

Ethereum EVM illustrated Modified

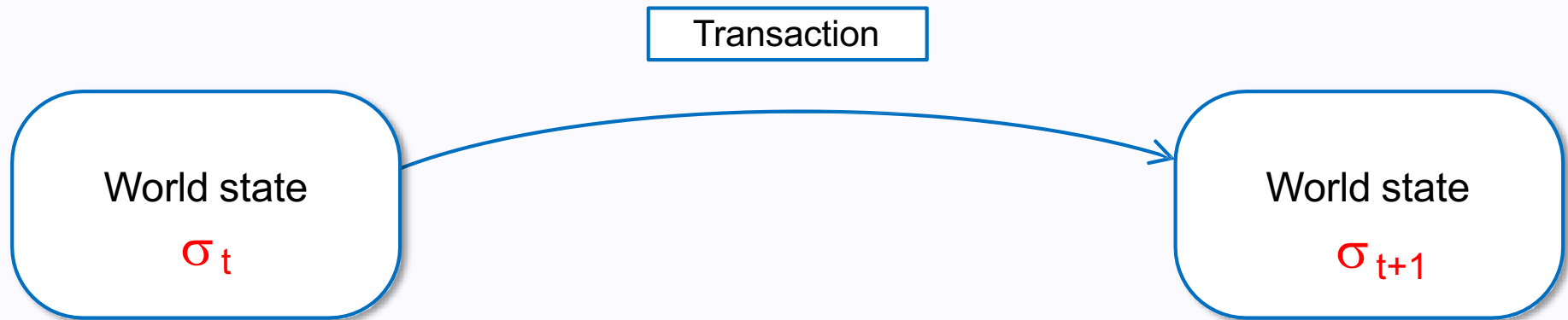
exploring some mental models and implementations

Takenobu T.

WIP

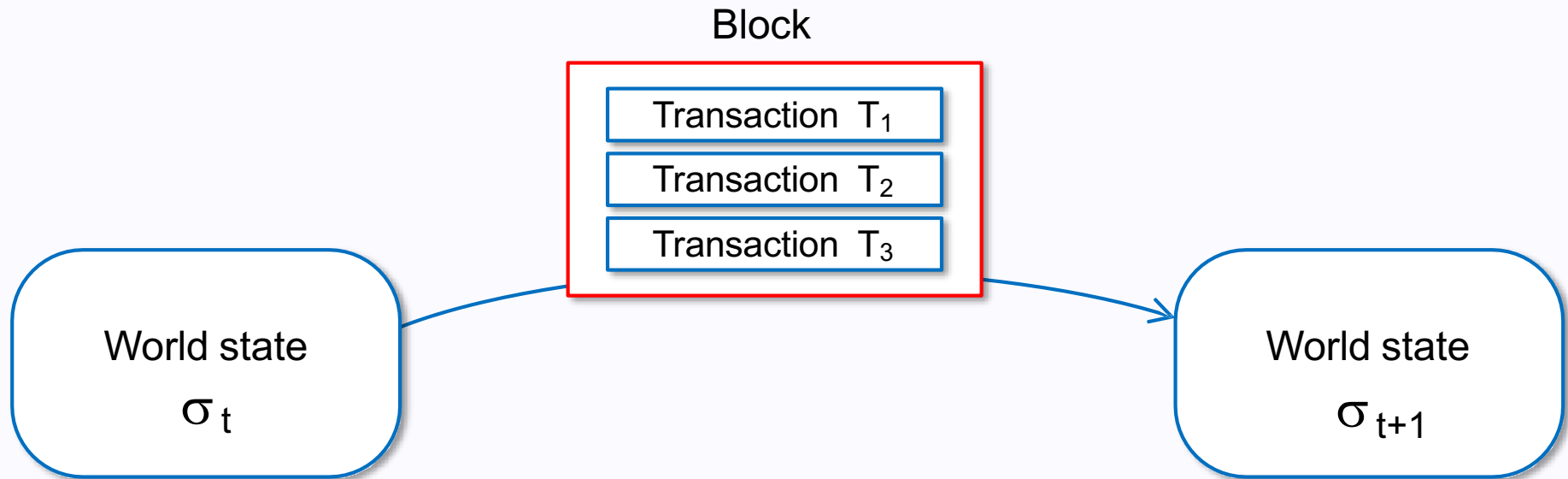
Rev. 0.01.1

A transaction-based state machine



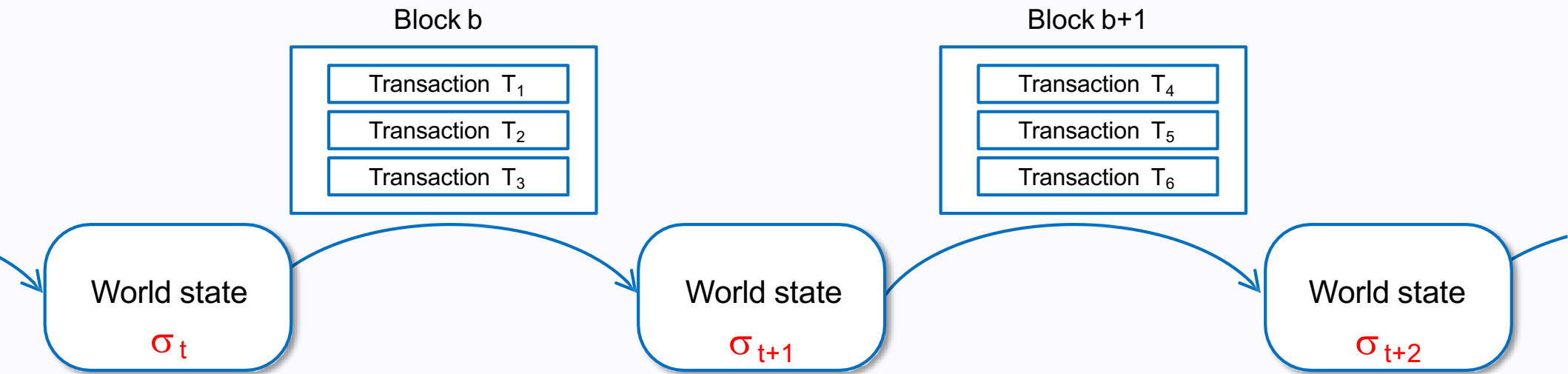
Ethereum can be viewed as a transaction-based state machine.

