

Account Abstraction in Ethereum: How ERC-4337 Works

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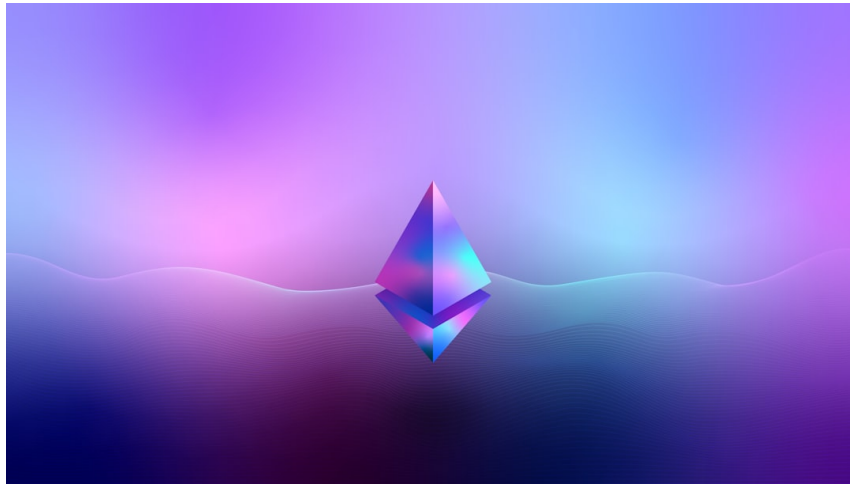


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Ethereum accounts come in two forms: externally owned accounts (EOAs), controlled by private keys, and contract accounts, governed by code. EOAs have always been the only type capable of initiating transactions, which creates significant limitations. Users must hold ETH to pay gas, cannot set custom authorization logic, and lose all funds if they lose their private key. ERC-4337, finalized in 2023, addresses these constraints without requiring a consensus-layer protocol change.

What ERC-4337 Actually Does

ERC-4337 introduces a parallel transaction processing system built entirely on top of Ethereum's existing infrastructure. Instead of standard transactions, users submit objects called `UserOperations` to a dedicated mempool. A new class of network participant called a `bundler` collects these `UserOperations`, packages them into a regular transaction, and submits that transaction to a singleton smart contract called the `EntryPoint`, deployed at the same address on every EVM-compatible network.

The EntryPoint contract coordinates execution. It calls each account's validation function to check whether the UserOperation is authorized, then executes the intended call. This design means the authorization logic lives inside the user's smart contract wallet rather than being hardcoded as ECDSA signature verification, which is the only option available to EOAs.

Key Capabilities Unlocked

Because validation logic is programmable, ERC-4337 wallets can implement a wide range of behaviors that are impossible with EOAs. Multisig authorization requires multiple signers to approve a transaction before execution. Social recovery allows designated guardians to rotate a wallet's signing key if the original is lost. Session keys can grant a dapp temporary, scoped permissions without exposing the master key.

Another major feature is gas sponsorship through Paymasters. A Paymaster is a contract that agrees to cover the gas cost for a UserOperation, either as a service or in exchange for payment in an ERC-20 token. This breaks the requirement that users must hold ETH before they can interact with any application on the network. Developers can subsidize onboarding costs, and users can pay fees in stablecoins.

Batching is also native to the model. A single UserOperation can encode multiple calls, so a user can approve a token and execute a swap in one atomic action rather than two sequential transactions.

Adoption and Limitations

EntryPoint v0.6 deployed in March 2023, followed by v0.7 in late 2023 with improvements to Paymaster accounting and gas estimation. By mid-2024, tens of millions of UserOperations had been processed on mainnet and Layer 2 networks, with most activity concentrated on Polygon, Optimism, and Base.

The system has real costs. Smart contract wallets consume more gas than EOAs because validation and execution go through additional contract calls. Bundler infrastructure adds a new layer of potential centralization if few entities dominate the role. ERC-4337 also does not eliminate EOAs; users still need one to deploy a smart wallet in the first place unless a factory contract and Paymaster handle initial deployment.

Future Ethereum roadmap items, specifically EIP-7702 and eventual native account abstraction proposals, aim to close these gaps at the protocol level, but ERC-4337 remains the practical standard for programmable accounts today.

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BIP39 MNEMONIC COLLECTION

The archive section of this document contains 63 generated word sequences illustrating the BIP39 format.

