

Verifying wallets

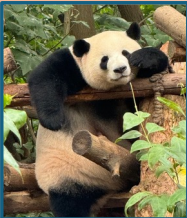
Devcon 2024 Bangkok

Wallet

4.75 ETH


0.1 BTC

500 USDC



→ theprotocolguild.eth
2024-11-12 -50 USDC

← vitalik.eth
2024-11-11 1 ETH

 Block #123 produced
2024-11-09 0.08 ETH

ETH balance

Tokens / NFTs

Metadata

Balances & allowances

Exchange rates

History

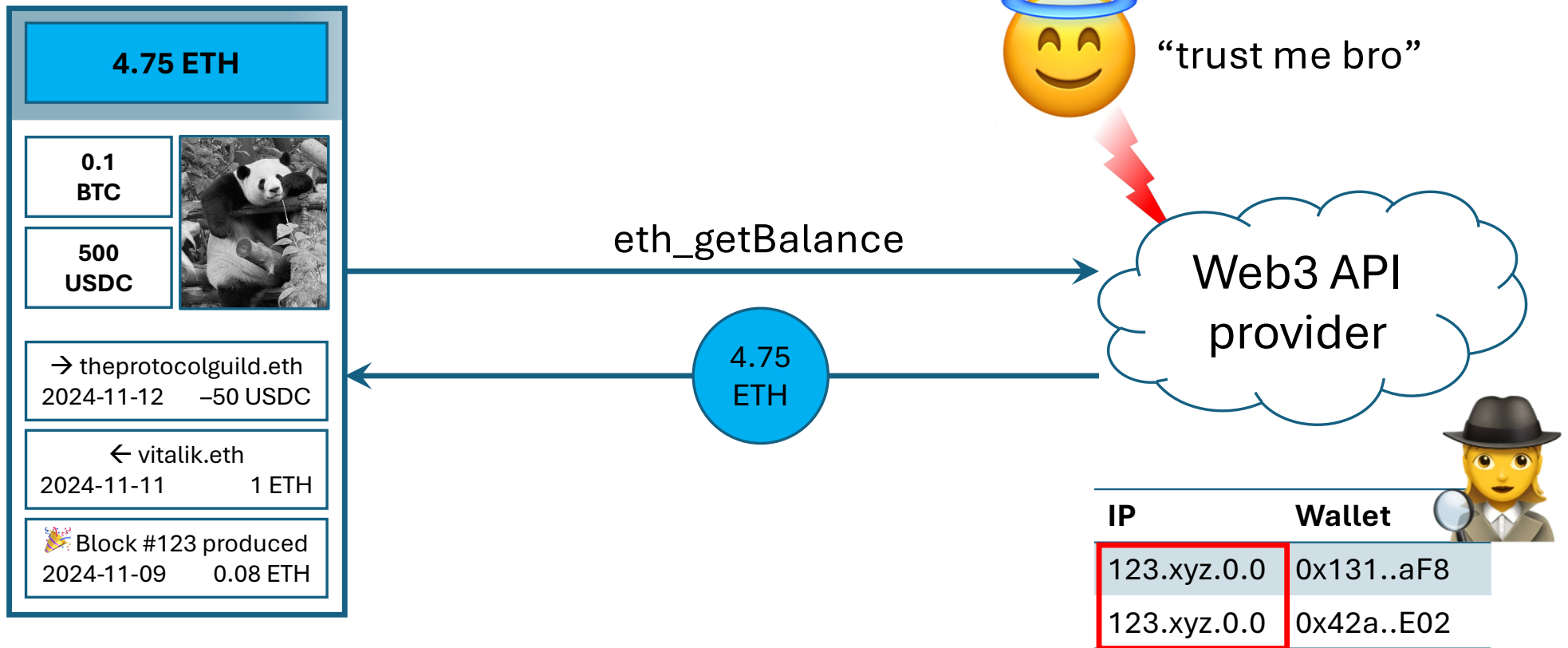
Transaction details

Fees & gas usage

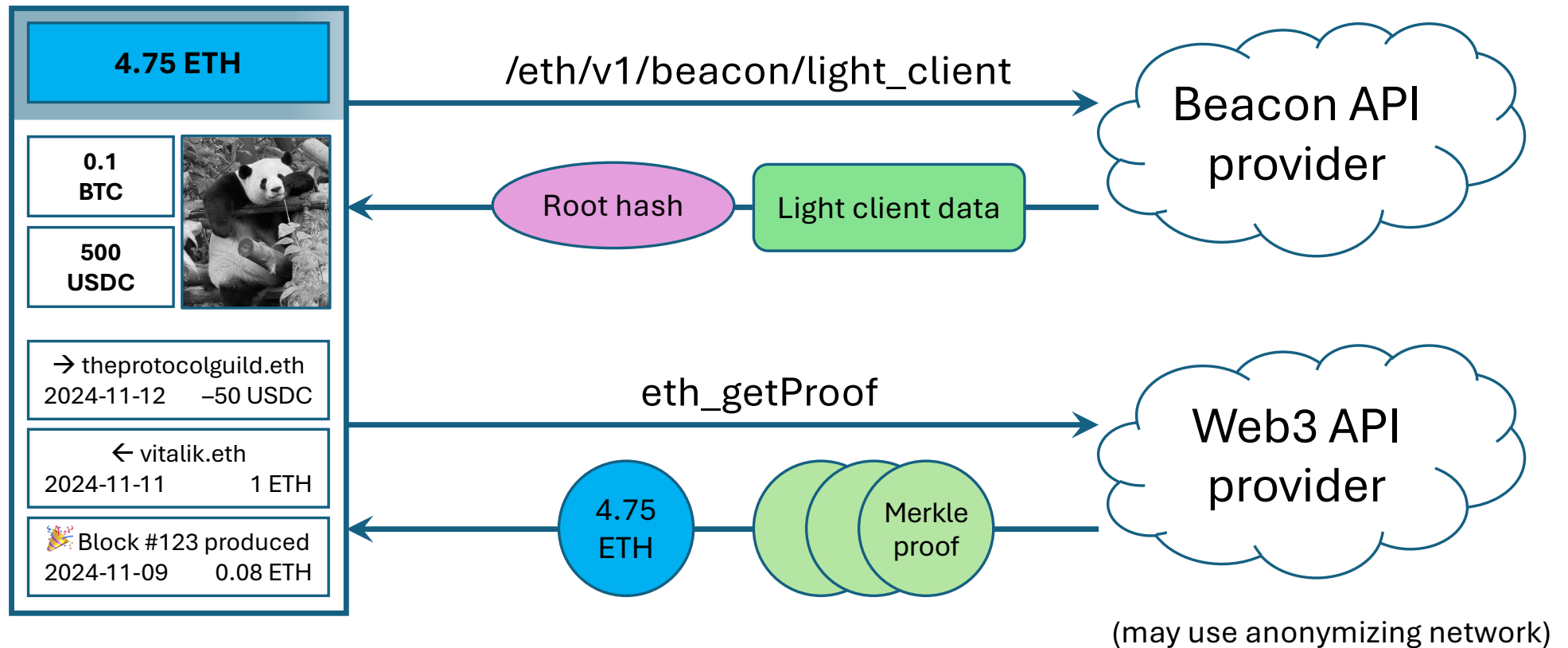
Staking operations & rewards

No missing entries

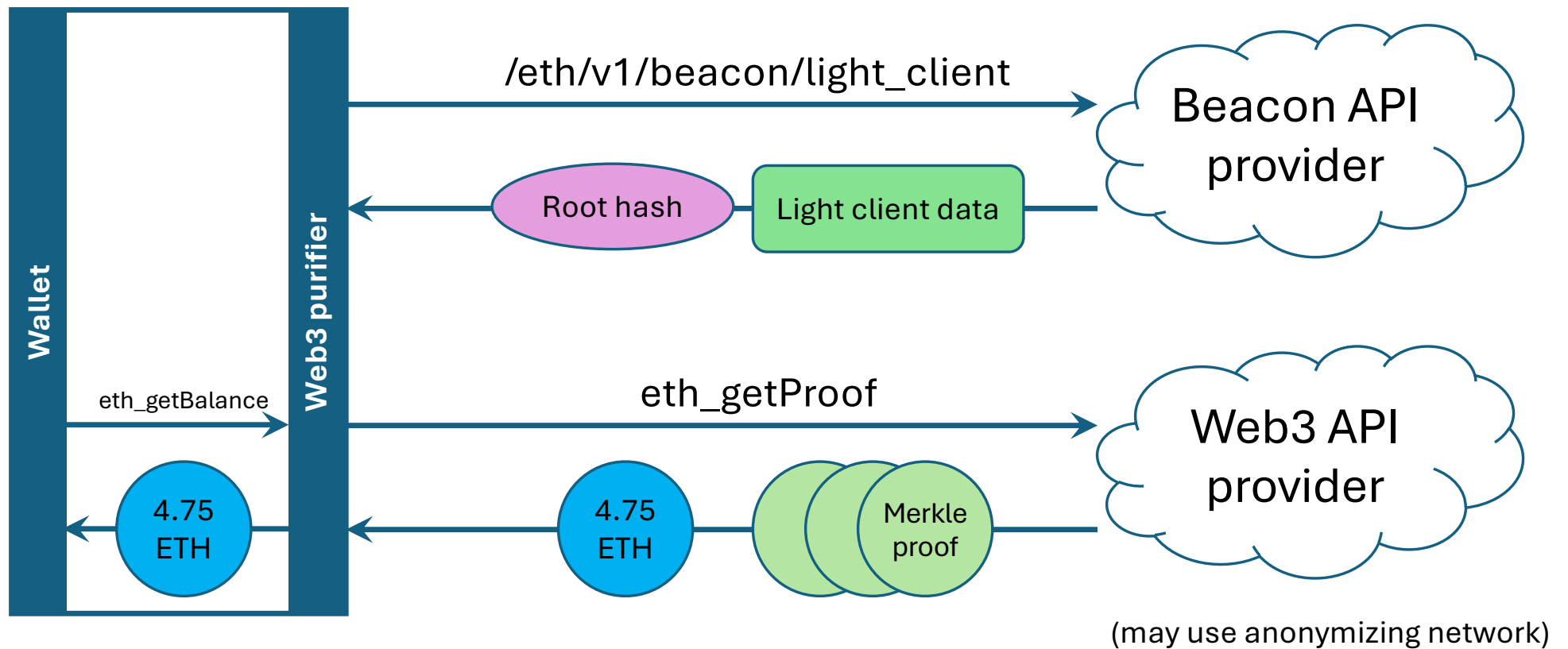
ETH balance



ETH balance (trust-minimized)



ETH balance (with purifier)



