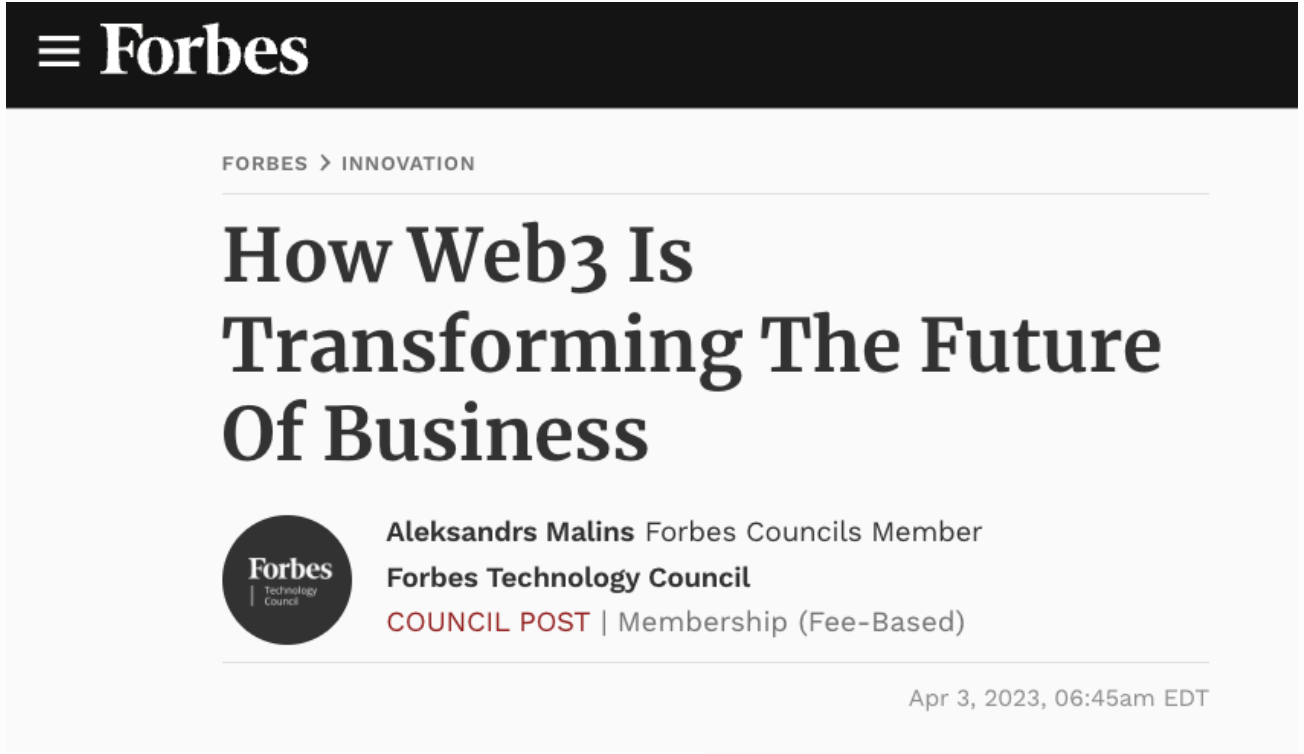
Blockchains and Decentralized Applications

Thierry Sans



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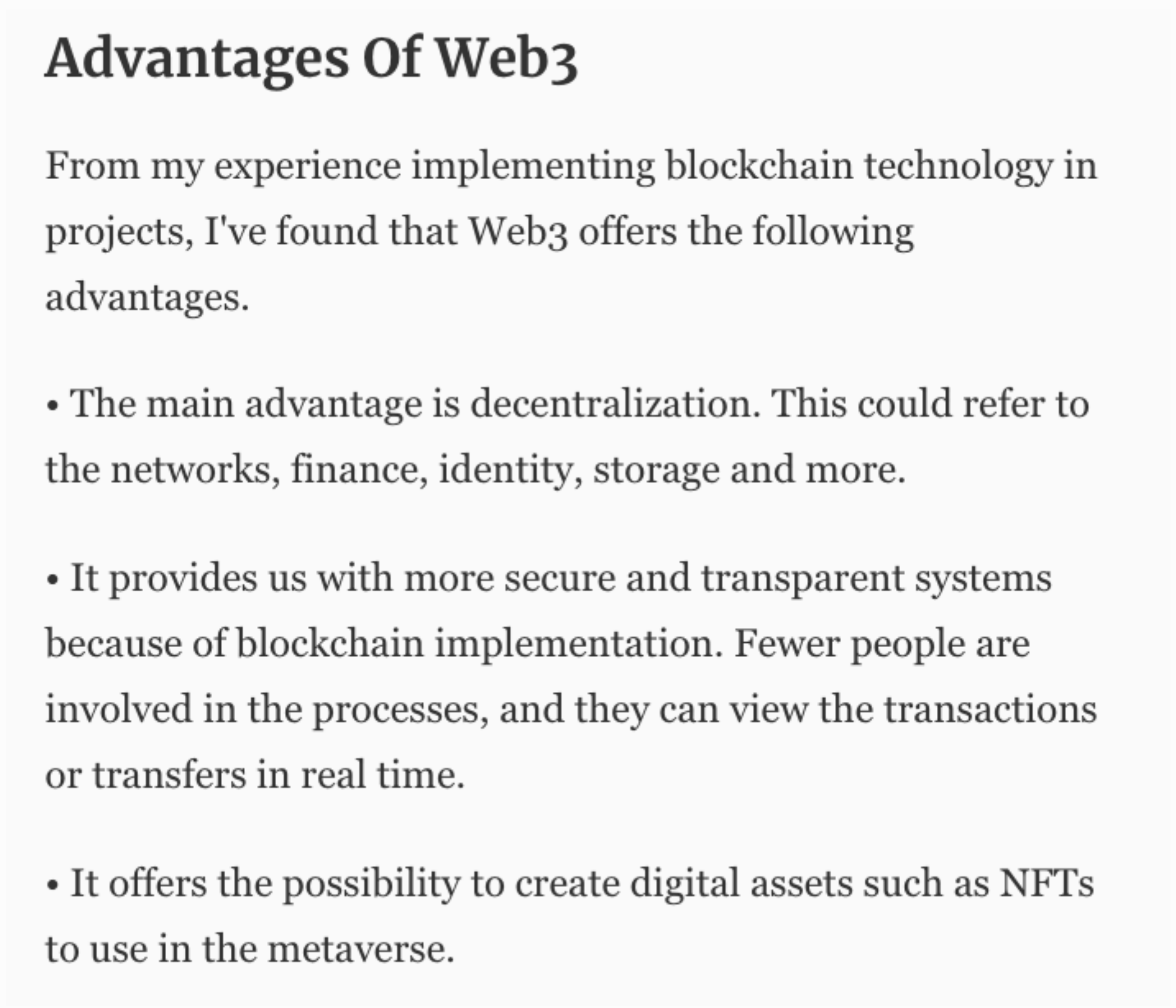
How Web3 Is Transforming The Future Of Business