Block and transactions



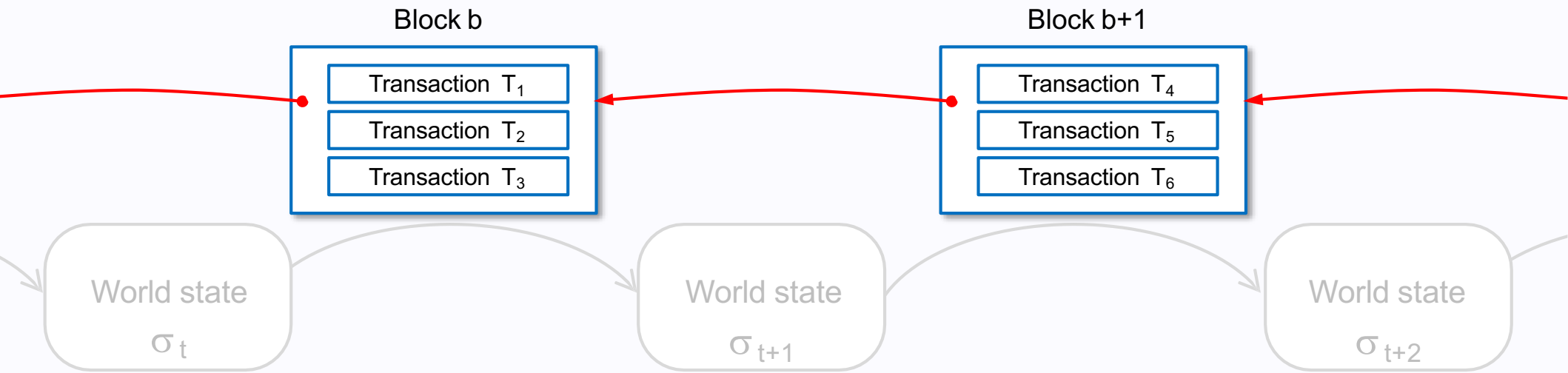
Transactions are collated into blocks.
A block is a package of data.

Chain of states



From the viewpoint of the states,
Ethereum can be seen as a state chain.

Chain of blocks: Blockchain

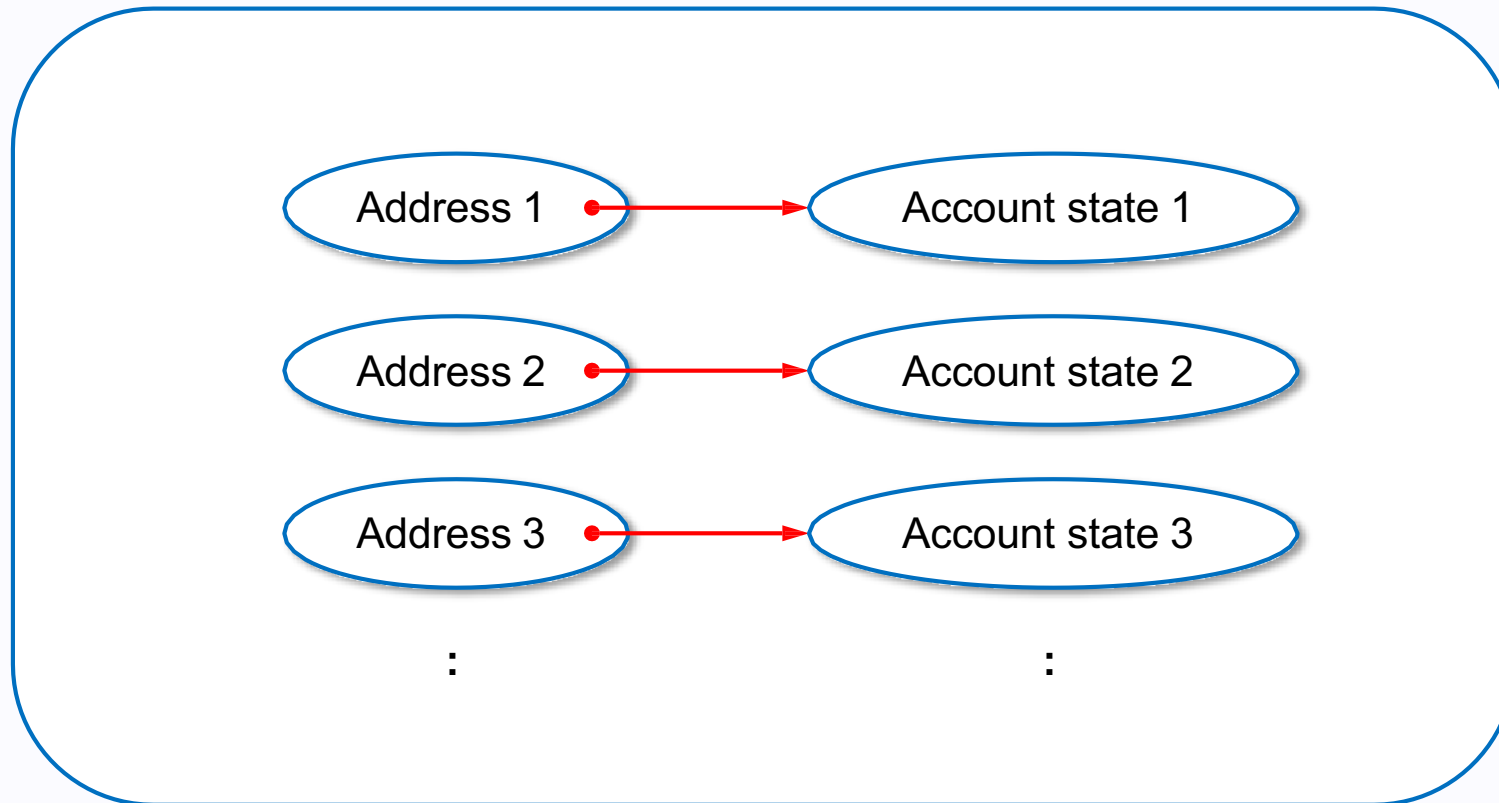


From the viewpoint of the implementation,
Ethereum can also be seen as a chain of blocks, so it is 'BLOCKCHAIN'.

World state

World state

World state σ_t



The world state is a mapping between address and account state.