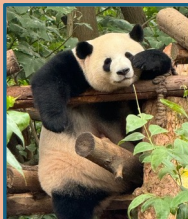
Wallet



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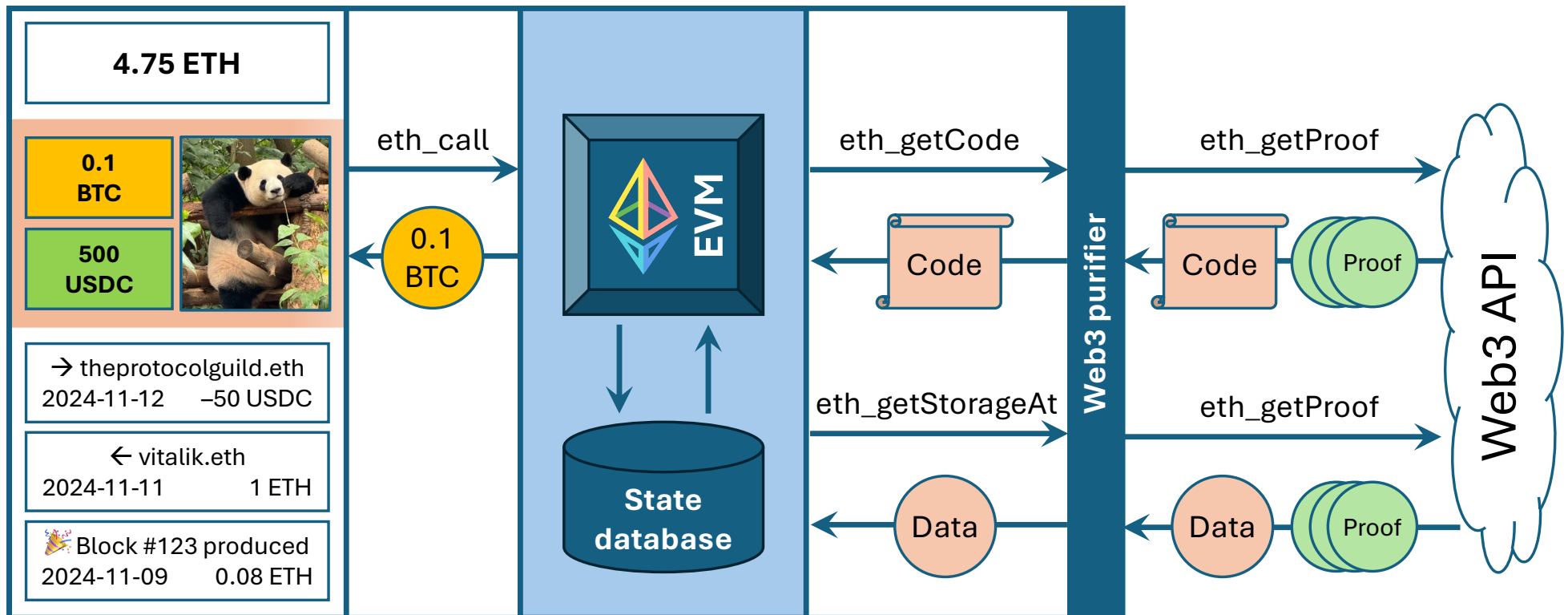
Transaction details

Fees & gas usage

Staking operations & rewards

No missing entries

Token balance

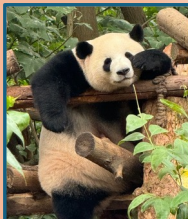


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Access lists are best effort
Lots of round trips

