

What a blockchain looks like

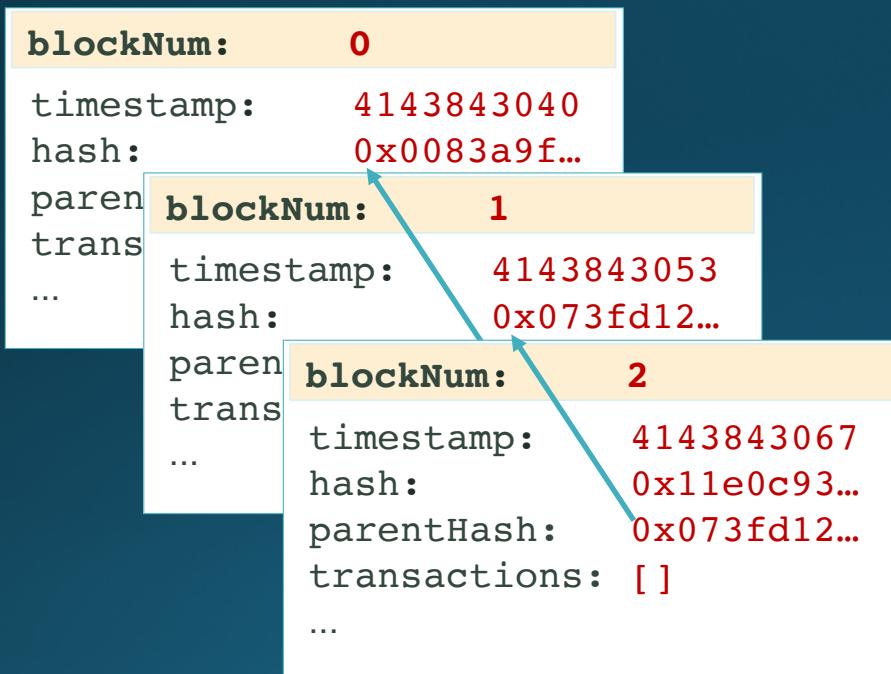
Data, Data, Data

# Blockchain

- blockchain == linked-list of blocks

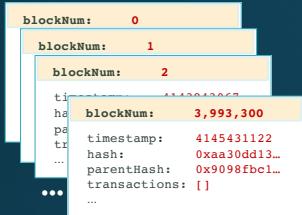
# Block

- blockchain == linked-list of blocks



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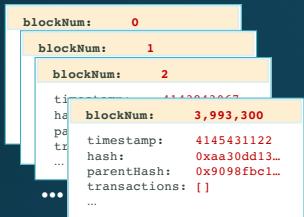
The Block Data Structure

field	description
number:	block number
timestamp:	unix timestamp when collated
hash:	hash of the block
parentHash:	hash of the parent block
nonce:	hash of the proof-of-work
transactions:	array of transactions
gasUsed:	total gas used in all txs
transRoot:	transaction trie root
stateRoot:	state trie root
receiptsRoot:	receipts trie root
logsBloom:	bloom filter for the block's logs
miner:	address that won mining rewards
gasLimit:	maximum gas allowed in this block
difficulty:	difficulty for this block
totDifficulty:	total difficulty of the chain
size:	size of this block in bytes
uncles:	array of uncle hashes
sha3Uncles:	SHA3 of uncles in the block
extraData:	extra data

block / txs data

# Block

- blockchain == linked-list of blocks



The Block Data Structure

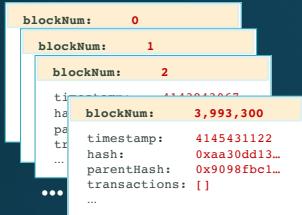
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tries and blooms