Several views of world state

Mapping view

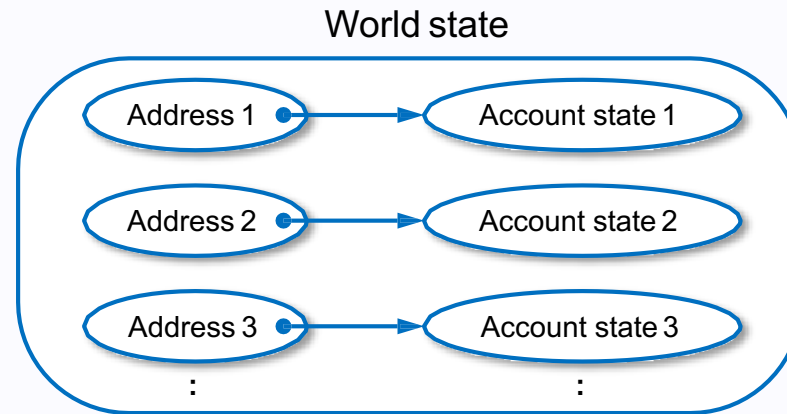


Table view

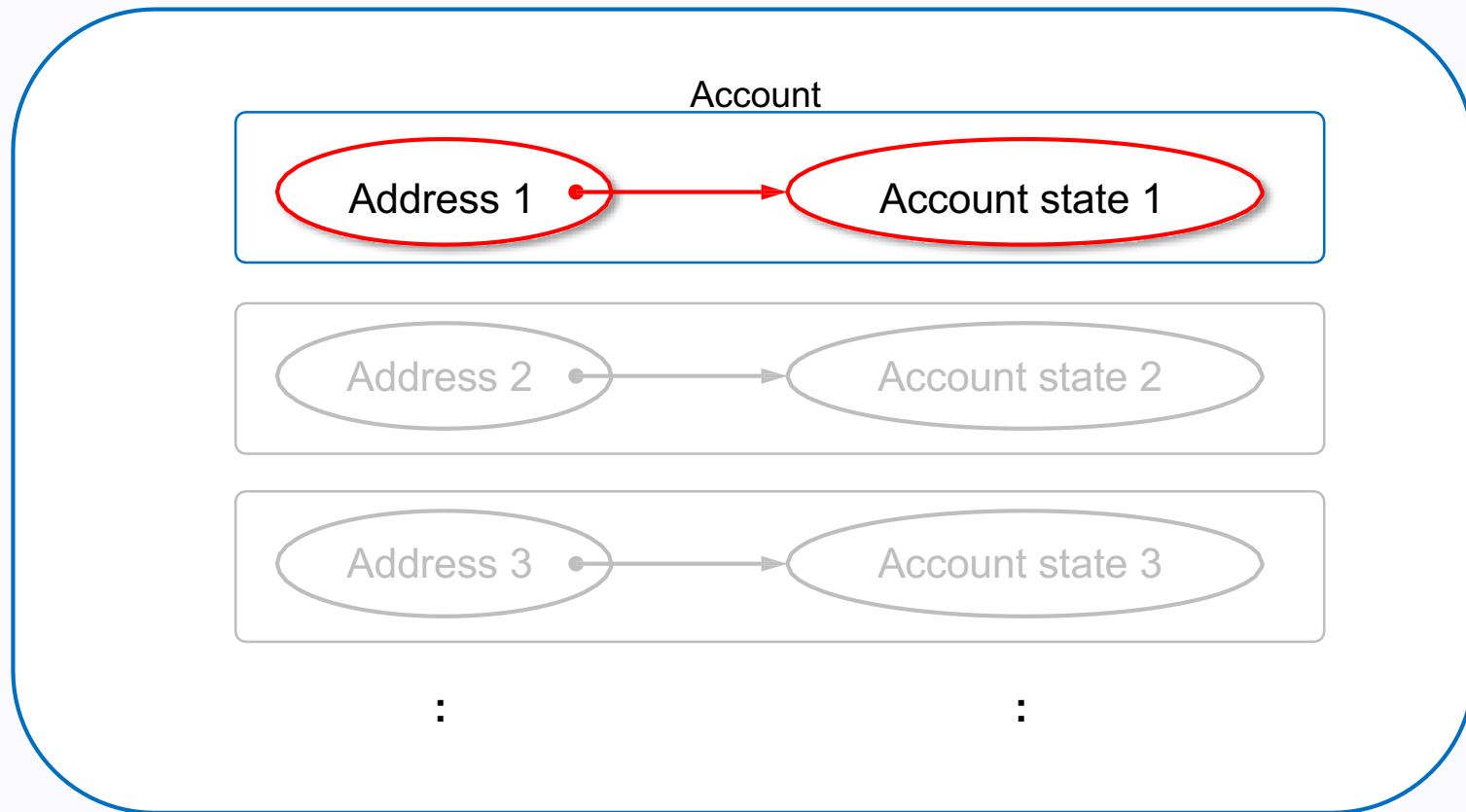
World state

Address 1	Account state 1
Address 2	Account state 2
:	:
Address n	Account state n