Aleksandrs Malins Forbes Councils Member
Forbes Technology Council
COUNCIL POST | Membership (Fee-Based)

Apr 3, 2023, 06:45am EDT



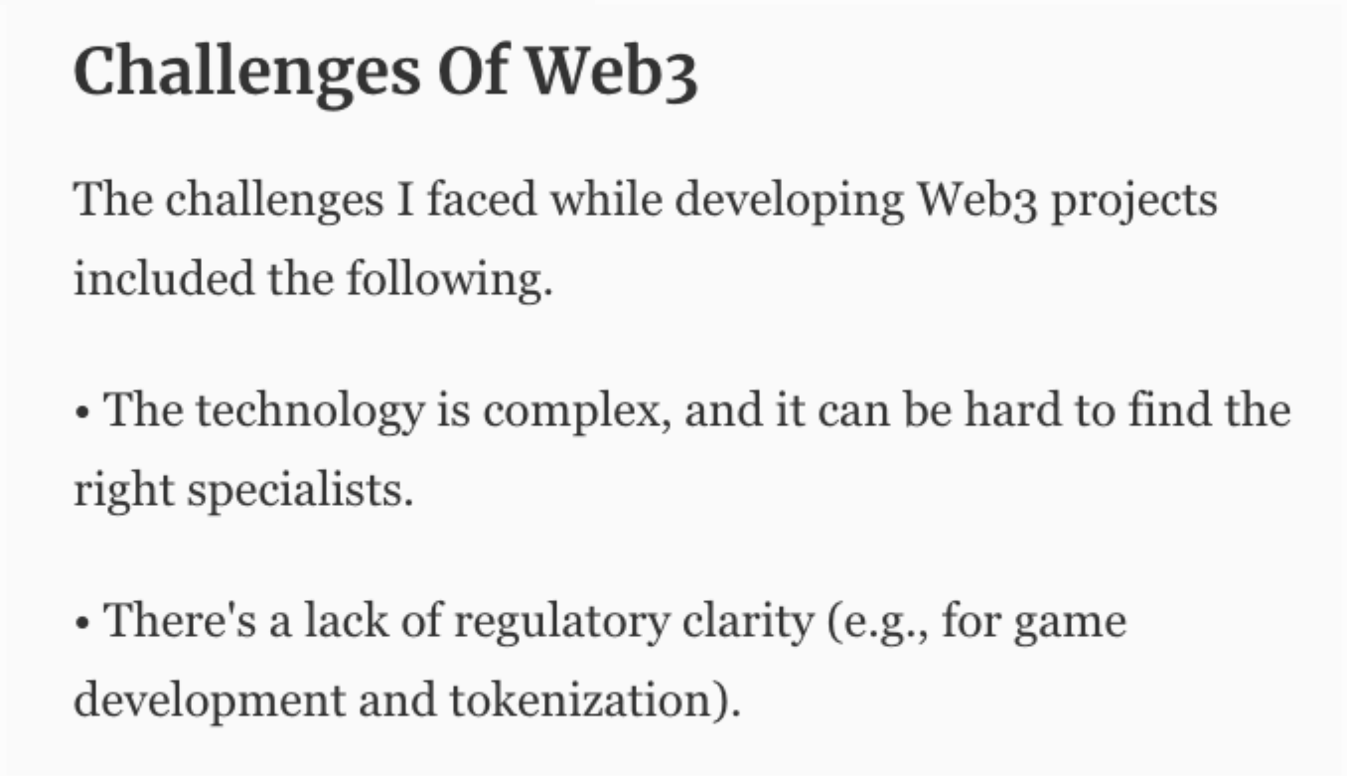
Advantages Of Web3

From my experience implementing blockchain technology in projects, I've found that Web3 offers the following advantages.

• The main advantage is decentralization. This could refer to the networks, finance, identity, storage and more.

• It provides us with more secure and transparent systems because of blockchain implementation. Fewer people are involved in the processes, and they can view the transactions or transfers in real time.

• It offers the possibility to create digital assets such as NFTs to use in the metaverse.