Transaction details

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From address



To address



Value transferred



Transaction data




Gas fees

Transaction details

4.75 ETH


0.1 BTC

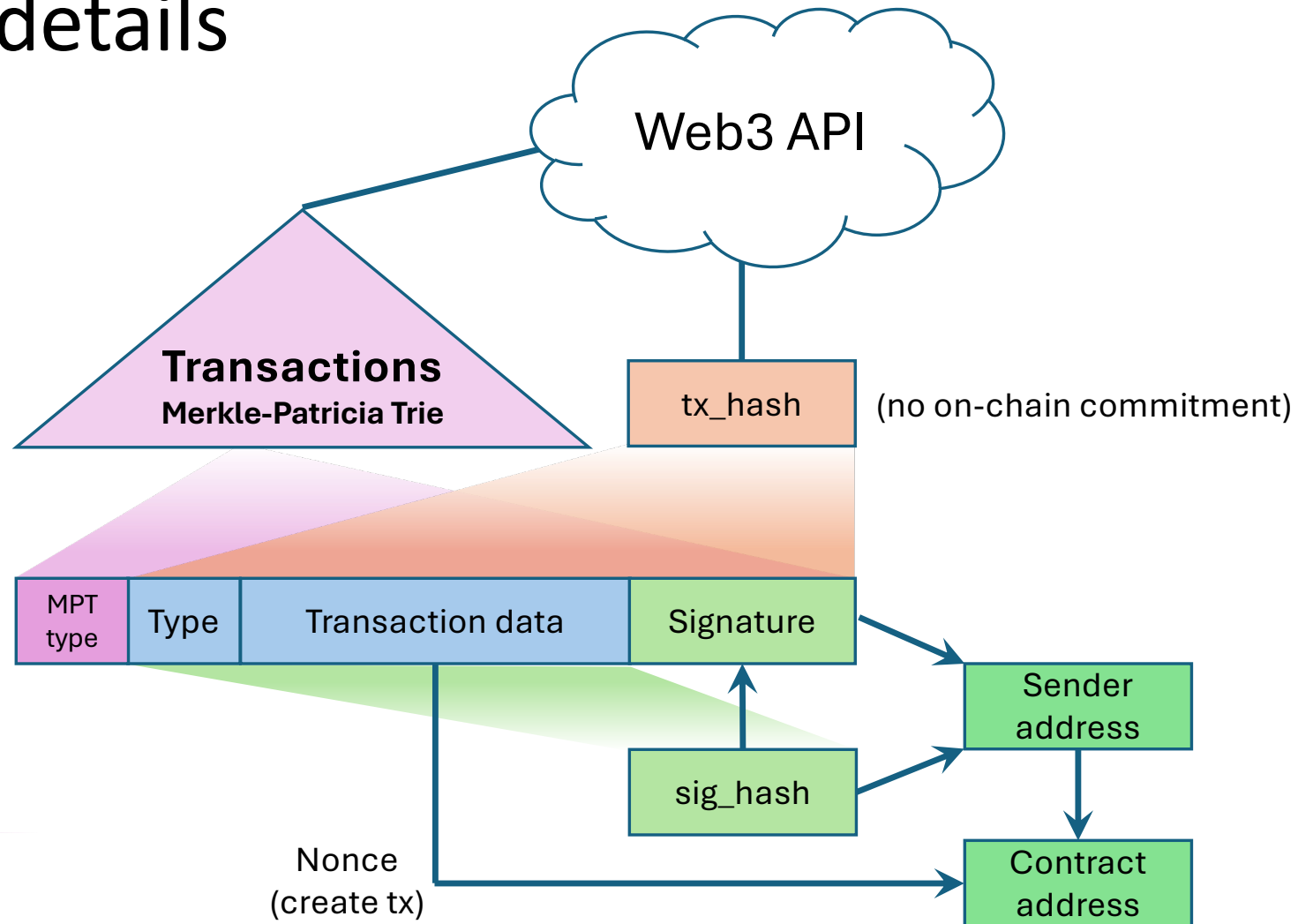
500 USDC



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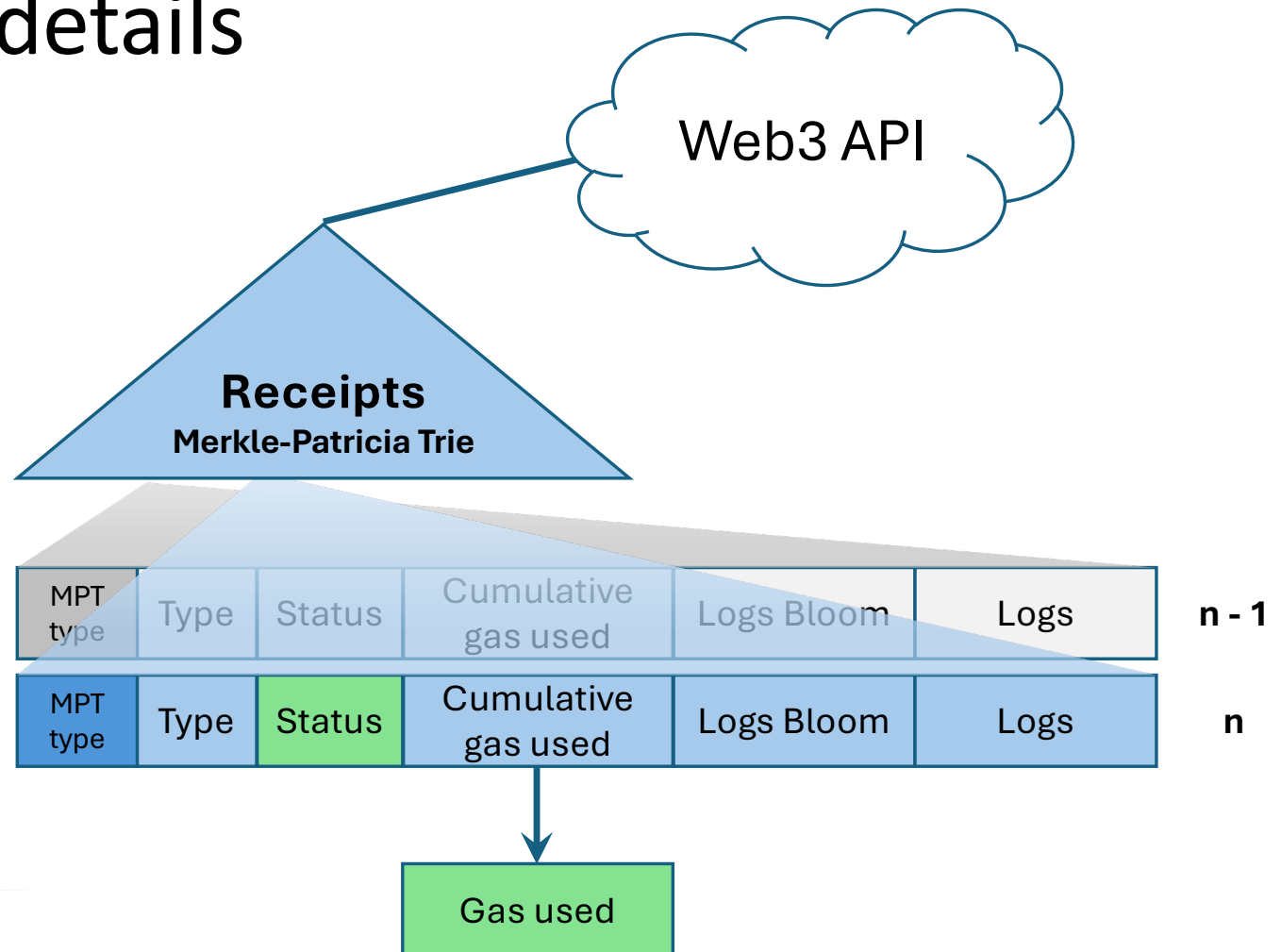
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From address

Full tx data required
Expensive ecrecover



To address

CREATE contract address
requires *from* address



Value transferred



Transaction date

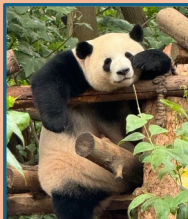
Tx type inconsistencies
Inefficient hashes



