Open Infrastructure for Edge: A Distributed Ledger Outlook

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How Will Edge Get Deployed?

• “Edge” = “edge for shared or general purpose computing”
• Private edge deployments for specific purposes not relevant for us

Spectrum of edge deployments

Small number of large providers (like cloud today)  Large number of small providers (our focus)
Motivation: An Open Infrastructure for Edge

• Where will the edge servers come from?
• Anyone should be able to become an edge provider
• Set of common standards and practices for edge providers is required
• Solution for handling agreement and financial transactions
  • Large number of independent providers
  • Large number of clients/users

• Is a distributed ledger a possible choice? (our focus in this paper)
Why Distributed Ledgers for Edge?

• Widely used and popular, despite known issues
• In principle, they provide decentralized trust and transactions
  • Very interesting and useful for open edge
• Two key building blocks:
  • Smart contracts: Executable code
  • Ricardian contracts: Legal agreement in machine-readable tamper-proof form
• Ricardian triple: <prose, parameters, code>
  • Prose = Ricardian contract
  • Code = Smart contract
  • Parameters: This particular instance of the agreement
Requirements for Agreements in Open Edge

• Fast and cheap transactions
• Appropriate level of privacy and accountability
• Protection from volatility of crypto assets
• Conflict resolution and escrow service
• Legislation for digital agreement
• Environmentally sustainable operation
• True decentralization, no central authority
Energy consumption of Bitcoin and Ethereum, similar levels to Colombia or Portugal.

Smart Contract Platforms

• Ethereum has been the leader so far
  • Cons: high energy consumption (proof-of-work), low performance, high costs
  • Pros: truly distributed, backing community is largest (7000-20000 nodes)
  • Transition to greener proof-of-stake Casper protocol is expected

• Second generation of platforms
  • EOS, Stellar, Cardano, etc
  • Many use delegated proof-of-stake (DPoS), greener and faster
  • Some charge zero fee

• Decentralization vs. efficiency
  • DPoS is efficient, but its decentralization is often questioned (e.g., EOS)
Other Considerations

• Volatility protection
  • Stable coins, e.g., Tether, USD Coin, TrueUSD, backed by some institution
  • Buyer of the coin must trust the institution, no decentralization
  • Allegations, e.g., no real money backing Tether, no way to check

• Privacy
  • Blockchain is open by design
  • For business considerations, edge providers might want to conceal their prices
  • Systems like Zcash use zero knowledge proofs to store private data while keeping blockchain public
  • No smart contract system supporting privacy in convenient way so far
Takeaways

• No distributed ledger exists that would support everything that open infrastructure for edge ideally requires

• Common tradeoffs
  • Accountability vs. privacy
  • Efficiency and low costs vs. true decentralization
  • Volatility vs. Trusting a non-regulated institution

• Legal status of digital agreement will always be out of technical scope

• Energy wasteful PoW and low transaction throughput are likely to be tackled as proof-of-stake family of protocols take hold

• Interledgers unite diverse systems enabling interactions between participants using different ledgers

• Current developments are leading into a positive direction
Open Questions? Issues? Problems?

• Will there ever be a general-purpose edge?
• What form will it take?
  • Based on current cloud operators?
  • Based on independent edge providers?
• This paper: Thought experiment + requirement analysis for open edge
  • Main conclusion: Feasible, although needs more work
• Shared edge looks very likely
  • Shared = One application, many providers
  • Need: Standardized APIs, discovery, agreements
Thank you!

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