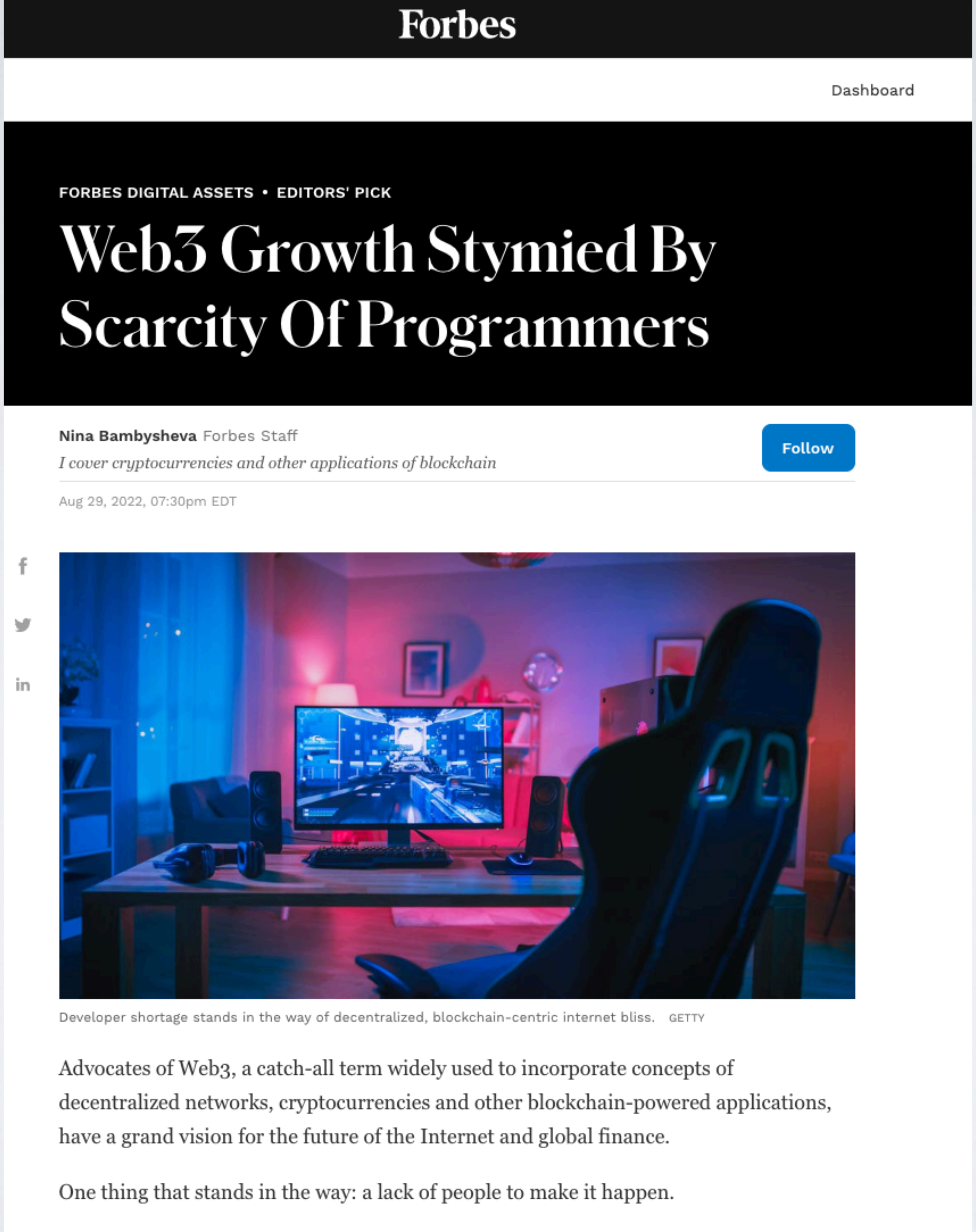


Challenges Of Web3

The challenges I faced while developing Web3 projects included the following.

• The technology is complex, and it can be hard to find the right specialists.

• There's a lack of regulatory clarity (e.g., for game development and tokenization).



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FORBES DIGITAL ASSETS • EDITORS' PICK