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mining data

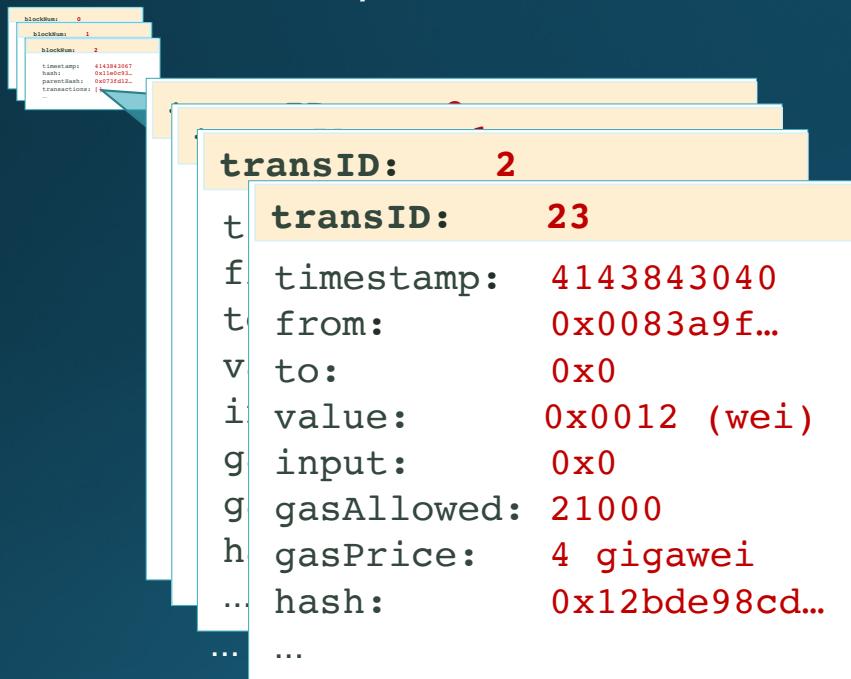
# Transaction

- block == array of transactions

```
blockNum: 0
blockNum: 1
blockNum: 2
...
has blockNum: 3,993,300
parentHash: 4145431122
timestamp: 0xa000000000000000...
hash: 0xa000000000000000...
parentHash: 0x9098fbcl...
transactions: []
...
...
```

# Transaction

- block == array of transactions



# Transaction

- block == array of transactions

blockNum: 0
blockNum: 1
blockNum: 2
timestamp: 4143843067
hash: 0x40772f412...
parentHash: 0x0772f412...
transactions: [ ]

## transactions: [ ]

tmstmp	from	to	value	input	gas	price	hash
41438...	0x00839f...	0x431bca...	34000	0x0	21000	400000	0x6c2e7275...
41438...	0x33efca...	0x0	0	0x7d124a0...	78298	400000	0xa70c3cd0...
41438...	0xa738bc...	0x33efca...	500010	0x0	21000	400000	0x12bde9cd...
41438...	0x0083a9...	0xa738bc...	0	0xe2ba92...	87290	400000	0xe22a923c...

# Transaction

- block == array of transactions

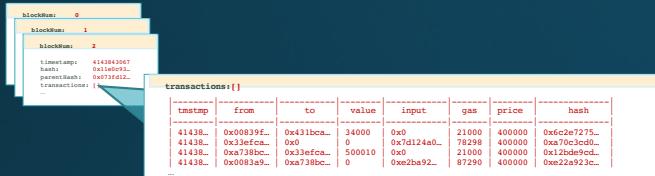
blockNum: 0  
blockNum: 1  
blockNum: 2  
timestamp: 4143843067  
hash: 0x07f3fd12...  
parentHash: 0x07f3fd12...  
transactions: [ ]

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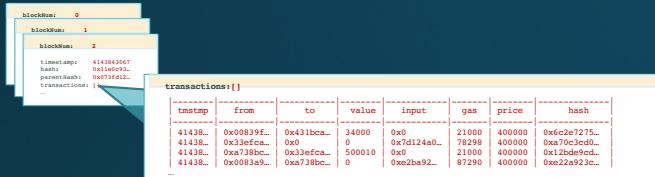


# The Transaction Data Structure

field	description
tx id:	index of transaction in block
timestamp:	unix timestamp when added to block
from:	initiating external account
to:	recipient (may be smart contract)
value:	amount in wei (may be zero)
input:	arbitrary data containing messages, functional data, or smart contract byte code
gas:	max gas to spend on this transaction
gasPrice:	wei per gas to pay for tx
hash:	hash of transaction's data
blockNumber:	reference to block number
blockHash:	reference to block hash
nonce:	number of transactions sent by 'from'
receipt:	disposition of the transaction
traces:	traces of internal message calls

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accounting data

blockchain data

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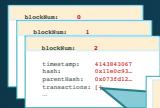
- block == array of transactions



transID:	0
timestamp:	4143843040
from:	0x0083a9f...
to:	0x0
value:	0x0012 (wei)
input:	0x0
gasAllowed:	21000
gasPrice:	4 gigawei
hash:	0x12bde98cd...
...	

