Exploring Account Abstraction

The past, present and future

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The past

Prehistory

Account abstraction is as old as Ethereum itself!

- Vitalik blogged about it in 2015
- Many early proposals in 2015 - 2020
  - EIP-86, EIP-101 - attempts at abstracting signature and nonce
  - Axic proposing gas abstraction in 2016
  - ERC-1613 - decentralized gas abstraction (GSN)
  - ERC-2771 - protocol for meta-transactions
  - EIP-2938, EIP-3074 - Quilt team making breakthroughs in AA research
  - ...

ERC-4337 inception

- 2021: Vitalik proposed a new account-abstraction model
  - Experimenting without protocol changes
- Brainstorming led to ERC-4337
- Goal: Full AA without sacrificing decentralization and censorship resistance

Challenges in decentralized AA

- Censorship resistance requires a permissionless mempool
- Full AA introduces DoS vectors
- Need to separate validation from execution
- …but that’s just the start

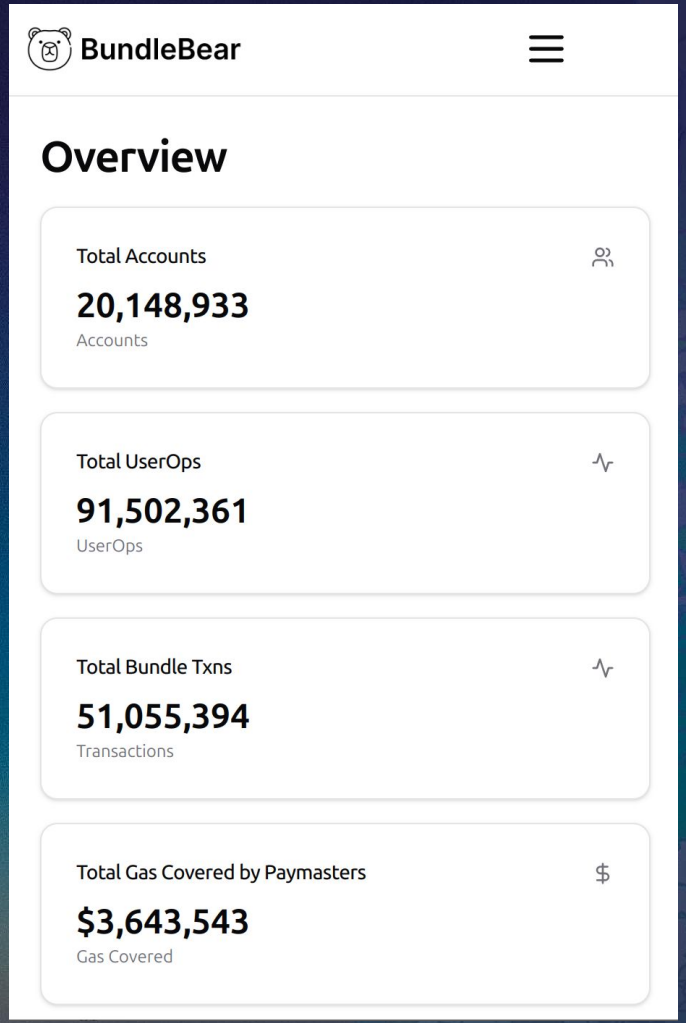
Developed AA mempool protocol

- Started with minimal validation rules to prevent DoS
- Evolved to enable more use cases safely
- Result: ERC-7562 mempool rules for both ERC-4337 and native AA
  - Off-chain protocol: ERC-4337 and RIP-7560 can be used without it
  - Enables non-mempool use cases, e.g. intents
- Mempool protocol only propagates compliant transactions
  - DoS resistant

The present

ERC-4337 gaining traction

- Live since 2023
- Wide adoption on L2 chains
- Gas abstraction becoming the norm
- A lot of great projects built!
    - Stay for “ERC-4337: Adoption Analysis” - Tom will dive deeper into adoption



Public AA mempool launched

- Coordinated effort by bundlers (thanks Partha!)
- Launched by three bundler teams
  - Etherspot
  - Candide
  - Silius
  - More joining soon
- Available on several networks
  - Ethereum mainnet
  - Arbitrum
  - Optimism
  - Polygon - enabled by Fastlane
  - More coming soon




The future

Native AA on L2

- L2 chains implementing their own native versions of ERC-4337
  - Wallet fragmentation issues - standard needed
- Initiated RIP (Rollup Improvement Proposals) process
- RIP-7560 - native AA for L2
  - Devnet ready
  - More implementations underway

Native AA on L1

- Longer term: EIP-7701
  - AA using EOF
- Better censorship resistance - can support inclusion lists
  - Check out FOCIL
- Stay for native AA deepdive by Alex
  - “Native Account Abstraction in Pectra, rollups and beyond: combining EOF, EIP-7702 and RIP-7560”

No EOA left behind

- EIP-7702 coming in pectra
  - Add code to EOA
- Works seamlessly with ERC-4337
  - Every EOA can become an ERC-4337 account
  - Gas abstraction enabled for EOA
- Check out lightclient’s talk
  - “EIP-7702: a technical deep dive”

How does it all fit together?

