

Account Abstraction in Ethereum: How ERC-4337 Works

September 17, 2026 · Document #389 · bip39-phrase.com

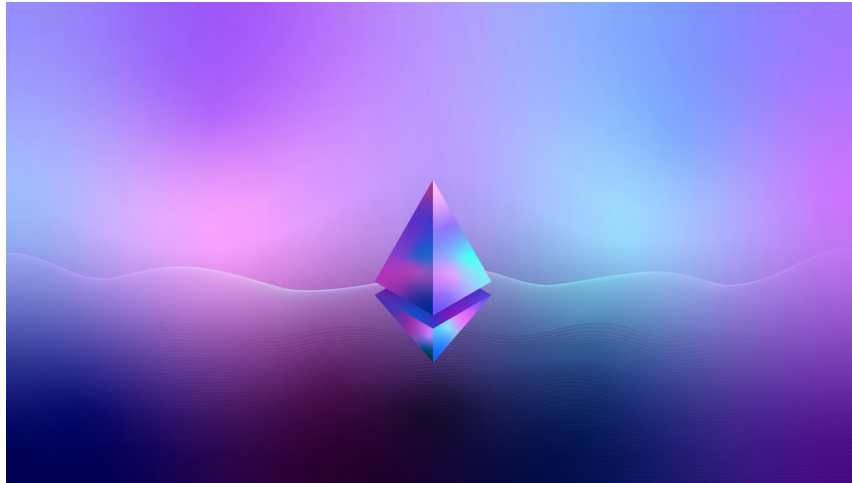


Photo by [Nenad Novakovic](#) on [Unsplash](#)

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 entry point for transactions, which creates hard constraints — every transaction must be signed by a single private key, gas must be paid in ETH, and there is no native way to batch operations or enforce custom validation logic. ERC-4337, finalized and deployed on Ethereum mainnet in March 2023, eliminates most of these constraints without requiring a protocol-level hard fork.

How UserOperations Replace Transactions

ERC-4337 introduces a new object called a UserOperation. Instead of submitting a transaction directly to the mempool, a user submits a UserOperation to a separate mempool maintained by nodes called bundlers. Bundlers collect these objects, validate them, and pack multiple UserOperations into a single on-chain transaction that calls a singleton contract named EntryPoint. The EntryPoint contract then dispatches each operation to the relevant smart contract wallet.

The smart contract wallet itself implements a validation function. When the EntryPoint calls this function, the wallet can apply any logic it chooses: multisig approval, WebAuthn-based passkey signatures, session keys scoped to specific contracts, or time-locked operations. This moves signature validation from a fixed protocol rule into user-defined code.

Paymasters and Gas Abstraction

One of the more practical changes ERC-4337 enables is the paymaster mechanism. A paymaster is a contract that agrees to cover gas costs on behalf of the user. This means a wallet can pay gas in ERC-20 tokens rather than ETH, or a dApp can sponsor transactions entirely for its users. The paymaster deposits ETH into the EntryPoint's stake system and is debited when it covers a UserOperation. Paymasters must pass a validation step so they cannot be drained by malicious operations.

This separates the economic layer of gas from the identity layer of the wallet, which is a meaningful change for onboarding. A new user can receive a stablecoin, interact with a dApp, and never hold ETH, because the dApp's paymaster covers the cost.

Adoption and Practical Limits

By mid-2024, several million smart contract wallets had been deployed using ERC-4337, with Polygon and Optimism seeing the highest UserOperation volumes due to lower gas costs. Major wallet providers including Coinbase Wallet and Safe have integrated the standard. The infrastructure layer — bundlers and paymaster services — is offered by firms like Pimlico, Stackup, and Alchemy.

There are real costs. Smart contract wallets consume more gas than EOA transactions because validation logic runs on-chain. A simple ETH transfer from an ERC-4337 wallet costs roughly 40–60% more gas than from an EOA. Bundler infrastructure also introduces a new trust assumption: bundlers can censor UserOperations, though decentralized bundler networks are being developed to address this.

ERC-4337 does not change the base protocol, so EOAs remain the default. A longer-term proposal, EIP-7702, would allow EOAs to temporarily delegate to contract code within a single transaction, narrowing the gap further. ERC-4337 establishes the programmable wallet layer that those future changes will build on.