Web3 Growth Stymied By Scarcity Of Programmers

Nina Bambysheva Forbes Staff

I cover cryptocurrencies and other applications of blockchain

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Aug 29, 2022, 07:30pm EDT

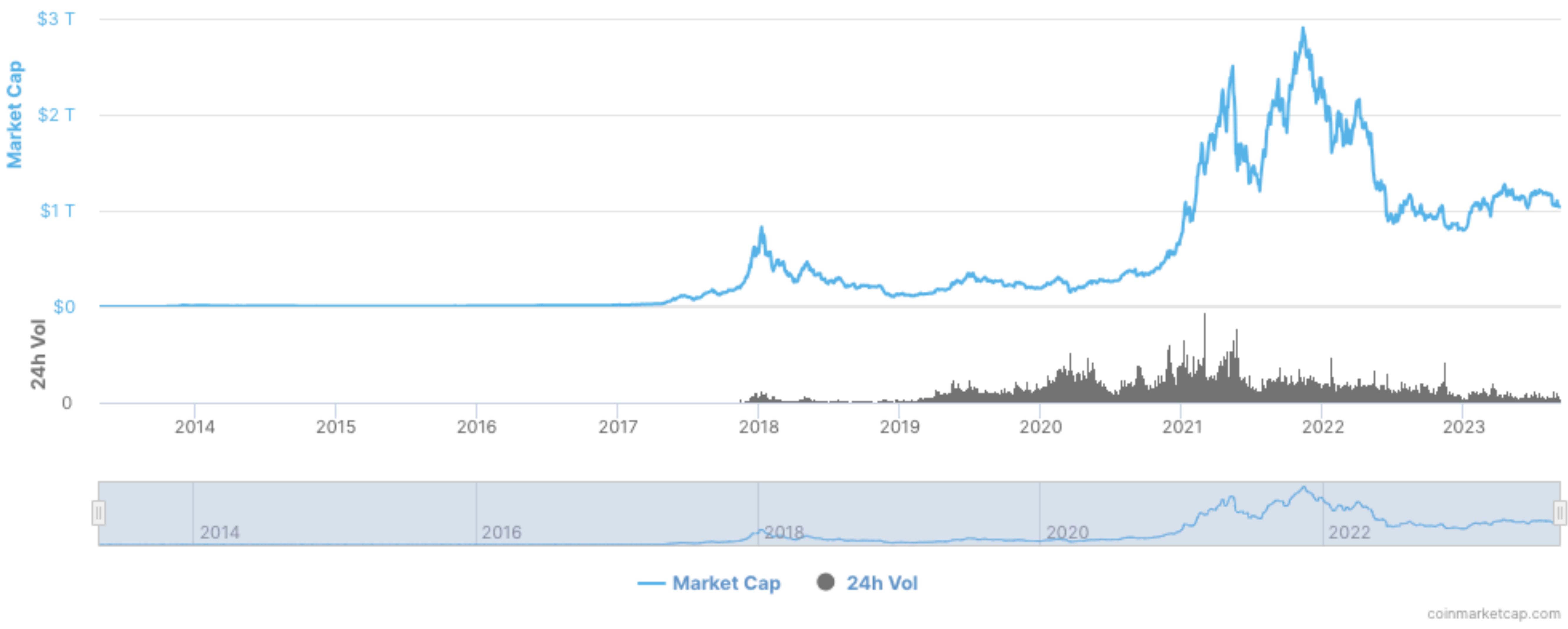
Developer shortage stands in the way of decentralized, blockchain-centric internet bliss. GETTY

Advocates of Web3, a catch-all term widely used to incorporate concepts of decentralized networks, cryptocurrencies and other blockchain-powered applications, have a grand vision for the future of the Internet and global finance.

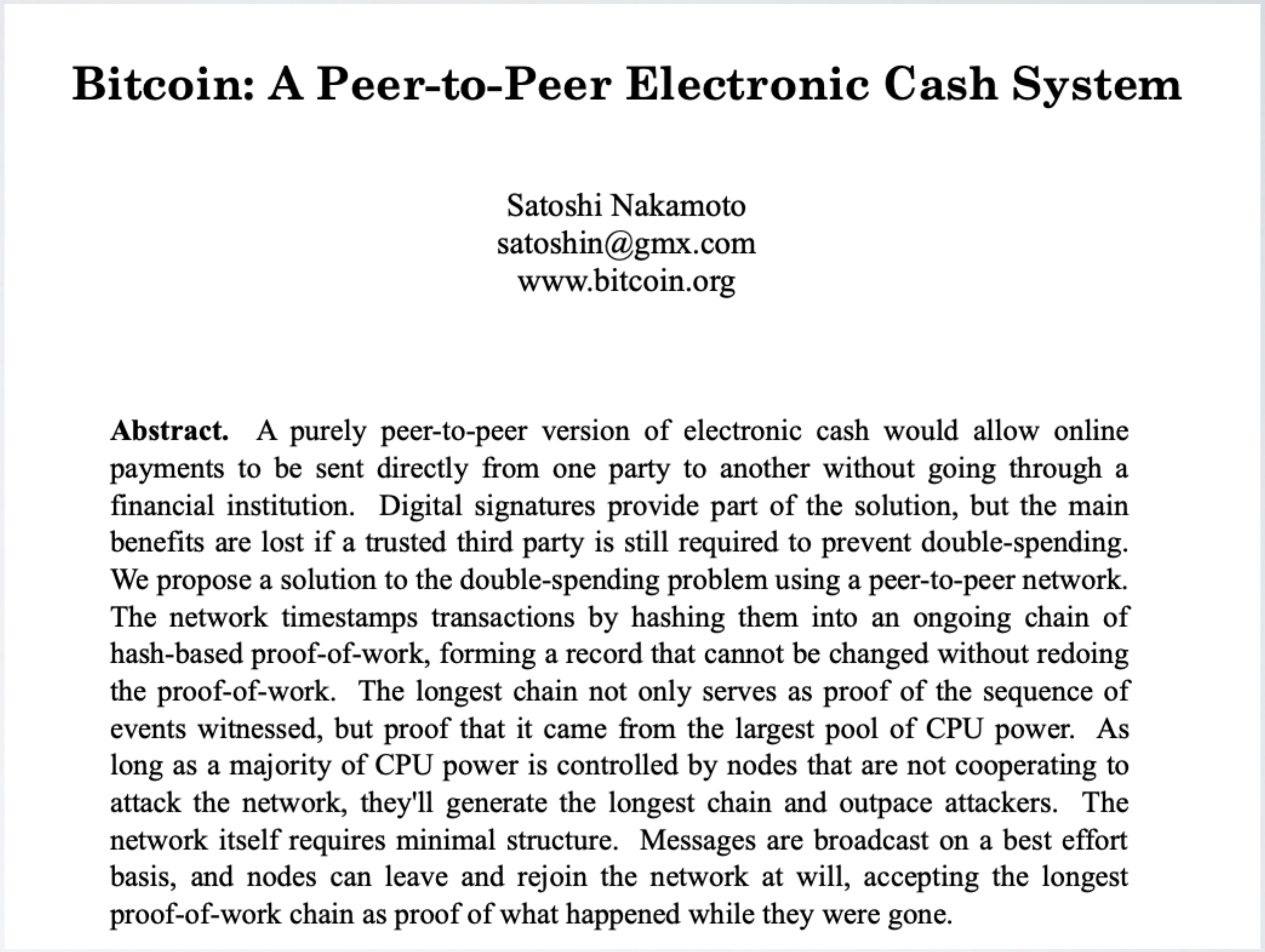
One thing that stands in the way: a lack of people to make it happen.