# Transaction

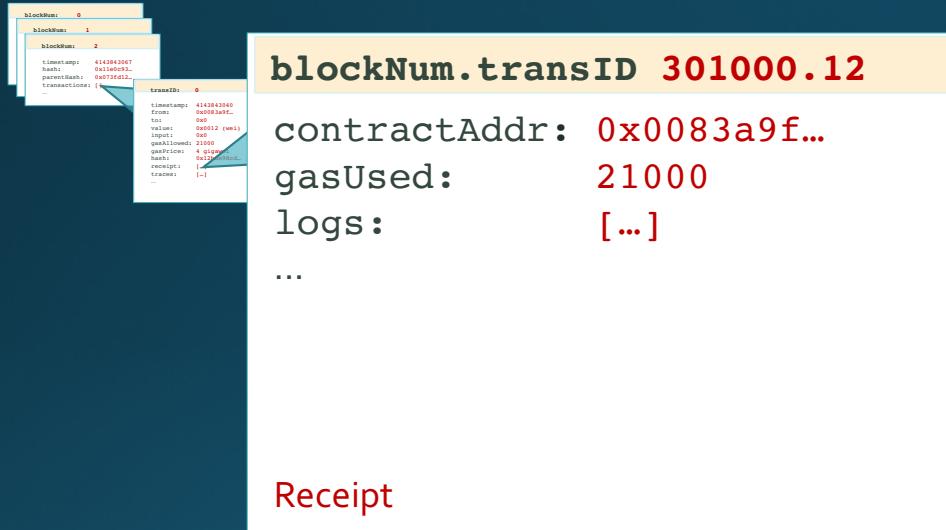
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gasAllowed:	21000
gasPrice:	4 gigawei
hash:	0x12bde98cd...
receipt:	[ ... ]
traces:	[ ... ]
...	