Read more articles: bip39-pharse.com/smart-contract-evm-what-it-is-and-how-it-works/

Contents: Article (p.1) -> Seed Phrases (pp.2-5) -> Related Documents (p.6)

GENERATED BIP39 MNEMONICS

The archive section of this document contains 112 generated word sequences illustrating the BIP39 format.

- aerobic among knife time clock mesh flee debate quiz portion gym good
- pigeon west kiss move fun mutual used diesel pupil also slab solve
- wagon slam usual ignore wolf kitchen before range setup decorate custom van
- eager decline clarify clock woman film omit main media unusual amused pilot
- drop ring distance sock frame planet drum scare know quick march cinnamon
- agent brush jump plastic motion summer clean august impose taste amateur patient
- goat tail code carry town gravity tourist waste icon foam rescue disease
- random other taste stable ring save check fluid merry dream inner vacuum
- ranch enroll oppose winter abstract roast fork render shoulder awful dice behave
- payment tray digital basic green perfect boss almost clock camp region daring
- urban credit door rapid stadium insect ghost disagree field parent wire indicate
- dolphin sphere protect car vague lens feel nerve physical come glare donate
- sight hen sell soul dutch shrimp lock soccer best fabric intact gold
- concert festival melt joy hidden river rude ship since axis boring layer
- forget review enough tumble desert produce woman frozen gasp paper casual long
- fatigue lumber coconut cinnamon nose kangaroo onion occur wood suspect slow fine
- impose nurse pole fine produce holiday clown match assist solve clock vacant
- panther safe march trade source border decade frequent chest visual blush annual
- problem tunnel board nature mom wealth wire affair smoke man neck pumpkin
- mind surprise bulk prepare resource recall similar march farm shrug hope crash
- nasty coil fragile strategy repeat test quote century elite project dog catalog
- phrase hotel vast mixture busy dune siege poverty when wagon tell electric
- wrist tuna blast spy raven allow caught message chief light leopard virtual
- spawn shield sunny mango rough strong spy super biology ozone chalk book
- cement demand pet auto empty holiday file illness desert glass congress domain

bip39-pharse.com · 3/6

GENERATED BIP39 MNEMONICS

- brown tomorrow foot elite piece floor mom fold frozen quit runway stumble
- fame raccoon recipe fog limb flip quote friend acquire cup palm abuse
- symbol inmate swift find airport echo refuse scatter antique record toast language
- need laptop imitate dinner maid clog bracket wrong open frown fiscal regret
- noodle fat abuse seminar dawn impact chief teach lobster plastic assume language
- blame ready tiny sheriff never mosquito piece typical reveal clever wolf winner
- cupboard alarm hockey kit habit mirror name mean solar give pass brick
- joy script tree lyrics alarm lesson citizen pistol melody anxiety spirit payment
- proud near rate trick switch trade spice stock keep spot change nest
- output birth error deal air gate chapter bread sand mystery fossil shrimp
- drop manual minute veteran chest limit hub live this clog timber fresh
- chase prepare carbon horse nurse sign kick flavor bulk bread silly addict
- odor bonus couch pen damage destroy such drift wedding margin march banner
- light lawsuit village gauge panda goddess police inch glue kick rapid gaze
- letter prison exchange embody mask concert message check mouse gauge merit kiwi
- fork basic argue north proof wall crawl chair strategy retire ankle wish
- antenna great river hospital above mother fancy equip teach wear plunge rare
- small frog check animal tail test cake pool sphere vehicle human increase
- output notice wagon news harbor about impulse lumber hair glow burst wash
- habit budget dragon ship salute hover cereal click mad liquid similar crisp
- hurry cable actor next provide parade leave impose mouse disease manage away
- unable curve mass employ fluid nose aim menu category tiger clap mansion
- village refuse stumble laundry card unlock suggest kite silk organ verb you
- exhibit hour fossil alien nuclear coyote fury icon gas eagle zebra crater
- donkey ill rural notice conduct visit access hover spice grow magic unaware
- resist reward wool plate notice call reduce soccer zero spring correct collect
- pretty electric sadness alter exercise lobster symptom exact prize negative strategy tag
- odor front drama rug raccoon wool feel carpet debris blast actual drill
- scrap organ view argue voyage salon renew random gadget risk wisdom mechanic
- team elephant grocery shadow eagle quick north pair soul pudding wonder rain
- question brick intact front speak depend cream rival forward join arrange hawk
- script embrace shiver elevator expand blanket safe frost dizzy soul canvas hedgehog
- visit unusual digital flee chase veteran insect dizzy purse wave involve love
- glare bag frown mushroom skin total pony minor visit fault target hope
- asthma stomach hunt clarify odor snake logic inside barely purchase effort dance
- seven deputy nurse inner hair favorite degree aisle away omit black fantasy