Account

Account

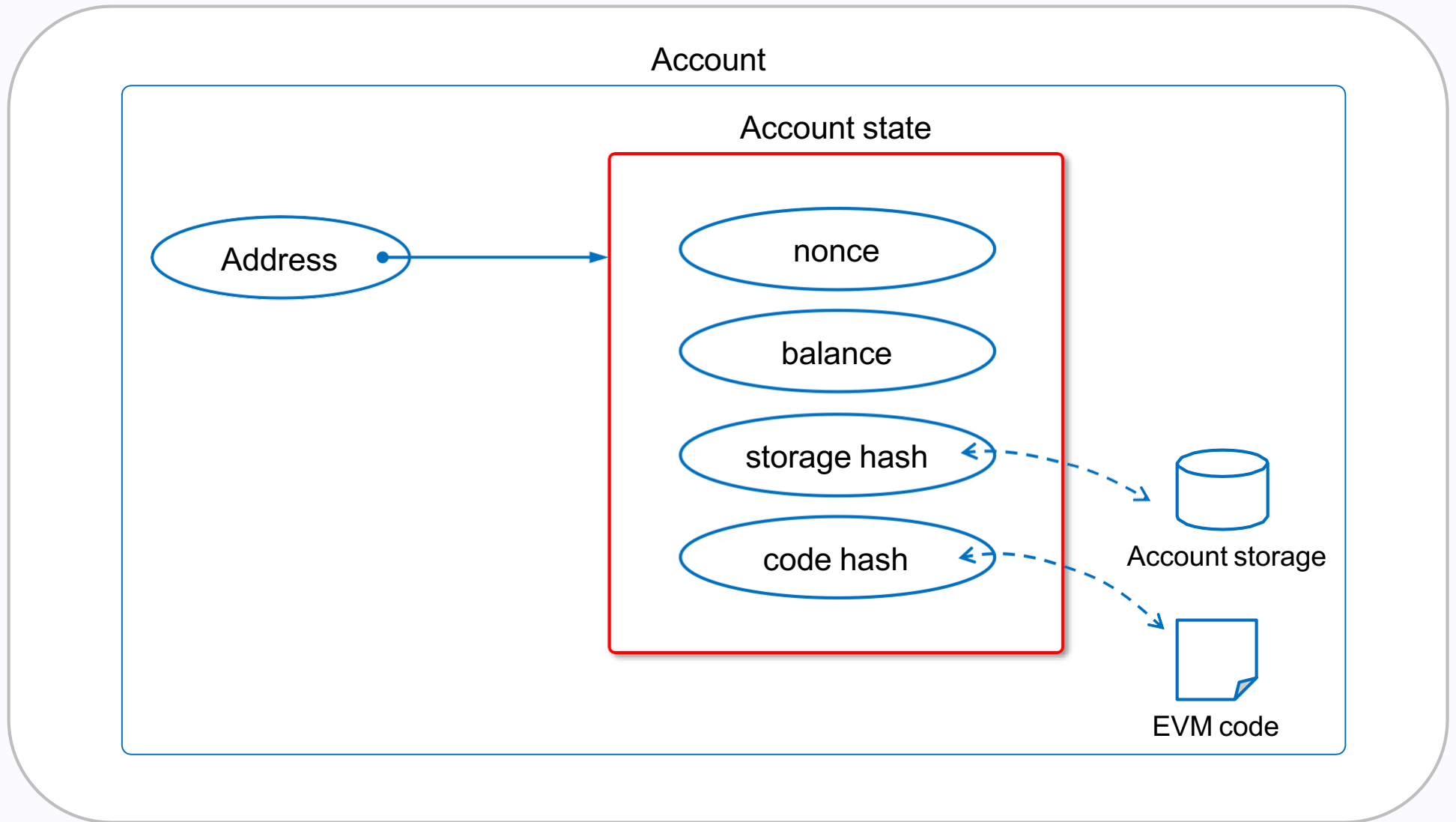
World state



An account is a mapping between address and account state.

Account state

World state



An account state could contain EVM code and storage.

Two practical types of account

External actor

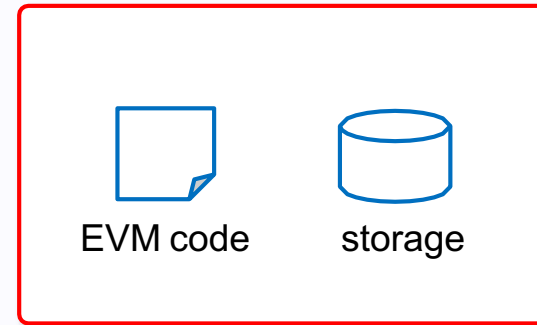


World state

Externally owned account (EOA)



Contract account



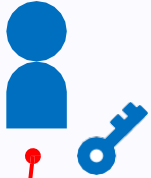
Autonomous object

EOA is controlled by a private key.

Contract account contains EVM code.

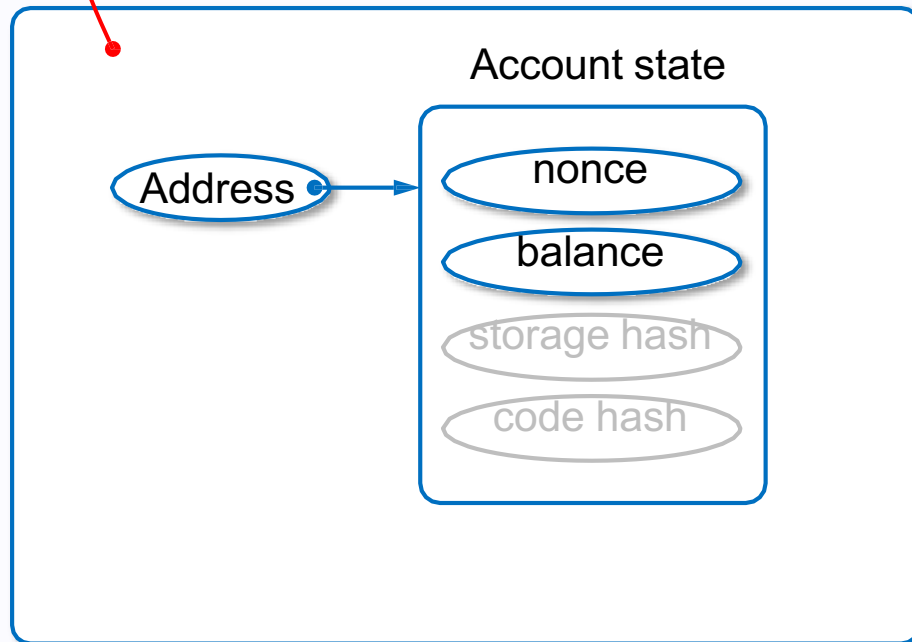
Two practical types of account

External actor

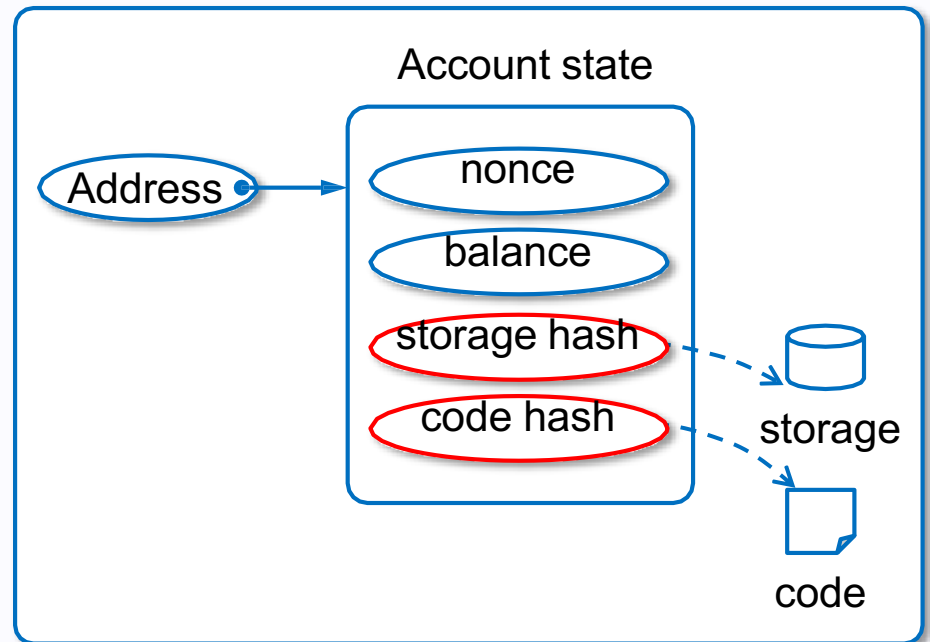


World state

Externally owned account (EOA)