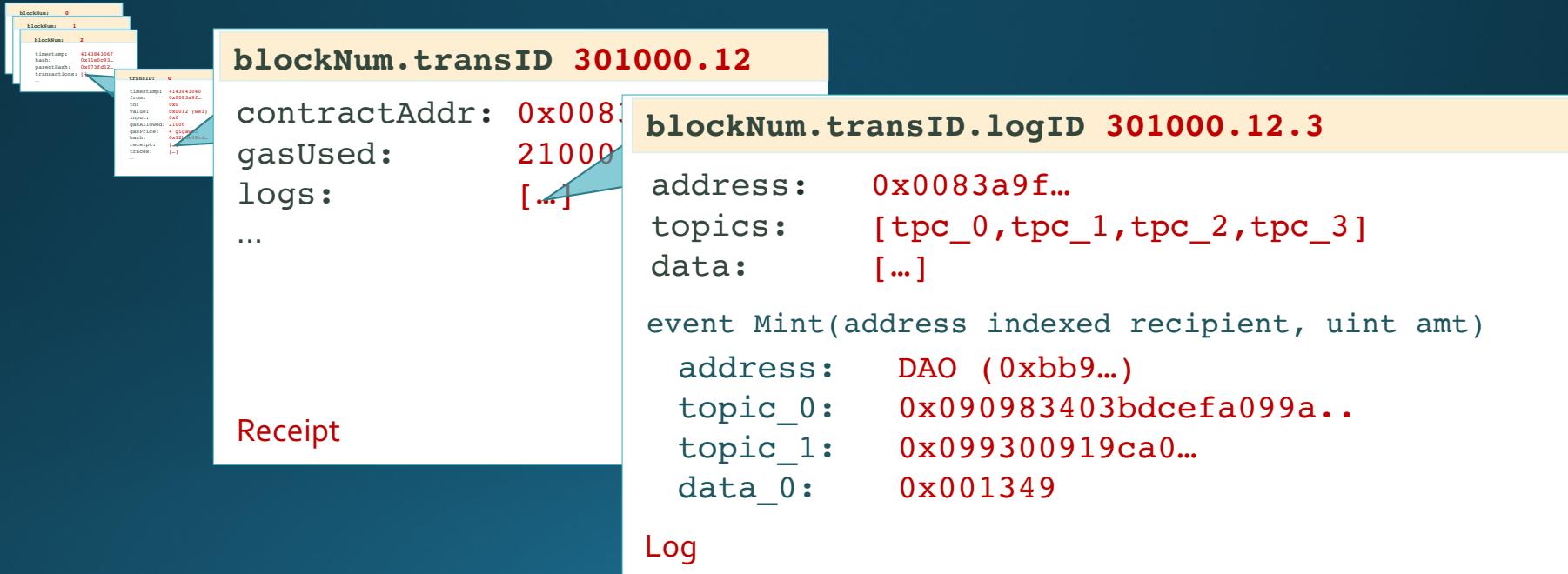
# Receipt

- transaction == when, to, from, value, input, receipt



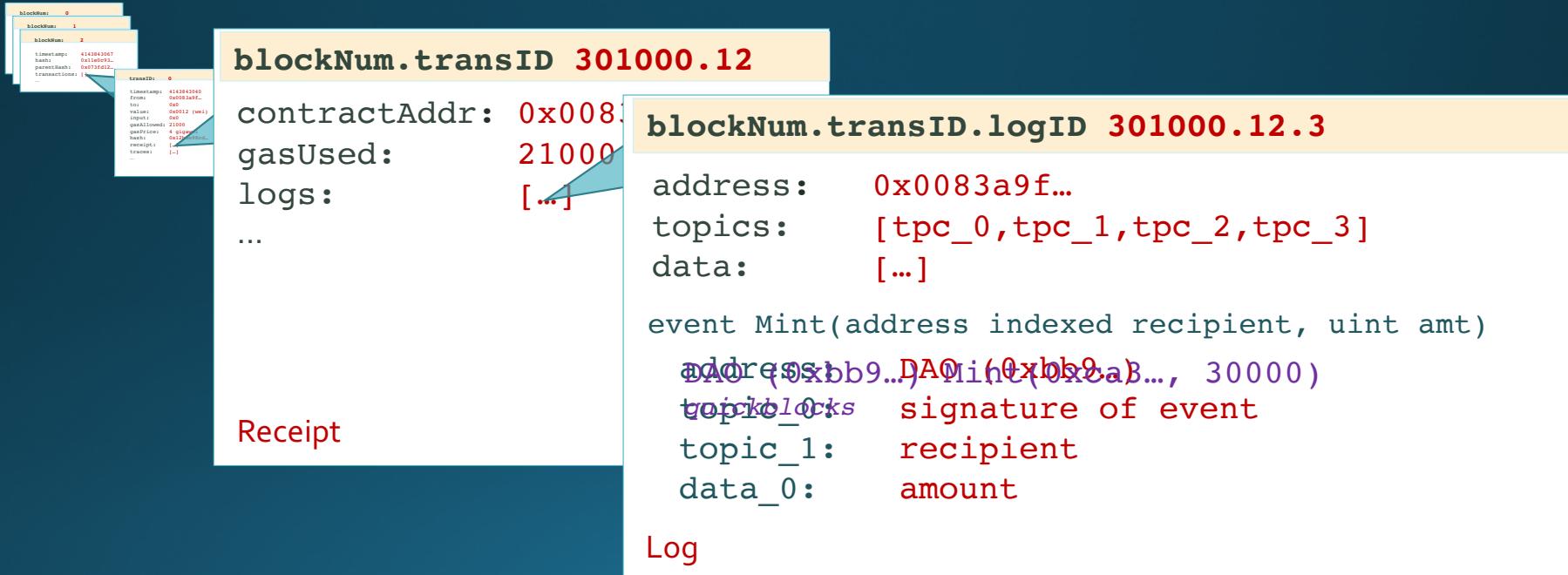
# Receipt

- transaction == when, to, from, value, input, receipt (with logs)



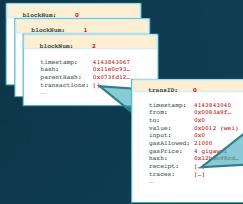
# Receipt

- transaction == when, to, from, value, input, receipt (with logs)



# Receipt

- transaction == when, to, from



**blockNum.transID 30100**

contractAddr: 0x008...  
gasUsed: 21000  
logs:  
[...]