bip39-phrase.com · 4/6

GENERATED BIP39 MNEMONICS

- buzz erode village bind top edge profit another shaft that erode critic
- planet welcome abstract range bargain slender shadow pony swamp diagram come shuffle
- comfort useless timber about perfect design aisle believe orange original tilt toilet
- crumble total blast album toy grit fabric ensure kiss alert sponsor happy
- noise question slam unlock rotate sea you episode renew tragic still hint
- stem wrong nasty frog fabric fold debate suggest orchard else sniff mimic
- galaxy domain grain improve misery true happy perfect shoe grid bleak sad
- point lunch rebel unknown more lens expect vicious bench minimum garlic side
- index neglect enroll draft police adjust afford nation smart pause armor soldier
- armed unfair found stadium outdoor palace benefit flash person velvet will split
- corn apple clap benefit clinic apple any correct chest invite dinner sleep
- false exotic bullet comfort nut arrive enough brother sponsor volume grunt scout
- recycle reunion pole liquid timber divide place size under response talent coffee
- knife ring casual warm negative soon stool obvious rocket voyage valve icon
- borrow parade umbrella turn mirror nation sausage side turtle fit follow mansion
- side hurdle story mirror lunch resemble original method cash found artist hockey
- churn punch tiger card engage thumb gun coast release mutual maple major
- among dirt hybrid large sunset hero bread tribe aerobic decade one reform
- wool pact claim sweet shoe step plate beach laundry tonight stereo alarm
- ignore drill woman crop fame setup spatial figure certain avocado chief crowd
- pig slice series alcohol spatial fire orange setup remind denial where occur
- pistol october palace industry flush rifle junior theory enact ritual alpha science
- stay few mother slim secret only define twenty bronze merry dry coach
- decline bottom manual choice poem answer guess tube much hard charge jewel
- razor pudding tag moment armed input pink six pet social behind cereal
- lens hungry nose noble cancel zebra wide flock purpose luggage enrich glory
- catalog fork vessel catch door burden artefact silk galaxy dumb door glare
- boat finger alone arm dumb tourist board act online clinic indoor betray
- boat evil adapt wing illness metal kick depend lottery travel blood civil
- chicken sense build retreat blade same alpha mammal armed visa camera way
- cousin yellow brother put guide round wild involve rail ribbon shiver cannon
- shaft opera sister royal sad thumb outdoor pole pet tell bright mouse
- flash alpha predict mandate whisper leave rail tuna verify cross case unusual
- brick capable joy cook move rather captain theory skill lecture myth dolphin

bip39-phrase.com · 5/6

GENERATED BIP39 MNEMONICS

- shoot text document mercy crunch saddle explain utility regular hamster mistake reward
- sport hurdle twenty predict attract million view venture depart access ancient chase
- awful quick cement thumb apart gospel proof ginger horror wealth lizard shock
- express swear cash feed soldier during team cost hero cave picnic service
- blossom tide small minor fluid over jar twice shrimp clog rose liar
- note monkey life ignore blood scene earn math tank fire fee install
- sphere when dumb liquid crisp little flash claim venue wrist bronze switch
- enable uphold sister split pull crack enroll chat adapt bachelor situate bacon
- stomach vote slogan want switch huge stadium jewel brief business water satoshi
- ecology click chase pizza tired antenna novel point express virus giggle off
- lecture episode dust humble seed worry move soon myth wash leaf catalog
- evidence fall earth nerve december barely benefit drip recall airport lava front
- crash accident grief mystery love notable royal aerobic type impact direct urge
- moon churn shallow soap clog movie reopen okay fringe satisfy box fashion
- oval please exhaust hat bundle upon among expire genre able poem course
- buddy train learn attitude trash false myself smoke fuel mammal number sauce
- hen direct pool crew room approve width exotic bubble home bottom range

SEE ALSO

- [Account Abstraction in Ethereum: How ERC-4337 Works — BIP39 Seed Phrases \(August 28, 2026\) \(2026-08-28\)](#)
- [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 \(August 09, 2026\) \(2026-08-09\)](#)

Educational examples only. Randomly generated, not valid wallet phrases - never use them to store funds. Details: bip39-phrases.com/security/
bip39-phrases.com · 6/6