- ERC-4337, RIP-7560, EIP-7701: same account model
- Easy to build accounts that support all
  - Build once, deploy everywhere
- Chains will gradually move towards native AA
  - Accounts will remain compatible




Beyond local AA

Solving cross-chain UX

AA enables trustless bridging

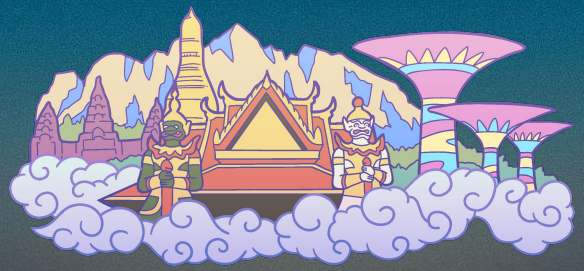
- User account is in control everywhere
- Bridge operator is not a part of the transaction
  - Bridging can be permissionless
- Gas payment handled via paymasters
  - Bridge operator gets compensated but can’t censor
- Enables solving cross-chain UX

Building the perfect cross-chain wallet

- Keystores on L1 or a designated L2
  - Manage credentials on one chain - use everywhere
- Seamless cross-L2 operations
  - One transaction performs operations on many chains
  - User pays gas on source chain
- Intents
  - Let solvers figure out the best path
  - Account verifies and enforces the result
- Chain specific addresses - wallet doesn't need to know every chain
  - ENS record for each L2
  - Records for standardized bridges, light client implementation, RPC...

Key takeaways

- Account abstraction is here
- Native AA is coming
- AA is improving UX on any chain
  - …but also enables solving cross-chain UX
- Future wallets will abstract keys as well as chains
  - …without sacrificing decentralization and censorship resistance



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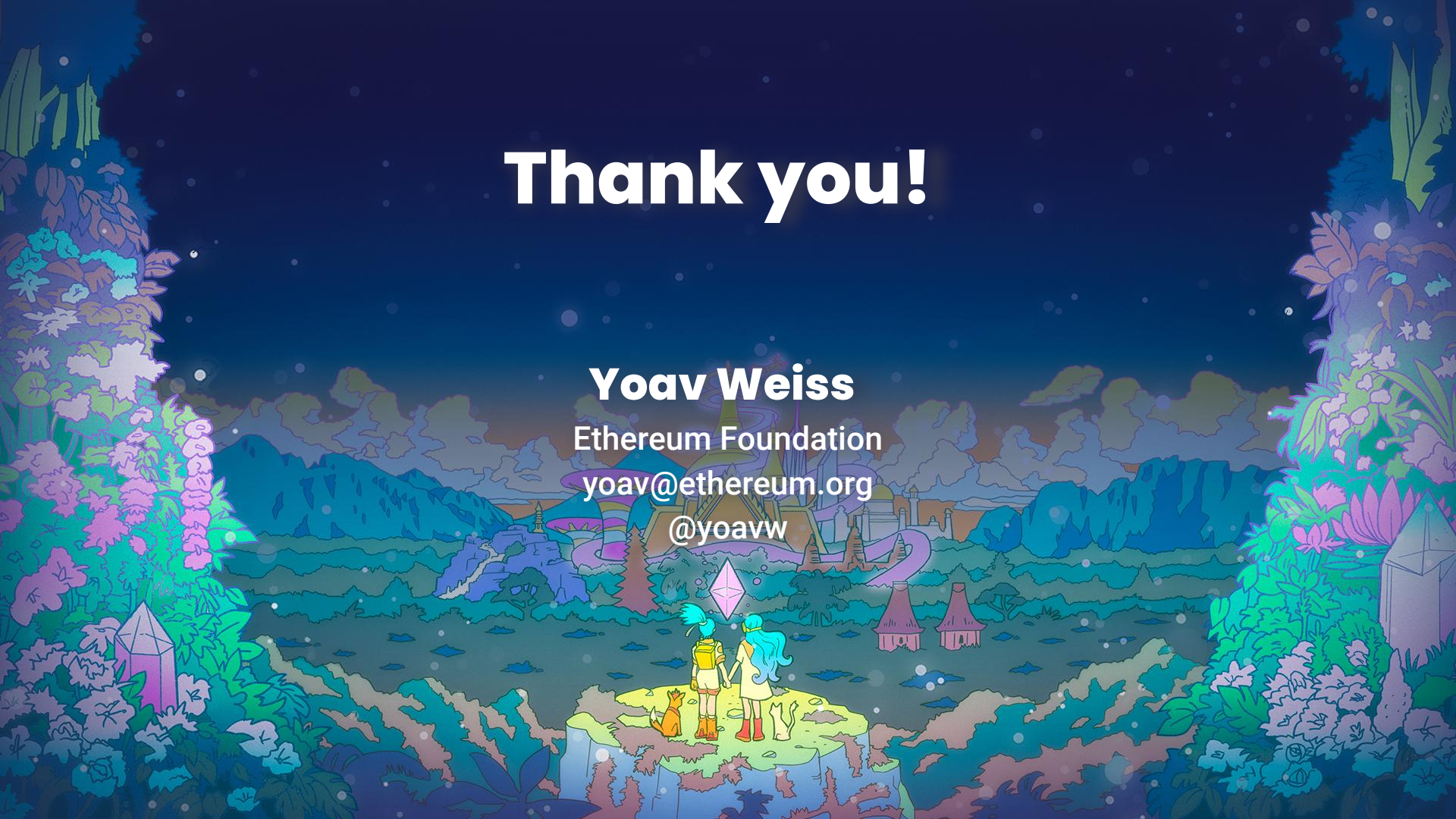

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