Receipt

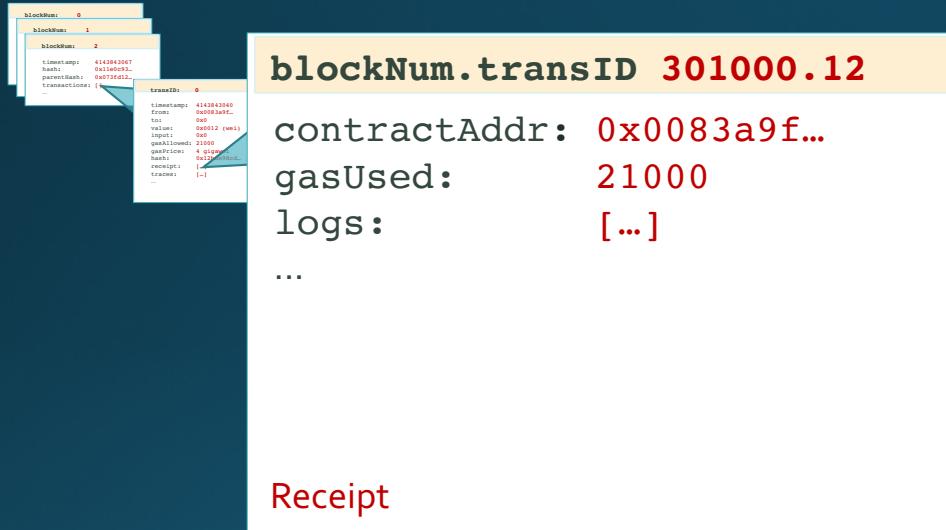
The Log Data Structure

field	description
logIndex:	index of log in the transaction
blockNumber:	reference to block timestamp
blockHash:	reference to block hash
transactionHash:	reference to transaction hash
transactionIndex:	index of transaction in the block
b	address: contract address from which logs should originate
a	topics: an array of 32 bytes indexed event parameters
t	data: max gas to spend on this transaction
...	[ ... ]

Log

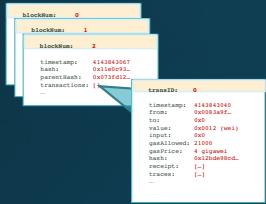
# Receipt

- transaction == when, to, from, value, input, receipt (with logs)



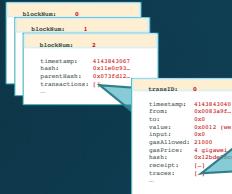
# Traces

- transaction == when, to, from, value, input, receipt, **traces**



# Receipt

- transaction == when, to, from, value, input, receipt, **traces**



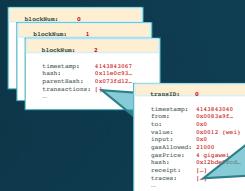
**blockNum.transID.traceID 301000.1.2**

<b>type:</b>	<b>call</b>
<b>action</b>	
<b>from:</b>	<b>0x1c39ba...</b>
<b>gas:</b>	<b>21000</b>
<b>input:</b>	<b>0x16c72721</b>
<b>to:</b>	<b>0x2bd23b...</b>
<b>value:</b>	<b>510000000</b>
<b>result</b>	
<b>gasUsed:</b>	<b>21000</b>
<b>output:</b>	<b>0x000001</b>
<b>subtraces:</b>	<b>1</b>
<b>traceAddress:</b>	<b>[ 0 ]...</b>

**Trace**

# Receipt

- transaction == when, to, from, value, input, receipt, **traces**



traces: [ ]				
from	to	value	input	gas
0x00839f...	0x431bca...	34000	0x0	21000
0x33efca...	0x0	0	0x7d124a0...	78298
0xa738bc...	0x33efca...	500010	0x0	21000
0x0083a9...	0xa738bc...	0	0xe2ba92...	87290

function vote(uint proposalID, bool supports) { ... }

0xc9d27afe 0ooooooooooooooooooooooocf2 0ooooooooooooooooooooo1

vote 33<sup>14</sup> true. (quickblocks)

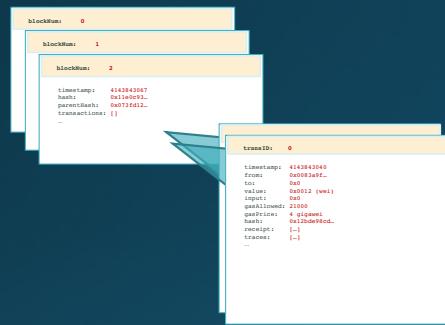
# Blockchain

- A linked list of blocks...