Cryptocurrencies

Total cryptocurrency market cap



The original Bitcoin paper (2008)



Bitcoin: A Peer-to-Peer Electronic Cash System

Satoshi Nakamoto
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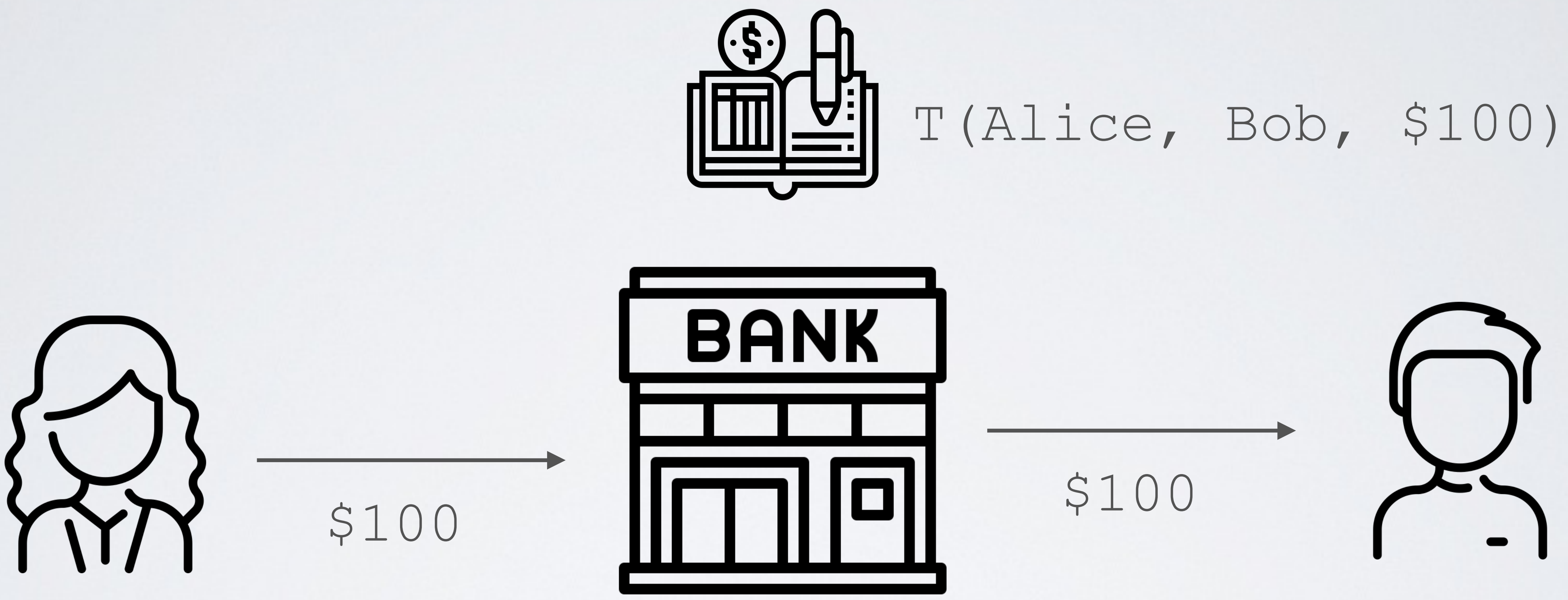
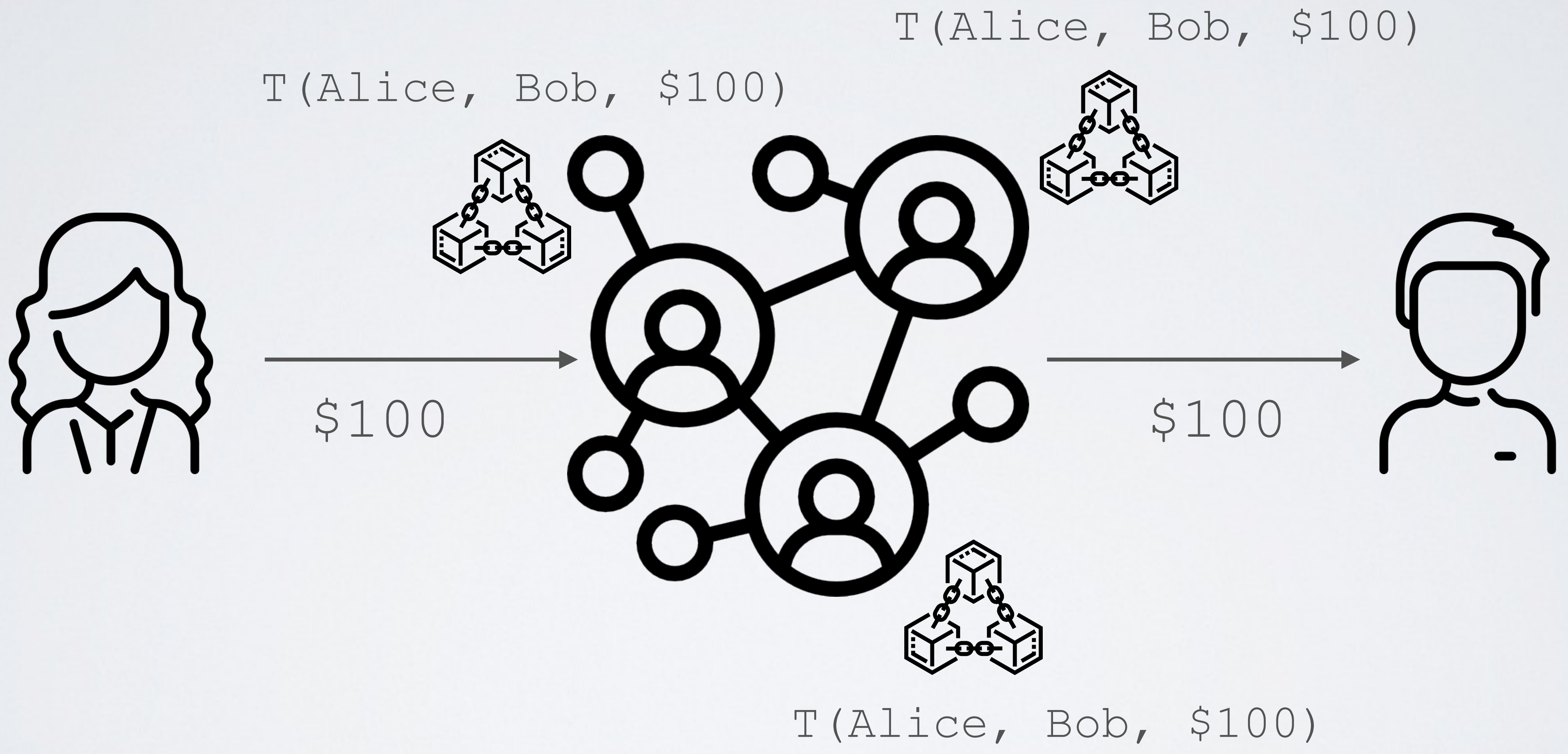
Abstract. A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of CPU power. As long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they'll generate the longest chain and outpace attackers. The network itself requires minimal structure. Messages are broadcast on a best effort basis, and nodes can leave and rejoin the network at will, accepting the longest proof-of-work chain as proof of what happened while they were gone.