Gas fees

Full data required incl logs
Prior receipt needed

Wallet

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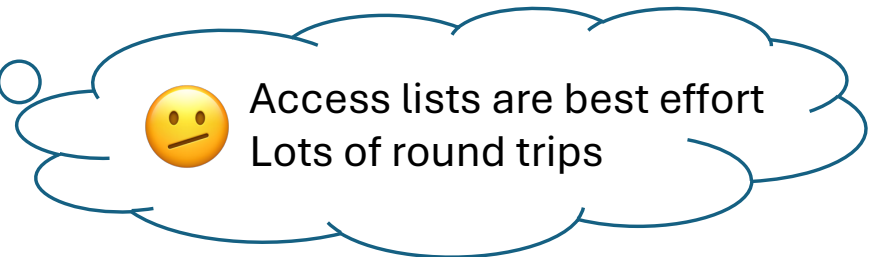
ETH balance

Tokens / NFTs

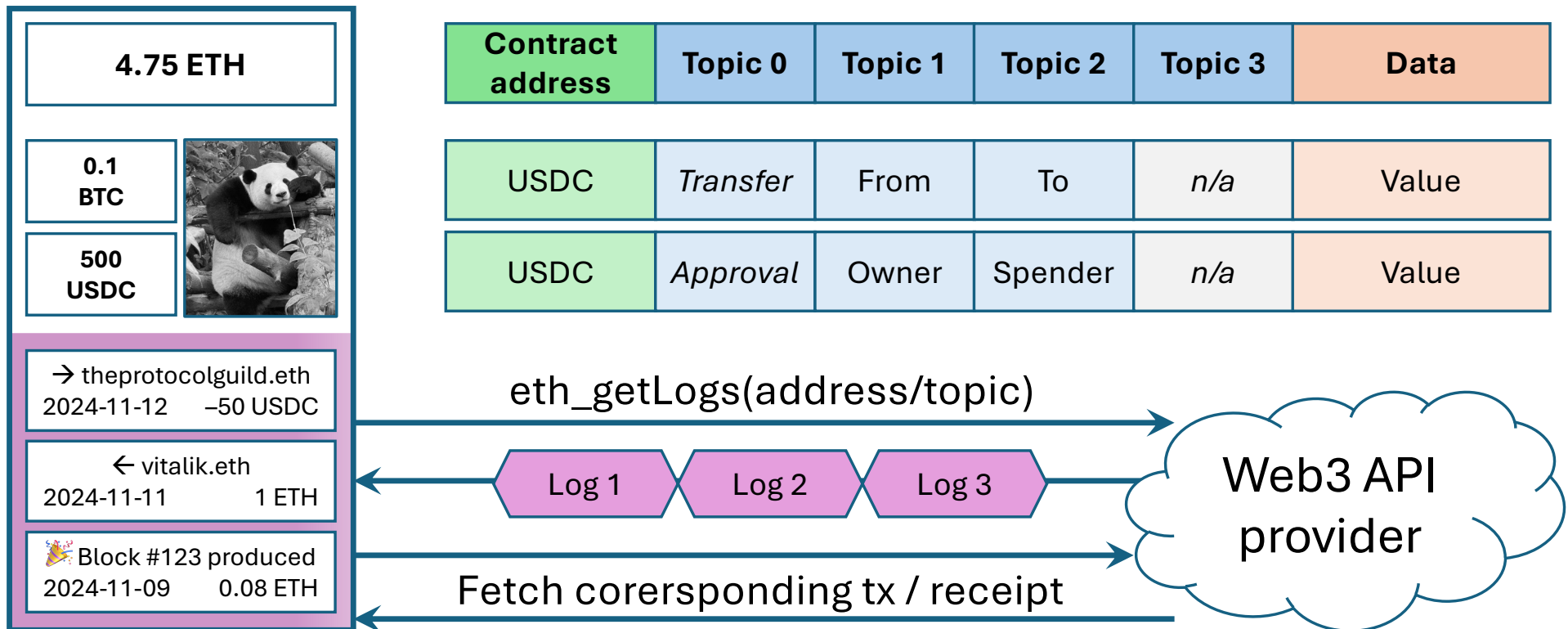
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Exchange rates

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No missing entries



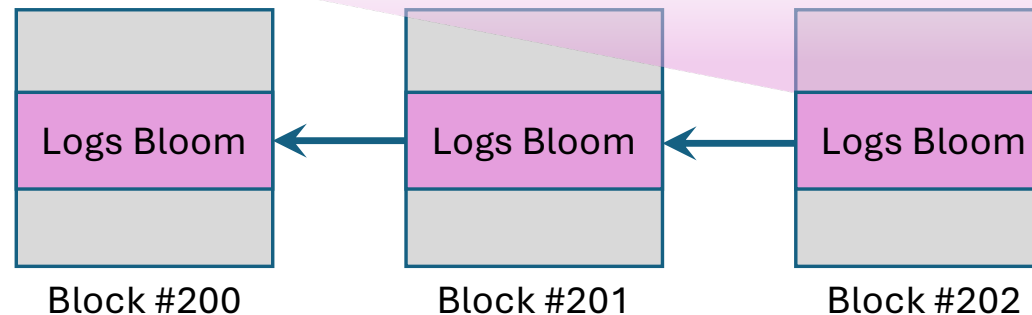
History



History (withholding mitigation)

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Contract address	Topic 0	Topic 1	Topic 2	Topic 3	Data
USDC	<i>Transfer</i>	From	To	<i>n/a</i>	Value
USDC	<i>Approval</i>	Owner	Spender	<i>n/a</i>	Value



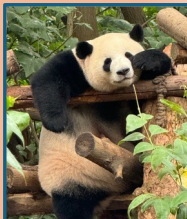
! Get *all* block headers, check Bloom, get *all* transactions / receipts...