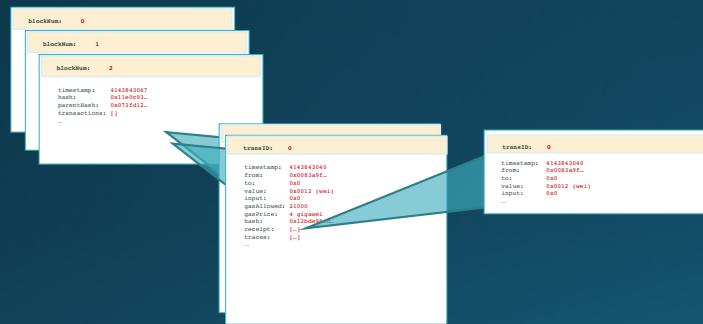
# Blockchain

- A linked list of blocks...arrays of transactions (to, from, when, amount, input)...



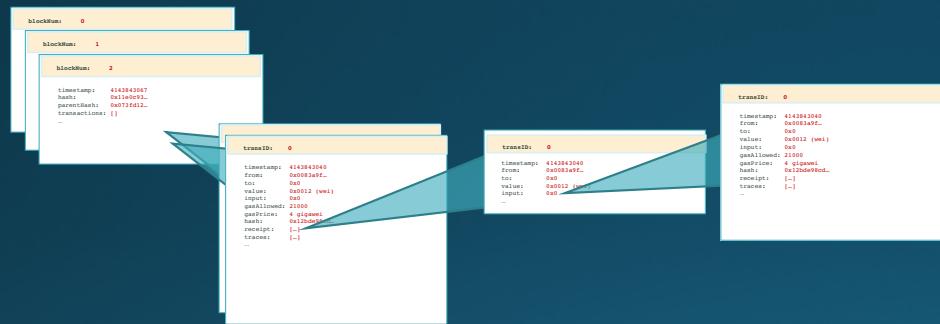
# Blockchain

- A linked list of blocks...arrays of transactions (to, from, when, amount, input)...with receipts...



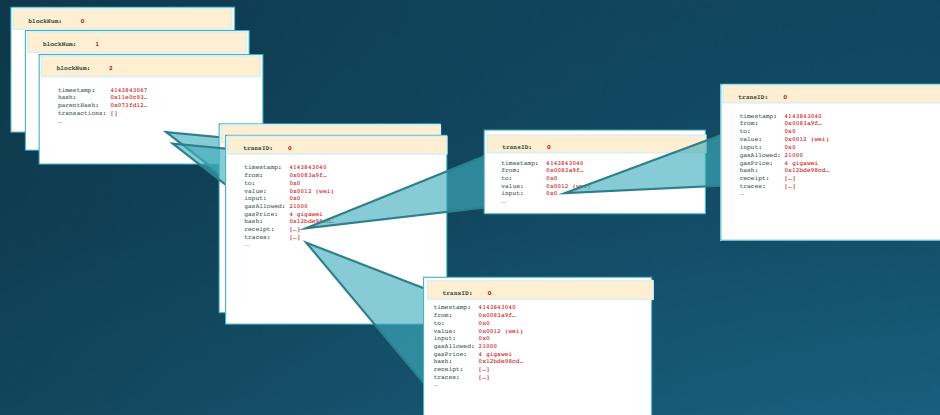
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- A linked list of blocks...arrays of transactions (to, from, when, amount, input)...with receipts...and logs...



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- A linked list of blocks...arrays of transactions (to, from, when, amount, input)...with receipts...and logs...and traces.



# QuickBlocks

- Same data, easier to understand

both internal and external transactions: []								
tmstmp	from	to	value	input	gas	price	hash	
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