Ethereum (2015) = $20k
- Ethereum (2017) = $2M

Previous work: ProofMarket, Mathgate, Qeditas

DISTRIBUTED VERIFICATION

Useful when we combine distributed proof market and smart contracts verification

Synergy between these two technologies can foster their further development

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