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BTC

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Access lists are best effort
Lots of round trips




Terribly inefficient



ETH transfers
from smart contracts

EIP-7708: ETH transfers emit a log

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0.1 BTC
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🎉 Block #123 produced 2024-11-09 0.08 ETH

Contract address	Topic 0	Topic 1	Topic 2	Topic 3	Data
System	<i>Transfer</i>	From	To	<i>n/a</i>	Value
System	<i>Fee</i>	From	<i>n/a</i>	<i>n/a</i>	Value

Transfer log

Transaction start

Nonzero-value *CALL*

Nonzero-value *SELFDESTRUCT*

Fee log

Transaction end



Accurate ETH balance history is available (without local EVM)

EIP-7668: Remove bloom filters

4.75 ETH


0.1 BTC

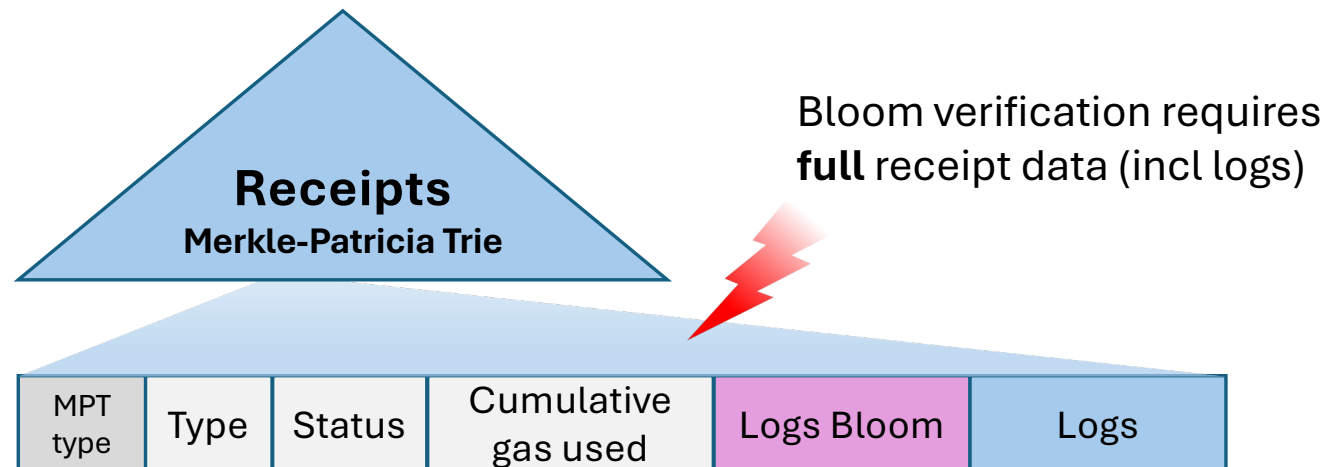
500 USDC

→ theprotocolguild.eth
2024-11-12 -50 USDC

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2024-11-11 1 ETH

🎉 Block #123 produced
2024-11-09 0.08 ETH





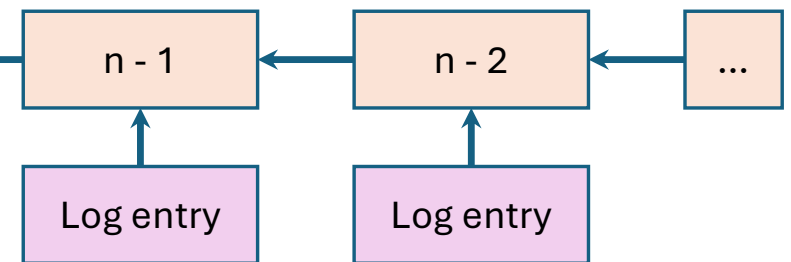
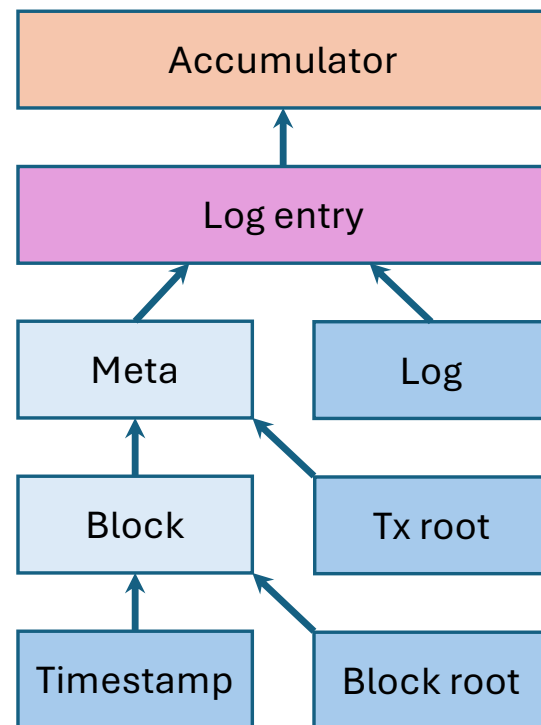
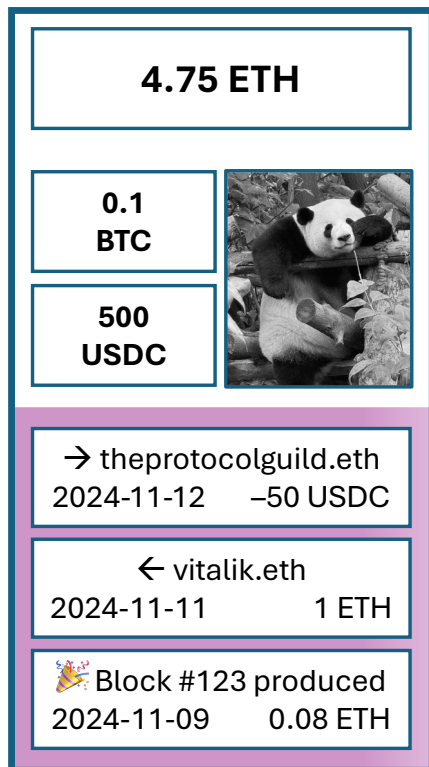
Remove Logs Bloom