Contract account

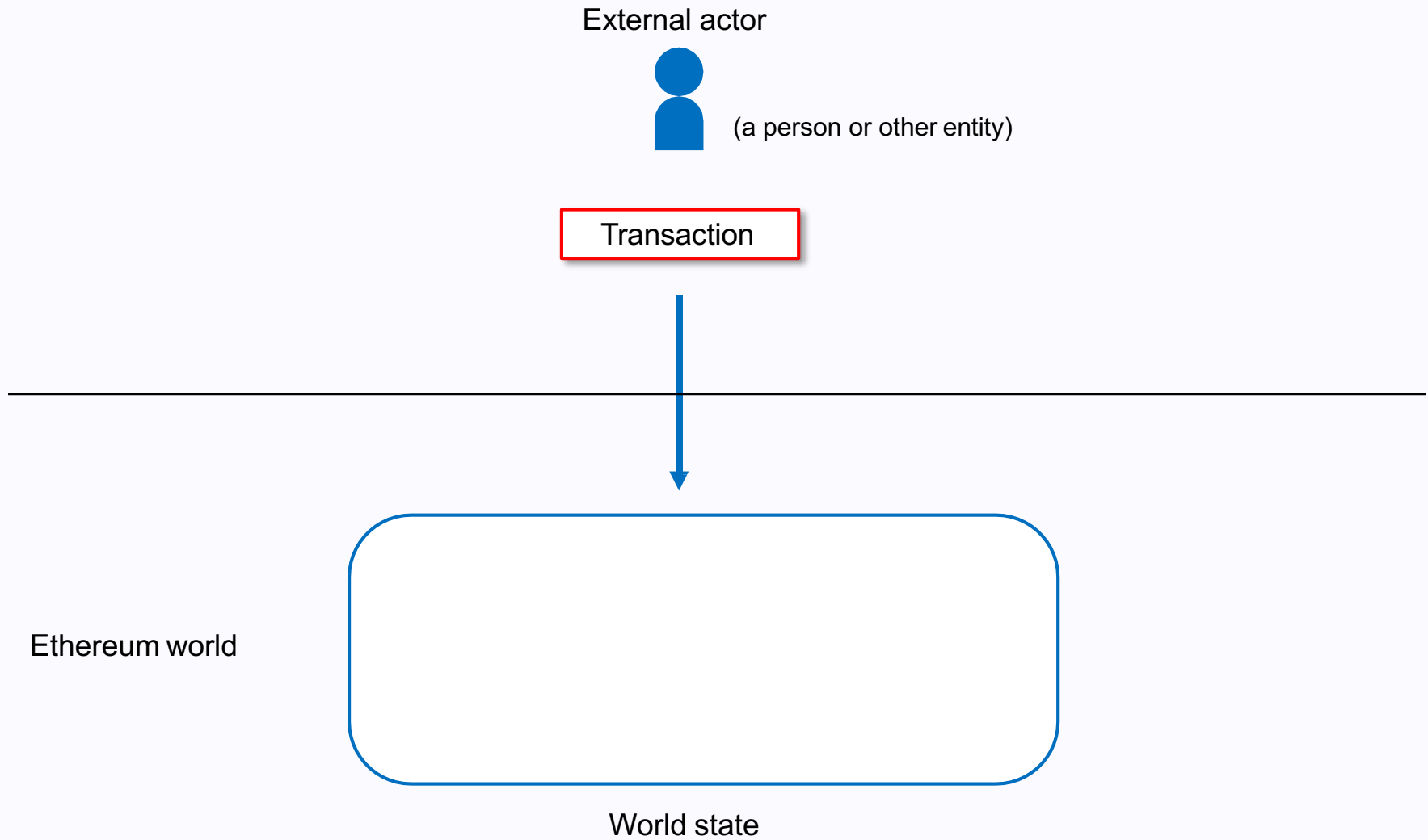


EOA is controlled by a private key.
EOA cannot contain EVM code.

Contract contains EVM code.
Contract is controlled by EVM code.