- 1) hurt tone profit patrol clean broccoli vapor predict cycle man island dish
- 2) slush rubber fancy educate broom fence sketch melt manage swift crime taxi
- 3) kingdom annual provide solve monkey mechanic hollow fly broccoli laundry defense absorb
- 4) episode regret cherry frequent candy cushion build indicate age muffin magic whale
- 5) switch web remain guitar immune monkey ladder hire elder bleak turkey sand
- 6) glove shrug wish unveil vivid cool believe noodle pulp ghost tomorrow sister
- 7) confirm void cheese divorce team tourist october tail fence submit there vehicle
- 8) sad junk mix lizard float version chronic tuition own cushion equip patch
- 9) indoor flush mandate hidden safe discover price chair legend lesson blanket scrub
- 10) clay thrive exclude engage tell lottery tide stone destroy hidden penalty life
- 11) energy timber forget lecture shrimp phone gospel social oyster dinner noise whisper
- 12) problem submit popular cactus love gold language denial weasel velvet olympic canvas
- 13) equip cable brother vendor maze hint bomb bundle property point stone explain
- 14) guide brass enemy document cry stem jeans sausage canyon region clay lounge
- 15) spoon inch jump job swim talent sail zero medal few immune giggle
- 16) forum reduce people curve truck spoon weekend size nation powder decrease require
- 17) leopard light page tattoo club interest profit echo south correct social rocket
- 18) tornado pretty drip link behind apology leisure receive toast debris toe craft
- 19) warfare loop useless buffalo meadow prison taxi monster term ice slam swim
- 20) fix soldier tide melt label pear scheme shrimp vibrant zero doll pear

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- 21) miracle melody town dwarf identify two brisk leave speed quiz castle great
- 22) surprise they ask eager mobile snap service speak country sting drum artist
- 23) glue electric expect flip myth juice hero must balance sound eyebrow energy
- 24) educate sail volcano liberty worry rather guitar enable gate right setup
conduct
- 25) fan cereal pave typical increase wool crew tenant sick useless pond room
- 26) card express drill chuckle trade cream cram victory wool focus steak couch
- 27) wild coin autumn crouch silent flash hood fee flat coach erode soda
- 28) sad grain sting economy print cargo camera gadget laugh rice energy cry
- 29) puzzle close wheat buzz engine silver media hair beyond sell license
catalog
- 30) blood object toilet major organ sun dune vital correct tower jewel just
- 31) honey hybrid pause shock lab album dolphin awesome rapid insect venture
poet
- 32) spring elephant pond found aisle pencil gesture endorse pull color drink
void
- 33) boss apple motion bleak announce beyond scissors pave describe goat marine
shrimp
- 34) tiger miracle saddle since tomorrow ride radar scrap pretty embrace cost
donkey
- 35) junior old pitch detail evil master roast fire giggle short domain version
- 36) rail escape race want planet teach news burst build year drastic neglect
- 37) pool fantasy apology snap peace attract promote harsh love park relax eagle
- 38) index special skull expose young busy bicycle put right rural genius suffer
- 39) domain north various prefer include squirrel derive motion drift six strong
also
- 40) resource rocket egg enough kitten glimpse danger quality embark road valve
practice
- 41) exercise magic fatigue text hotel leopard turtle usual neglect predict
unveil alpha
- 42) forget usage wrap dismiss kingdom need exhibit hunt focus document either
carbon
- 43) ready book skate rule bus else series used myself hair inspire afford
- 44) menu what initial assault own job water equip envelope fossil plunge hat
- 45) program visual luxury secret heavy giant space worth hungry voyage payment
sadness
- 46) badge town oval spawn virus undo ready soap crystal divert habit hamster
- 47) assist reason wheat entry oblige seed kind churn canal demise excuse truck
- 48) expose foot receive doll crop control glance buddy brain curtain solve
prison
- 49) system velvet collect chuckle main nasty today chicken dinner mutual
believe among
- 50) palm plug there town liberty piece jazz blame cry steak universe month

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51) believe deputy lunar polar family trouble promote anchor notice owner
column kick

52) dune winter angry oven man gap slow jelly crystal bleak license breeze

53) coach emotion eagle bird puppy lucky ship oblige entry noble tiger flash

54) brick frost impact lecture hidden runway aspect wish hope cable ginger
green

55) copper immense shuffle peasant return hub vendor change tumble casual
manage method

56) float dance mind glue border sunny cigar find wash awake arrive imitate

57) easily hard upgrade ahead art envelope mistake blind coin dream right pave

58) federal tent arrange copy flag novel couple media carpet verify winner
cheap

59) chair assist brown fan rhythm river answer theme describe grab base melody

60) shield inside report element camera jeans chest shove garage attitude
fabric fluid

61) wage donate appear clap library grass pig border bridge thought mouse
tuition

62) camera venue enter bless alert smooth game off summer weasel awful load

63) edge toddler recipe fence brush helmet gap betray allow stone extend jeans

SEE ALSO

- [MEV: Maximal Extractable Value Explained — BIP39 Seed Phrases \(June 11, 2026\) \(2026-06-11\)](#)
- [Restaking and EigenLayer Shared Security: Unlocking Modular Blockchain Innovation — BIP39 Seed Phrases \(May 31, 2026\) \(2026-05-31\)](#)
- [EIP-1559 and Ethereum Fee Burning Explained — BIP39 Seed Phrases \(August 09, 2026\) \(2026-08-09\)](#)
- [Sharding and the Ethereum Roadmap — BIP39 Seed Phrases \(July 21, 2026\) \(2026-07-21\)](#)

Educational examples only. Randomly generated, not valid wallet phrases - never use them to store funds. Details:

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