Saves 256 bytes per transaction



ETH transfer logs can be stored in saved disk space

EIP-7792: Verifiable logs



Separate accumulator per filter

Address

Topic

Address & topic combination


Accumulators stored in state

Fetchable with `eth_getProof`



Incomplete `eth_getLogs` responses can be detected

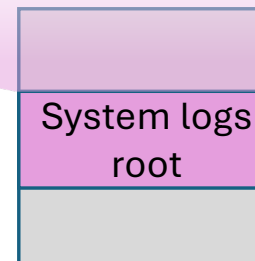
EIP-7799: System logs

4.75 ETH
0.1 BTC
500 USDC

→ theprotocolguild.eth 2024-11-12 -50 USDC
← vitalik.eth 2024-11-11 1 ETH
🎉 Block #123 produced 2024-11-09 0.08 ETH

Contract address	Topic 0	Topic 1	Topic 2	Topic 3	Data
System	Priority Rewards	To	n/a	n/a	Value
System	Withdrawal	To	n/a	n/a	Value

Priority Fees (EIP-1559)

No longer paid after each tx
Single combined credit after all txs
Better parallel tx execution

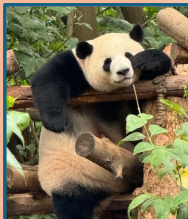


Block #456



Accurate staking reward tracking (without historical block headers)

Wallet

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🎉 Block #123 produced 2024-11-09 0.08 ETH		

ETH balance

Tokens / NFTs

Metadata
Balances & allowances
Exchange rates

History

Transaction details
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No missing entries



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Terribly inefficient



ETH transfers
from smart contracts

EIP-6466: SSZ receipts

4.75 ETH


0.1 BTC

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2024-11-11 1 ETH

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MPT type	Type	Status	Cumulative gas used	Logs Bloom	Logs
----------	------	--------	---------------------	------------	------

StableContainer
Forward compatibility

Tx gas used

Prior receipt no longer needed
Better parallel tx execution

Remove

SSZ binary tree

Proofs for partial data
Simpler L2 bridge designs

Add *From*, *Contract* (CREATE), and *Authority* (EIP-7702) addresses

Transaction data and *ecrecover* no longer needed for verification
Reduced dependency on EVM internals




On-chain commitments to relevant data (fewer round trips, more efficient)

EIP-7706: Separate gas types

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2024-11-11 1 ETH

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Nonce	Max fee per gas	Gas limit	To	Value	Input	Replayable signature		Legacy				
Nonce	Max fee per gas	Gas limit	To	Value	Input	Signature + Chain ID		EIP-155				
0x01	Chain ID	Nonce	Max fee per gas	Gas limit	To	Value	Input	Access list	Sig			
0x02	Chain ID	Nonce	Prio fee per gas	Max fee per gas	Gas limit	To	Value	Input	Access list	Sig		
0x03	Chain ID	Nonce	Prio fee per gas	Max fee per gas	Gas limit	To	Value	Input	Access list	Fee per blob gas	Blob hashes	Sig
0x04	Chain ID	Nonce	Prio fee per gas	Max fee per gas	Gas limit	To	Value	Input	Access list	Auth list	Sig	
0x06	Chain ID	Nonce	Gas limit	To	Value	Input	Access list	Blob hashes	Auth list	Max fees per gas	Prio fees per gas	Sig



Normalized gas fee computation

EIP-6404: SSZ transactions

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2024-11-11 1 ETH

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0x1f	Nonce	Gas limit	To	Value	Input	Max fees per gas	Sig					
0x1f	Chain ID	Nonce	Gas limit	To	Value	Input	Max fees per gas	Sig				
0x1f	Chain ID	Nonce	Gas limit	To	Value	Input	Access list	Max fees per gas	Sig			
0x1f	Chain ID	Nonce	Gas limit	To	Value	Input	Access list	Max fees per gas	Prio fees per gas	Sig		
0x1f	Chain ID	Nonce	Gas limit	To	Value	Input	Access list	Blob hashes	Max fees per gas	Prio fees per gas	Sig	
0x1f	Chain ID	Nonce	Gas limit	To	Value	Input	Access list	Auth list	Max fees per gas	Prio fees per gas	Sig	
0x1f	Chain ID	Nonce	Gas limit	To	Value	Input	Access list	Blob hashes	Auth list	Max fees per gas	Prio fees per gas	Sig



Restored type safety for different transaction profiles

EIP-7495: SSZ StableContainer

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2024-11-12 -50 USDC

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2024-11-11 1 ETH

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0x1f	n/a	Nonce	Gas limit	To	Value	Input	n/a	n/a	n/a	Max fees per gas	n/a	Sig
0x1f	Chain ID	Nonce	Gas limit	To	Value	Input	n/a	n/a	n/a	Max fees per gas	n/a	Sig
0x1f	Chain ID	Nonce	Gas limit	To	Value	Input	Access list	n/a	n/a	Max fees per gas	n/a	Sig
0x1f	Chain ID	Nonce	Gas limit	To	Value	Input	Access list	n/a	n/a	Max fees per gas	Prio fees per gas	Sig
0x1f	Chain ID	Nonce	Gas limit	To	Value	Input	Access list	Blob hashes	n/a	Max fees per gas	Prio fees per gas	Sig
0x1f	Chain ID	Nonce	Gas limit	To	Value	Input	Access list	n/a	Auth list	Max fees per gas	Prio fees per gas	Sig

0x1f	Chain ID	Nonce	Gas limit	To	Value	Input	Access list	Blob hashes	Auth list	Max fees per gas	Prio fees per gas	Sig
------	----------	-------	-----------	----	-------	-------	-------------	-------------	-----------	------------------	-------------------	-----