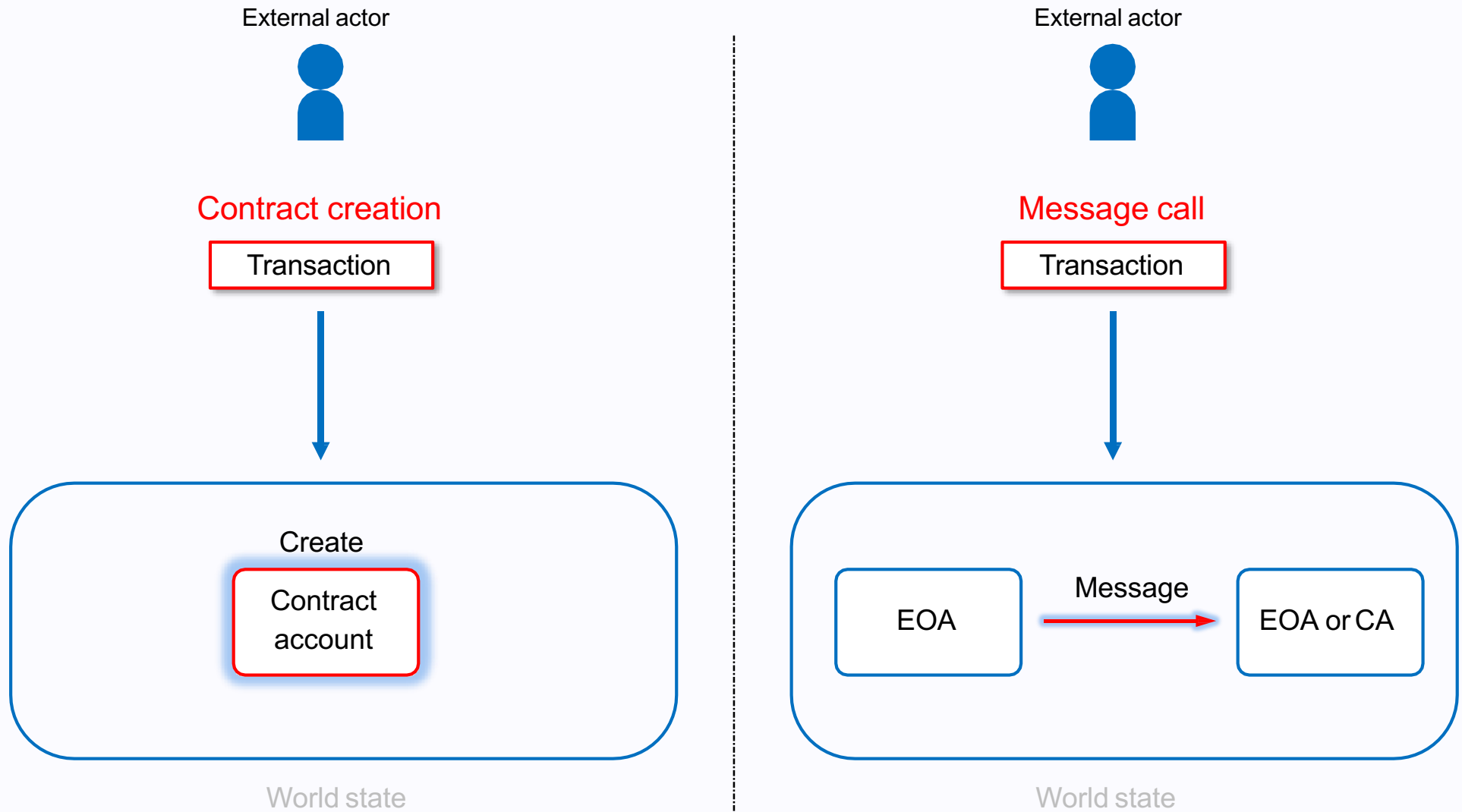
Transaction

A transaction to world state



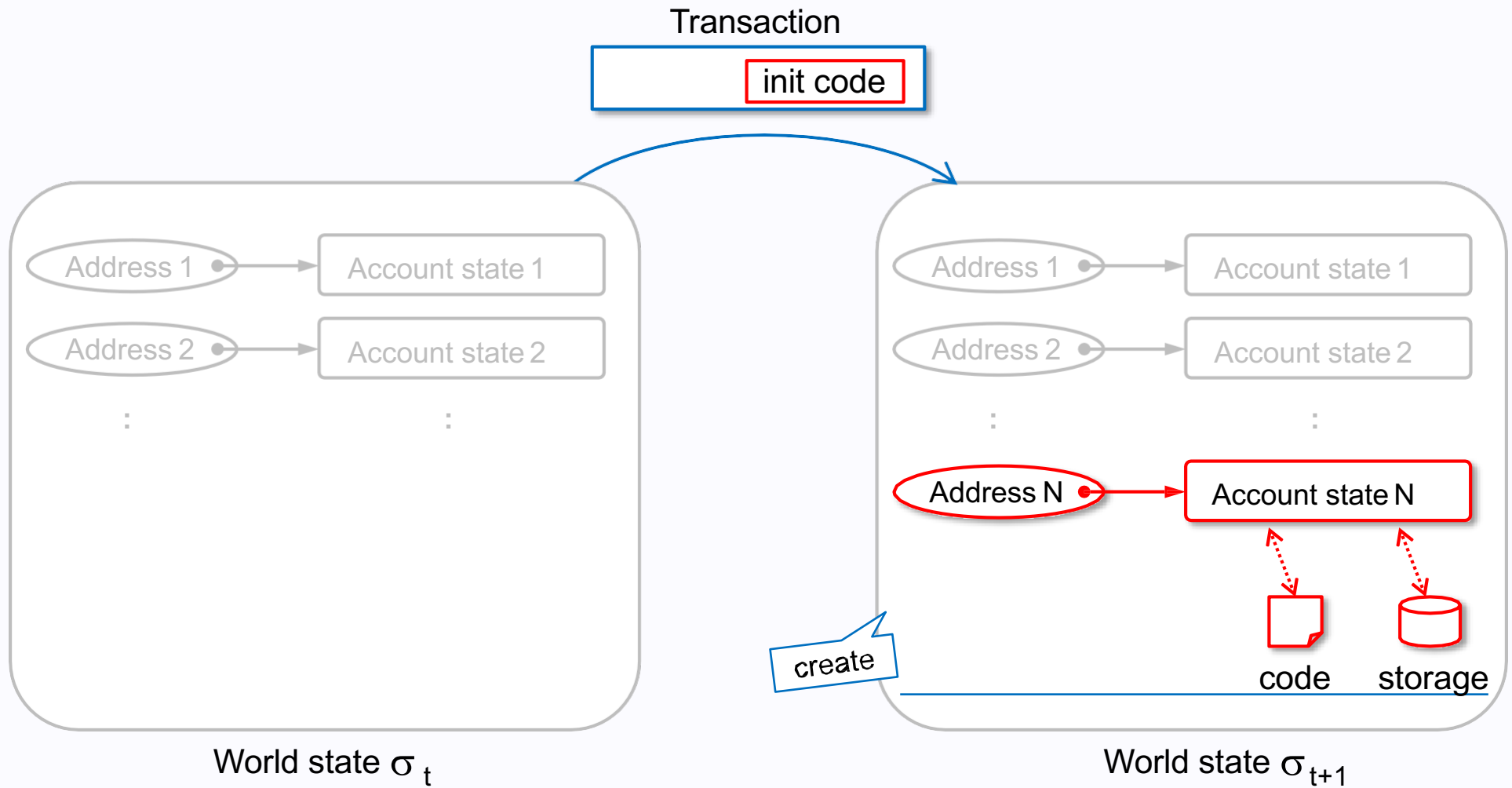
A transaction is submitted by external actor.