A centralized ledger (Trusted Third Party)



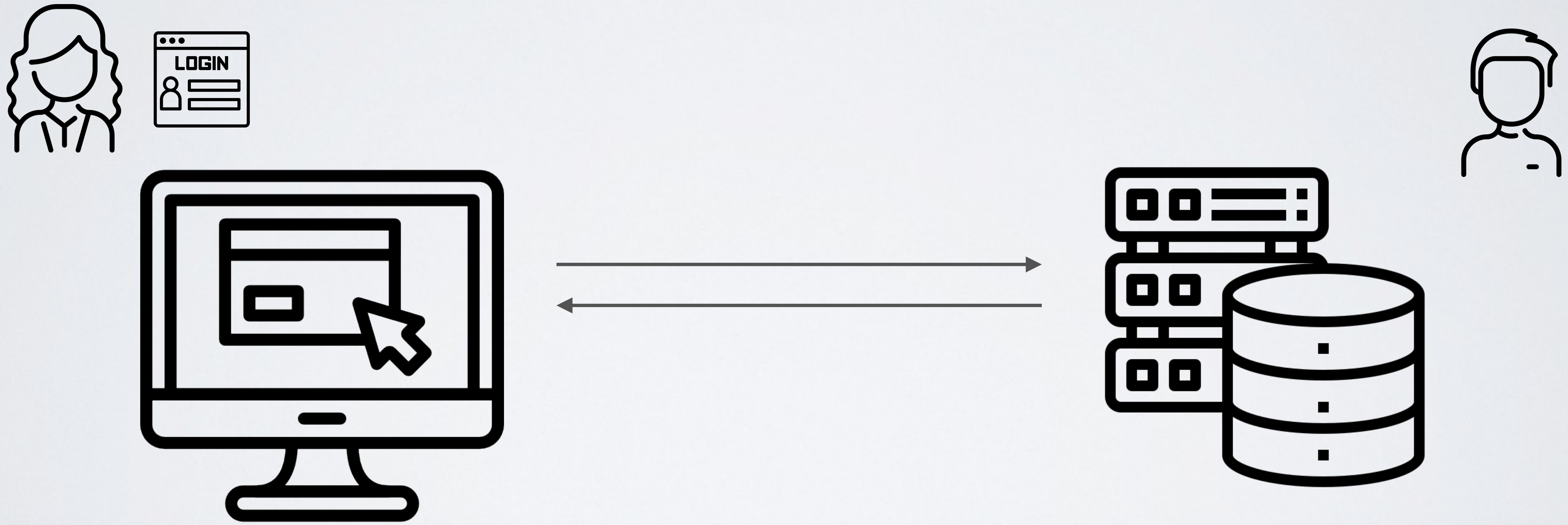
A decentralized ledger (Trustless)



