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# Smart Contracts and Decentralized Finance Transactions

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# Transactions on Ethereum

**A transaction is a message sent from an externally owned account (EOA).**

Transactions can modify states:

- Ether balances of accounts
- Contract account's (CA) storage

Transactions optionally contain:

- Ether
- Data

## Transactions by Recipient



**EOA to EOA**  
ETH transfer

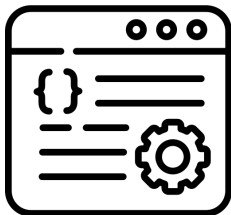


**EOA to CA**  
ETH transfer  
Contract execution



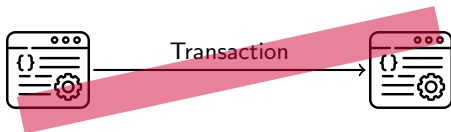
**EOA to 0**  
Contract deployment

# Internal Transactions



## Contract Accounts Send Internal Transactions

CAs can only issue internal transactions / internal calls. A (non-internal) transaction can never originate with a smart contract. In other words: Initially, CAs **must** be triggered by an EOA transaction.



# Transactions and Calls

**Transaction:** Must originate with an EOA. States can only be changed through transactions and each transaction leads to a state change. May contain multiple internal transactions and/or internal calls.

**Call:** A call is executed locally (on the node). It is read-only, i.e., does not lead to state changes.

**Internal Transaction:** An internal transaction is a transaction that is part of another transaction. The internal transaction must be executed alongside the containing transaction.

**Internal Call:** An internal call is a call that is part of a transaction. The internal call must be executed alongside the containing transaction. Note that, in contrast to a regular call, internal calls are s.t. network fees.

# A Detailed Look at Ethereum Transactions

Ethereum Transactions **always** contain the following data points:

- **Recipient Address:** The recipient's hexadecimal address.
- **Nonce:** Transaction count from sender.
- **Signature:** Consisting of the variables V, R and S.
- **Gas Limit:** Maximum number of transaction execution steps.
- **Gas Price:** Fee the sender is willing to pay per execution step.

Depending on the transaction purpose, they **further** include:

- **Value:** Ether value in Wei, where  $10^{18}$  Wei = 1 ETH.
- **Data:** Contract execution or deployment instructions.

# EOA to EOA

Overview	Access List	State	Comments
Transaction Hash:	0xdd8888cc23048f9f577eb49eb3cdfaeae1a3709e2730bdf8ddc7f692d71c385 <a href="#">🔗</a>		
Status:	<div>Success</div>		
Block:	<div>13281236</div> <div>12 Block Confirmations</div>		
Timestamp:	<div>3 mins ago (Sep-23-2021 09:39:54 AM +UTC)</div>   <div>Confirmed within 45 secs</div>		
From:	<div>0xb5d85cbf7cb3ee0d56b3bb207d5fc4b82f43f511</div> (Coinbase 5) <a href="#">🔗</a>		
To:	<div>0xe0761fe51506eefcda41399287a1e11f397efb3b</div> <a href="#">🔗</a>		
Value:	<div>0.02475 Ether</div> (\$77.17)		
Transaction Fee:	<div>0.001097571054909 Ether</div> (\$3.42)		
Gas Price:	<div>0.000000052265288329 Ether</div> (52.265288329 Gwei)		
Txn Type:	<div>2 (EIP-1559)</div>		
Gas Limit:	<div>21,000</div>		
Gas Used by Transaction:	<div>21,000 (100%)</div>		
Base Fee Per Gas:	<div>0.000000050265288329 Ether</div> (50.265288329 Gwei)		
Max Fee Per Gas:	<div>0.000000099 Ether</div> (99 Gwei)		
Max Priority Fee Per Gas:	<div>0.000000002 Ether</div> (2 Gwei)		
Burnt Fees:	<div>0.001055571054909 Ether</div>		
Txn Savings:	<div>0.000981428945091 Ether</div>		
Nonce	Position	<div>2567826</div> <div>72</div>	
Input Data:	<div>0x</div>		

## EOA to CA

[illegible]

# EOA to 0

Overview	State	Comments
Transaction Hash:	0x2efbced5ff40226635298626956df931e25b2efaa04be509fba9ad3f006b579	
Status:	Success	
Block:	8928125 4353181 Block Confirmations	
Timestamp:	679 days 14 hrs ago (Nov-13-2019 07:09:21 PM +UTC)	
From:	0xd0b108893104de4e1c5d0e47c42237db4e617acc (Maker: Deployer 4)	
To:	[Contract 0xb0606a16621616875a6c2637948bf99ea57c58fa Created]	
Value:	0 Ether (\$0.00)	
Transaction Fee:	0.021745899 Ether (\$87.82)	
Gas Price:	0.000000009 Ether (9 Gwei)	
Ether Price:	\$168.10 / ETH	
Gas Limit:	7,000,000	
Gas Used by Transaction:	2,416,211 (34.52%)	
Nonce	Position 1215 7	
Input Data:	<pre>0x608060405234801561001057600080fd5b50611231e806100206000396000f3fe608060405234801561001057600080fd5b506004361061002b5760003508e01c8003ccb2e614610030575b000080fd5b1005c0004003603602881101561004057600080fd5b101908008035066020019092919050505061009e505b004051808273ff1673ff16815260200191505060405180910390f35b6000816040516100ad90610209565b00828152602001915050604051809103906000f8001580156100d3573d6000803e3d6000fd5b5098508073ff166365fae35a36040518263ffffffff1660e01b18152600401808273ff1673ff168152602001915050600060405180830381000087803b15801561015557600080fd5b505af1158015610169573d6000803e3d6000fd5b5050505080073ff16639c52a7f1306040518263ffffffff1660e01b18152600401808273ff1673ff168152602001915050600060405180830381000087803b158015610169573d600080fd5b5050505050919050565b5120d3806102178339019056fe608060405234801561001057600080fd5b506040516120d33803806120d38339018101604052602001101561003357</pre>	
View Input As		Decode Input Data