Two practical types of transaction

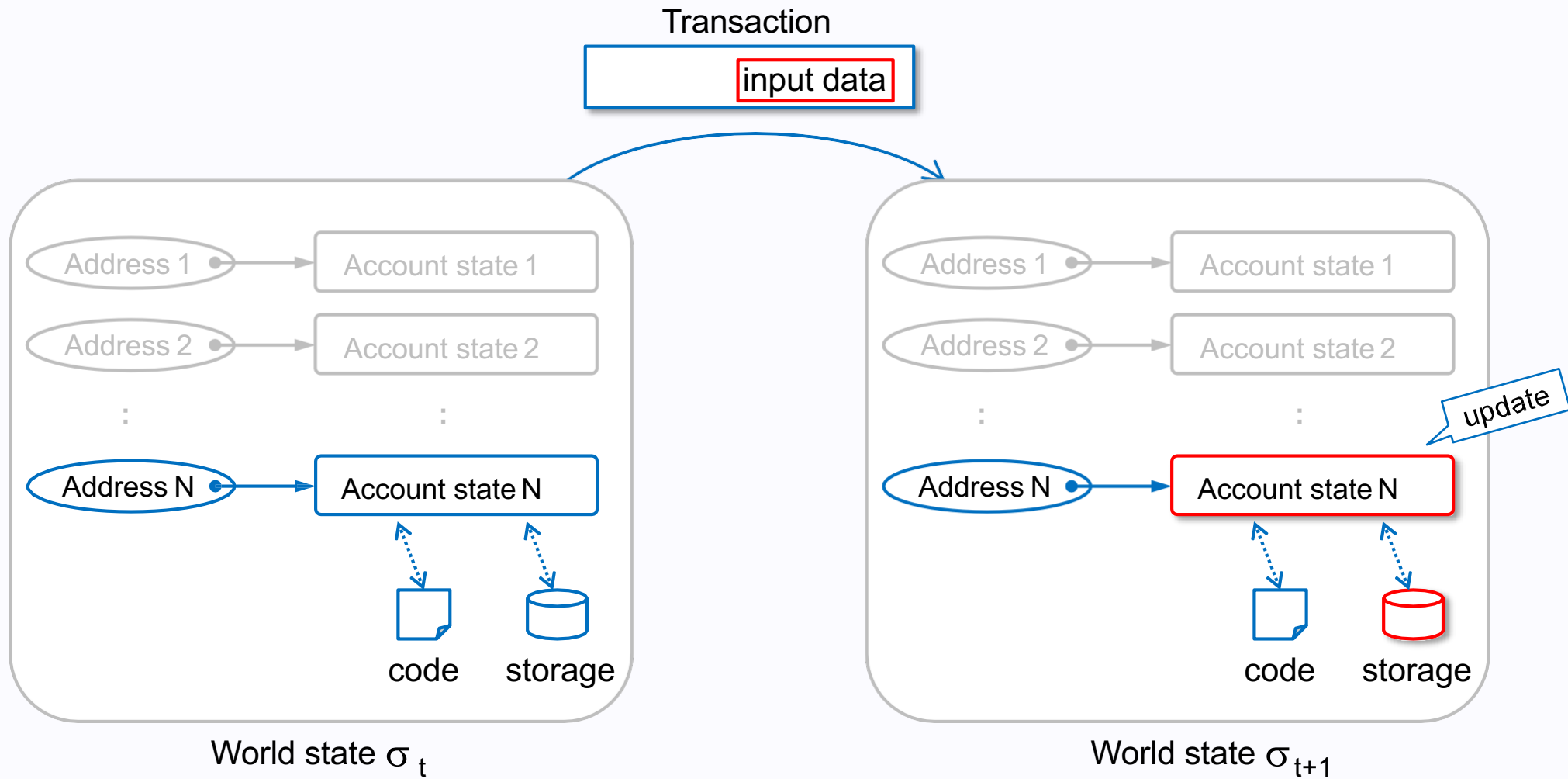


There are two practical types of transaction, contract creation and message call.