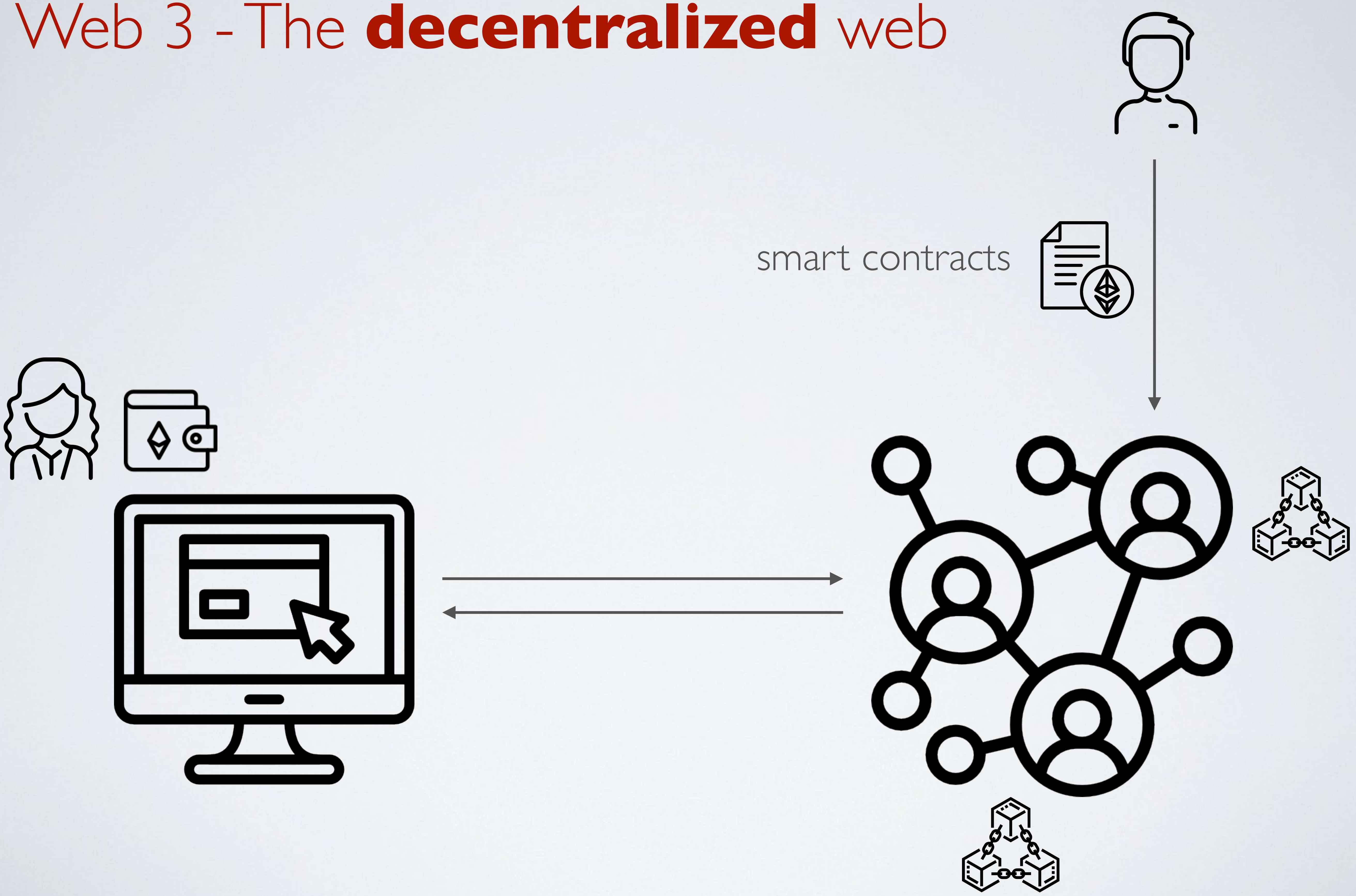
Beyond Cryptocurrencies

Towards Decentralized Applications

Web 2 - The centralized Web



Web 3 - The **decentralized** web



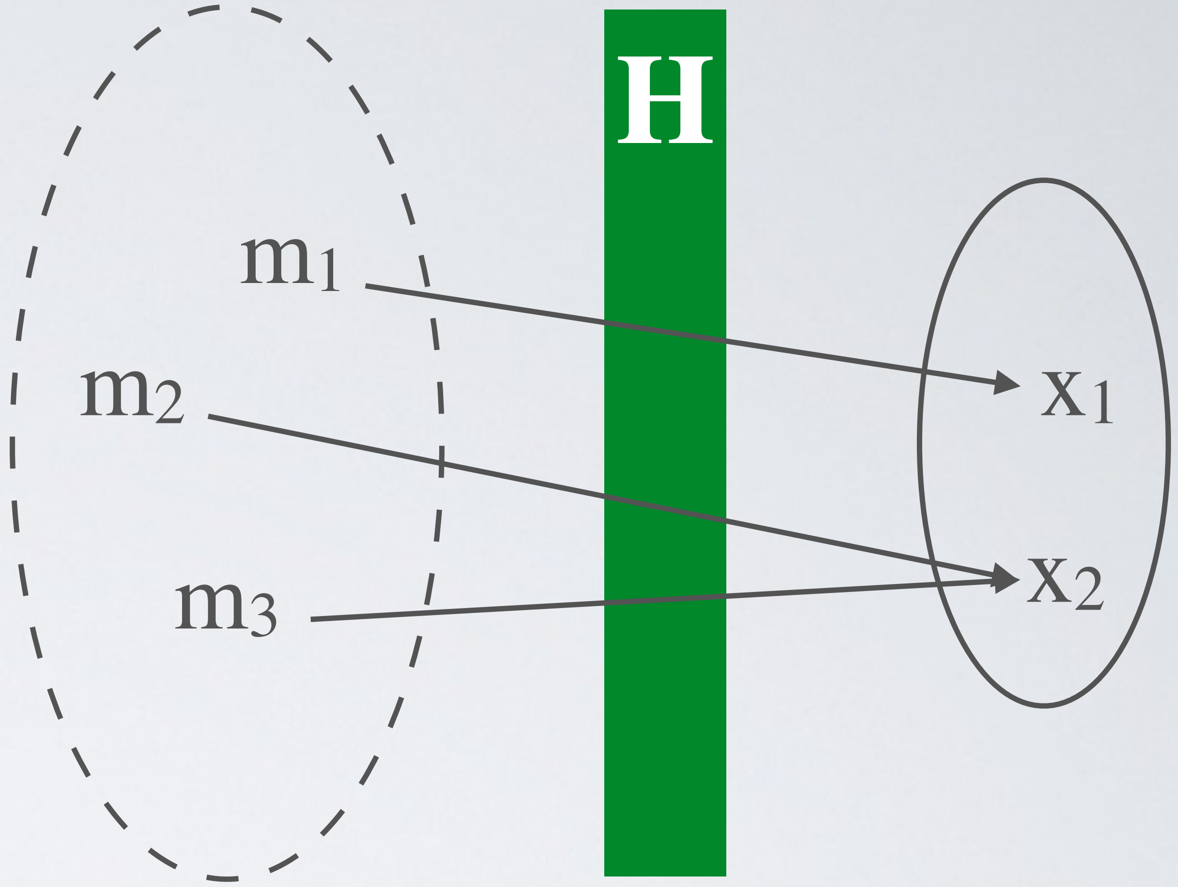
Cryptography Toolbox

The cryptography toolbox has many building blocks …

… but here we only need:

- Hashing
- Digital Signature

Cryptographic Hashing



$H(m) = x$ is a hash function if

- m is a message of any length
- x is a message digest of a fixed length
- H is a non invertible function

➡ H is a lossy compression function
necessarily there exists x, m_1 and m_2 | $H(m_1) = H(m_2) = x$

Computational Properties

$$\begin{tikzcd} m \arrow[r, dash] & \boxed{H} \arrow[r] & x \end{tikzcd}$$

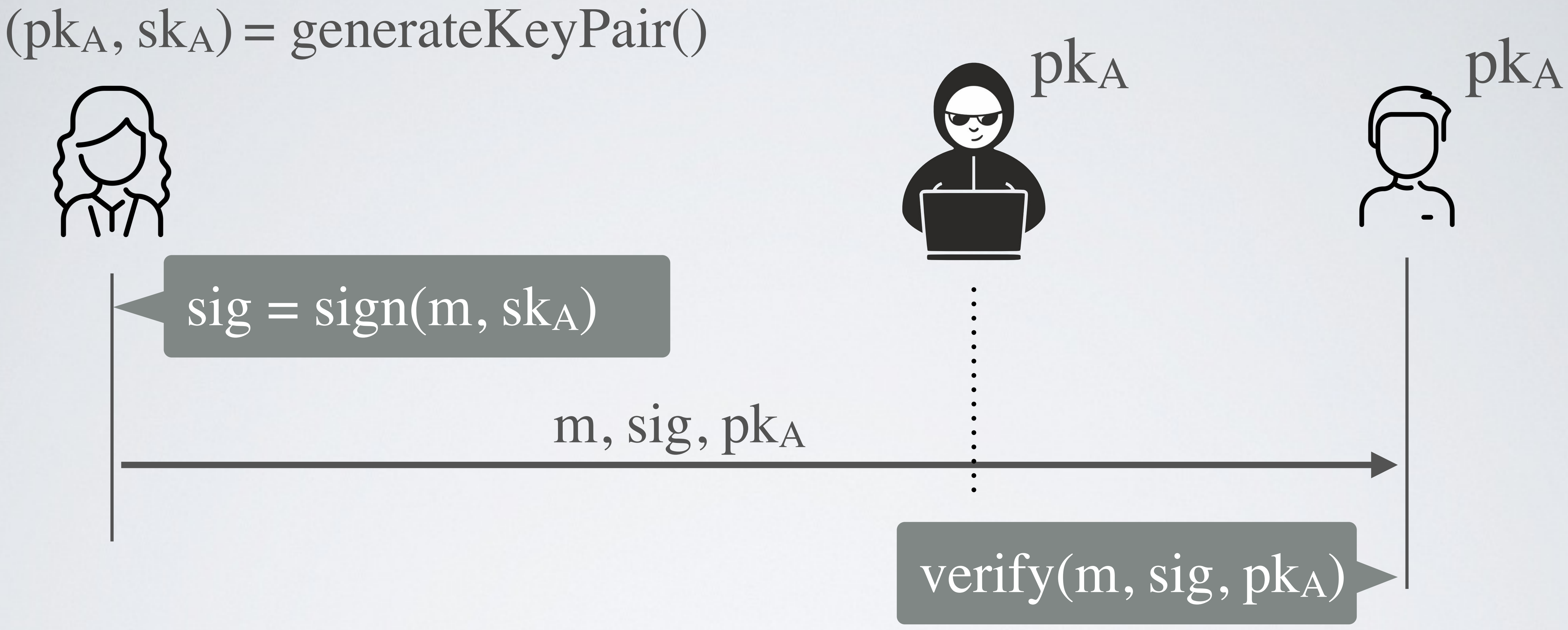
✓ Given **H** and **m**, computing **x** is **easy** (polynomial or linear)

◉ Given **H** and **x**, computing **m** is **hard** (exponential)

◉ Given **H**, **m** and **x**, it is hard (exponential) to find **m’** such that $H(m) = H(m') = x$

◉ Given **H**, it is hard (exponential) to find **m** and **m’** such that $H(m) = H(m') = x$

Digital Signatures



Only Alice can sign a message **m** with her secret key **sk_A**

➡ Everybody can verify **m** using Alice's public key **pk_A**

Computational Properties

- ✓ (pk, sk) = generateKeyPair()
  is easy to compute (polynomial)
- ✓ sig = sign(m, sk_A)
  is easy to compute (either polynomial or linear)
- ✓ verify(m, sig, pk_A)
  is easy to compute (either polynomial or linear)
- ◉ Finding a matching key **sk**, given **pk** is hard (exponential)
- ◉ Forging a valid signature without knowing **sk** is hard (exponential)