Re-usable verifier (all profiles share stable SSZ merkleization)

EIP-7807: SSZ execution blocks

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Block metadata

Parent hash	Miner	State root	Number	Time-stamp	Extra data	Mix hash	Parent CL root
-------------	-------	------------	--------	------------	------------	----------	----------------

Gas accounting (separate gas types)

Gas limits	Gas used	Base fees	Excess gas
------------	----------	-----------	------------

Removed fields (PoW era / Bloom)

Ommers hash	Difficulty	Block nonce	Logs Bloom
-------------	------------	-------------	------------

Operations

Transactions root	Withdrawals root
Receipts root	System logs root
Requests hash	



Merkle-Patricia Tries (MPT) removed, encoding and hashing normalized

Inclusion proofs

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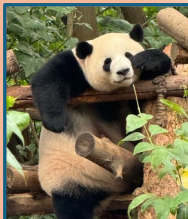




No extra data
required to
verify tx

```
{
  "jsonrpc": "2.0",
  "id": 1,
  "result": {
    "blockHash": "0xe0f3b04a0078ee51f14bfed3f77fc70611273641f942d29781f7bb29a9b2f45d",
    "blockNumber": "0x405f",
    "from": "0xd3248ba3e5492d767f8e427cb9c7b9d5c3972d7b",
    "gas": "0x5208",
    "gasPrice": "0x8",
    "type": "0x0",
    "chainId": "0x1a4e45926",
    "hash": "0xbec73925f3102c03ac9a53303aaae0828e7c1a97cd30f38c3db87c16c52a0b2f",
    "input": "0x",
    "nonce": "0xc7b",
    "to": "0x6177843db3138ae69679a54b95cf345ed759450d",
    "transactionIndex": "0x0",
    "value": "0xaa87bee538000",
    "v": "0x349c8b270",
    "r": "0xa782fb270090da86dfb9be131597edb76f71893d274b0f5de4e9b53feca97182",
    "s": "0x67b2d07f4041a505396fdaf222062bec5afa96172e9e3f5bf2a54ea9d635d725",
    "inclusionProof": {
      "merkleBranch": [
        "0xa75164113ab3274e55321265025c9598a3254467cecf175b626488fa61439d5f",
        "0x3611b3df675ce8ac4da791d332bdd11b027de2b51db46877c02a6ba2680a5560",
        "0x372723f5d8765dee1779fff846dd4897ccf27a72b4c1355f4400a3222977c3e9",
        "0xc78009fd077fc56a11f122370658a353aaa542ed63e44c4bc15ff4cd105ab33c",
        "0x536d98837f2dd165a55d5eeae91485954472d56f246df256bf3cae19352a123c",
        "0x9efde052aa15429fae05bad4d0b1d7c64da64d03d7a1854a588c2cb8430c0d30",
        "0xd88ddfeed400a8755596b21942c1497e114c302e6118290f91e6772976041fa1",
        "0x87eb0ddb57e35f6d286673802a4af5975e22506c7cf4c64bb6be5ee11527f2c",
        "0x26846476fd5fc54a5d43385167c95144f2643f533cc85bb9d16b782f8d7db193",
        "0x506d86582d252405b840018792cad2bf1259f1ef5aa5f887e13cb2f0094f51e1",
        "0xfffff0ad7e659772f9534c195c815efc4014ef1e1daed4404c06385d11192e92b",
        "0x6cf04127db05441cd833107a52be852868890e4317e6a02ab47683aa75964220",
        "0xb7d05f875f140027ef5118a2247bbb84ce8f2f0f1123623085daf7960c329f5f",
        "0xdf6af5f5bbdb6be9ef8aa618e4bf8073960867171e29676f8b284dea6a08a85e",
        "0xb58d900f5e182e3c50ef74969ea16c7726c549757cc23523c369587da7293784",
        "0xd49a7502ffcfb0340b1d7885688500ca308161a7f96b62df9d083b71fcc8f2bb",
        "0x8fe6b1689256c0d385f42f5bbe2027a22c1996e110ba97c171d3e5948de92beb",
        "0x8d0d63c39ebade8509e0ae3c9c3876fb5fa112be18f905ecacfecb92057603ab",
        "0x95eec8b2e541cad4e91de38385f2e046619f54496c2382cb6cacd5b98c26f5a4",
        "0xf893e908917775b62bfff23294dbbe3a1cd8e6cc1c35b4801887b646a6f81f17f",
        "0x0500000000000000000000000000000000000000000000000000000000000000"
      ],
      "transactionsRoot": "0xb3b114e634754c6bfa0ecc90e6d28243cd956ed2f063994b61ed8bad2f0ee8f8",
      "transactionRoot": "0x8d669cc4f99769216442cd514013930b7e21bf37ca4f4eca1cfd1d58a71c05f4"
    }
  }
}
```

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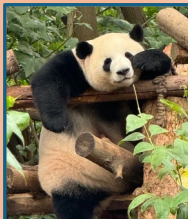
Terribly inefficient
ETH transfers
from smart contracts

Learn more

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Devnet

Nimbus + EthereumJS + Helios

Buidling guides

Verifying wallets

Web3 purifiers

Developer tools

Kurtosis network config

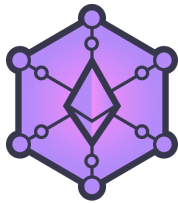
RLP → SSZ converting explorer

SSZ StableContainer implementations



<https://fusaka-light.box>

Related sessions



Gajinder Singh, Jason Chaskin

Today Verkle + Tomorrow ZK = Everything Stateless, Everything Lightclient

Nov 13th — 4:30 PM - 5:00 PM

Talk - Stage 2



Noah Citron

The Future of Light Clients

Nov 13th — 5:30 PM - 6:00 PM

Talk - Stage 5