Contract creation

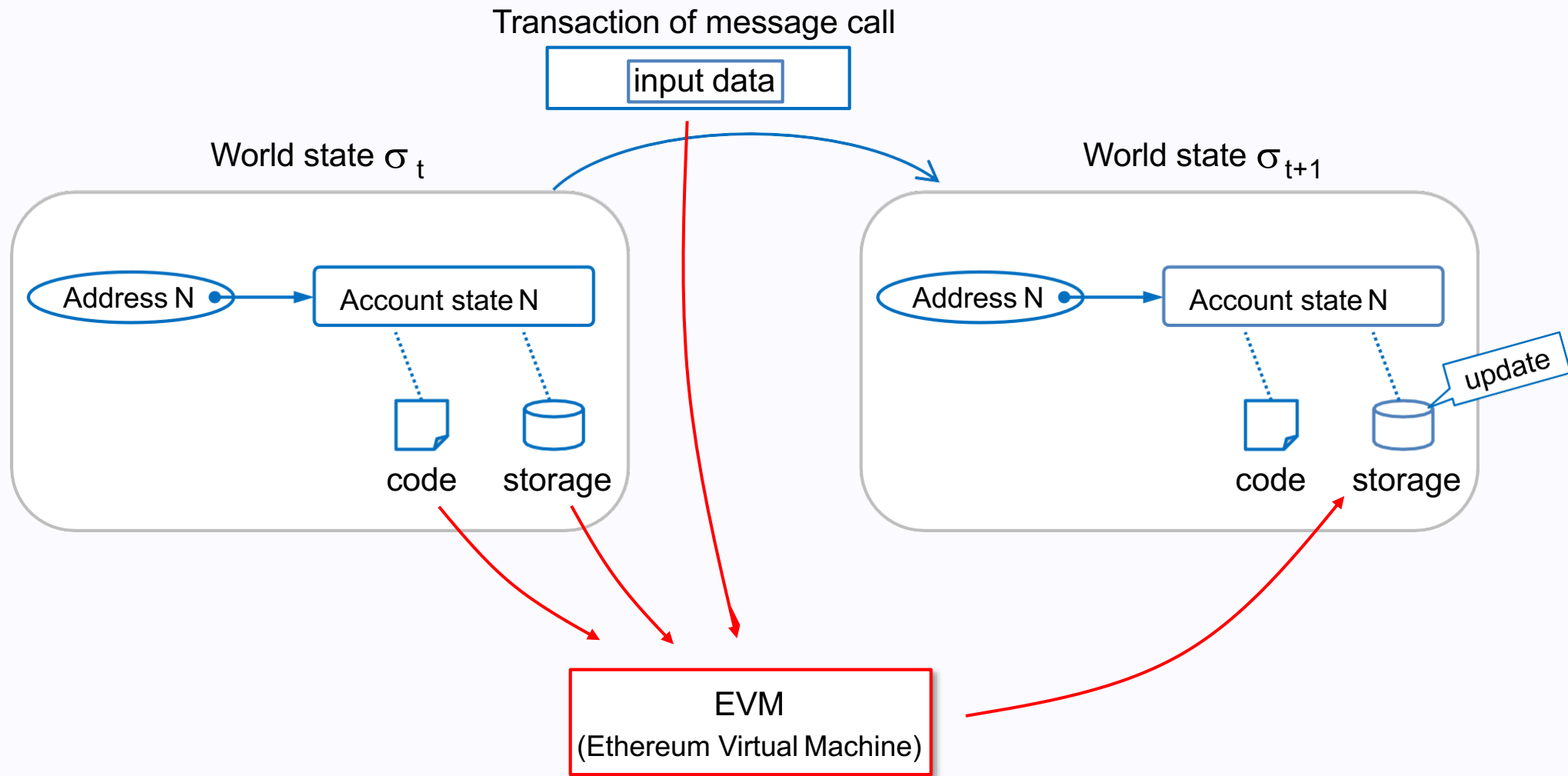


Message call



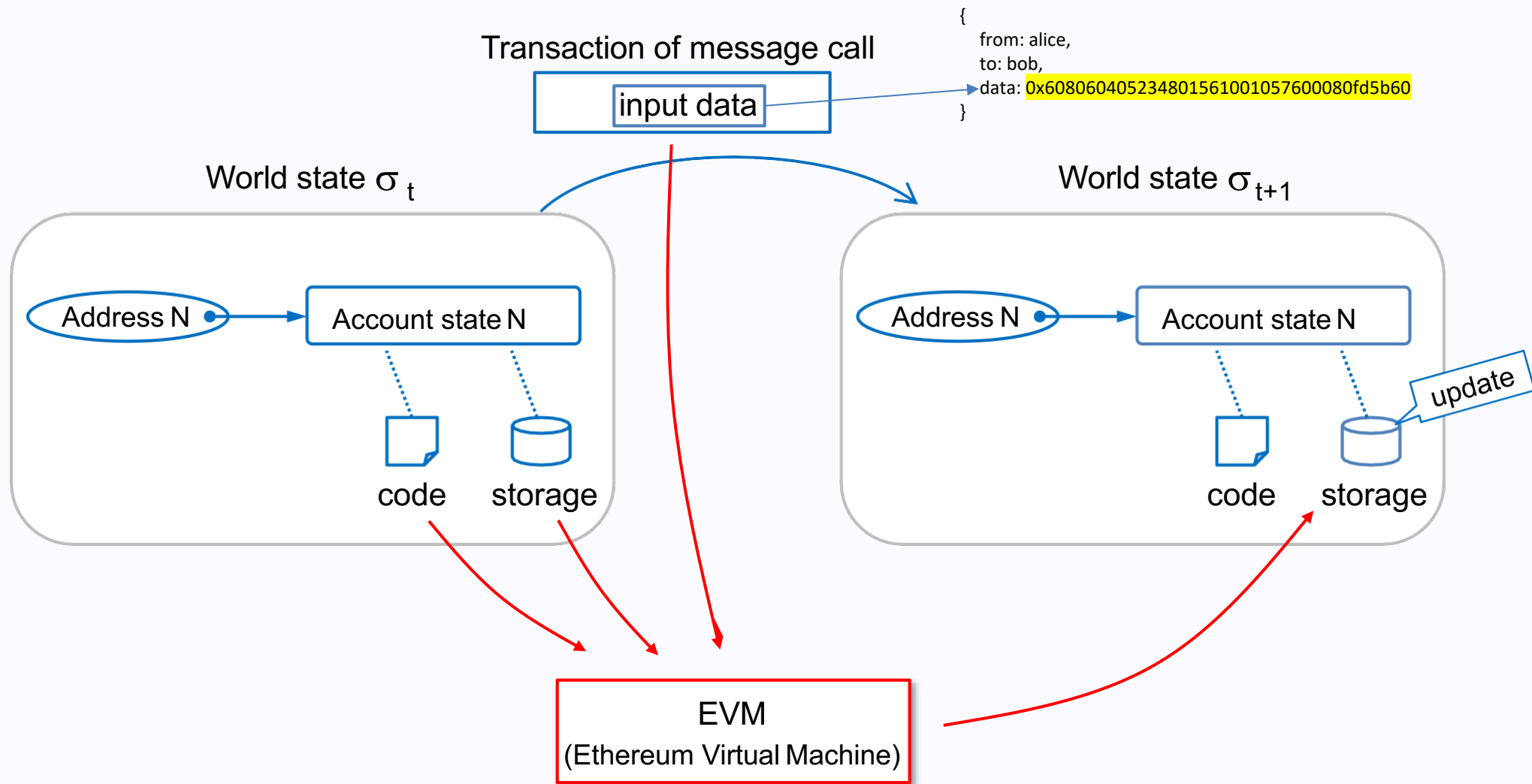
Ethereum virtual machine (EVM)

Ethereum virtual machine



EVM code is executed on Ethereum Virtual Machine (EVM).

Ethereum virtual machine



EVM code is executed on Ethereum Virtual Machine (EVM).

EVM code

Bytecode view

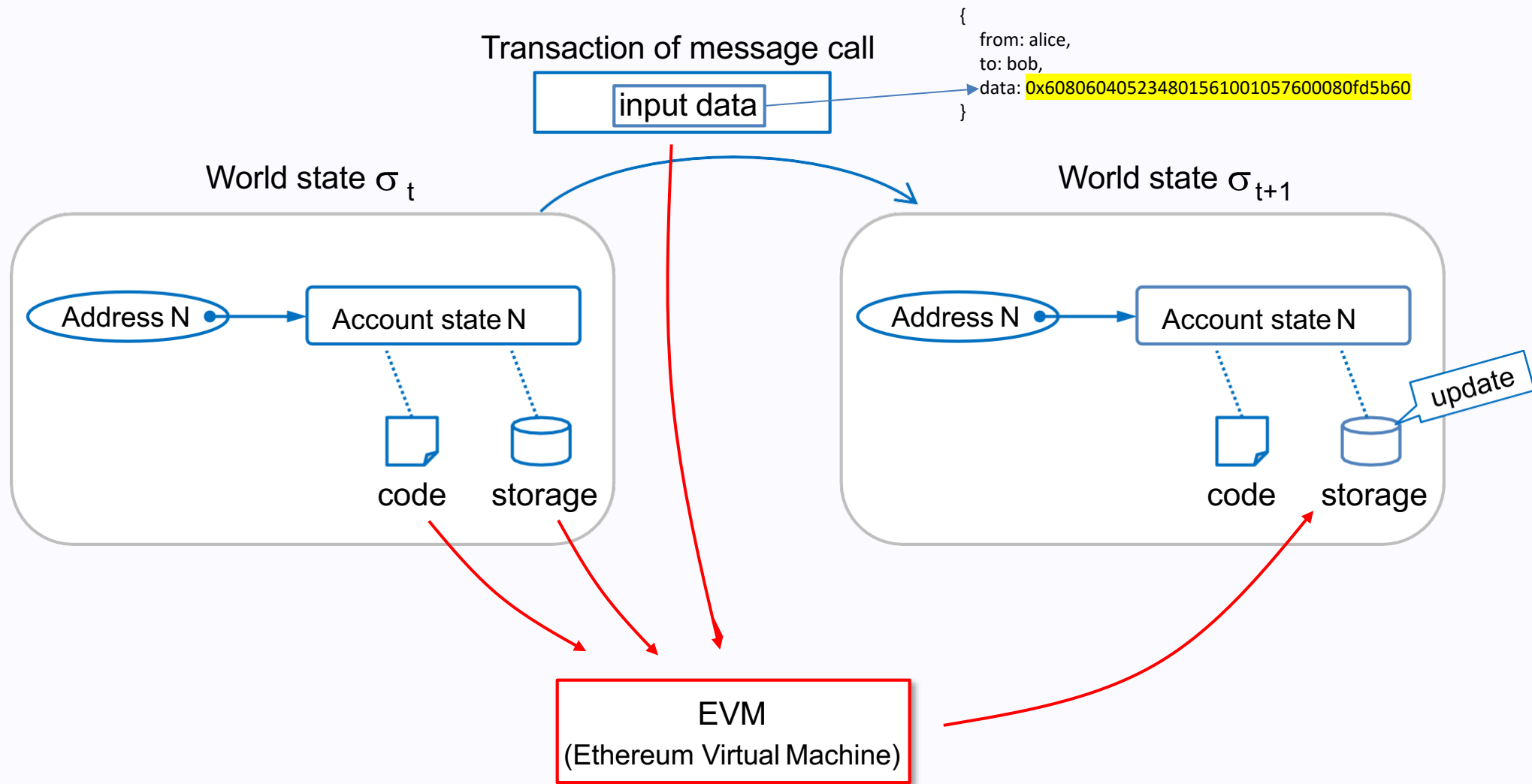
0x60e060020a600035...

Assembly view

```
PUSH1 e0  
PUSH1 02  
EXP  
PUSH1 00  
CALLDATALOAD  
:
```

EVM Code is the bytecode that the EVM can natively execute.

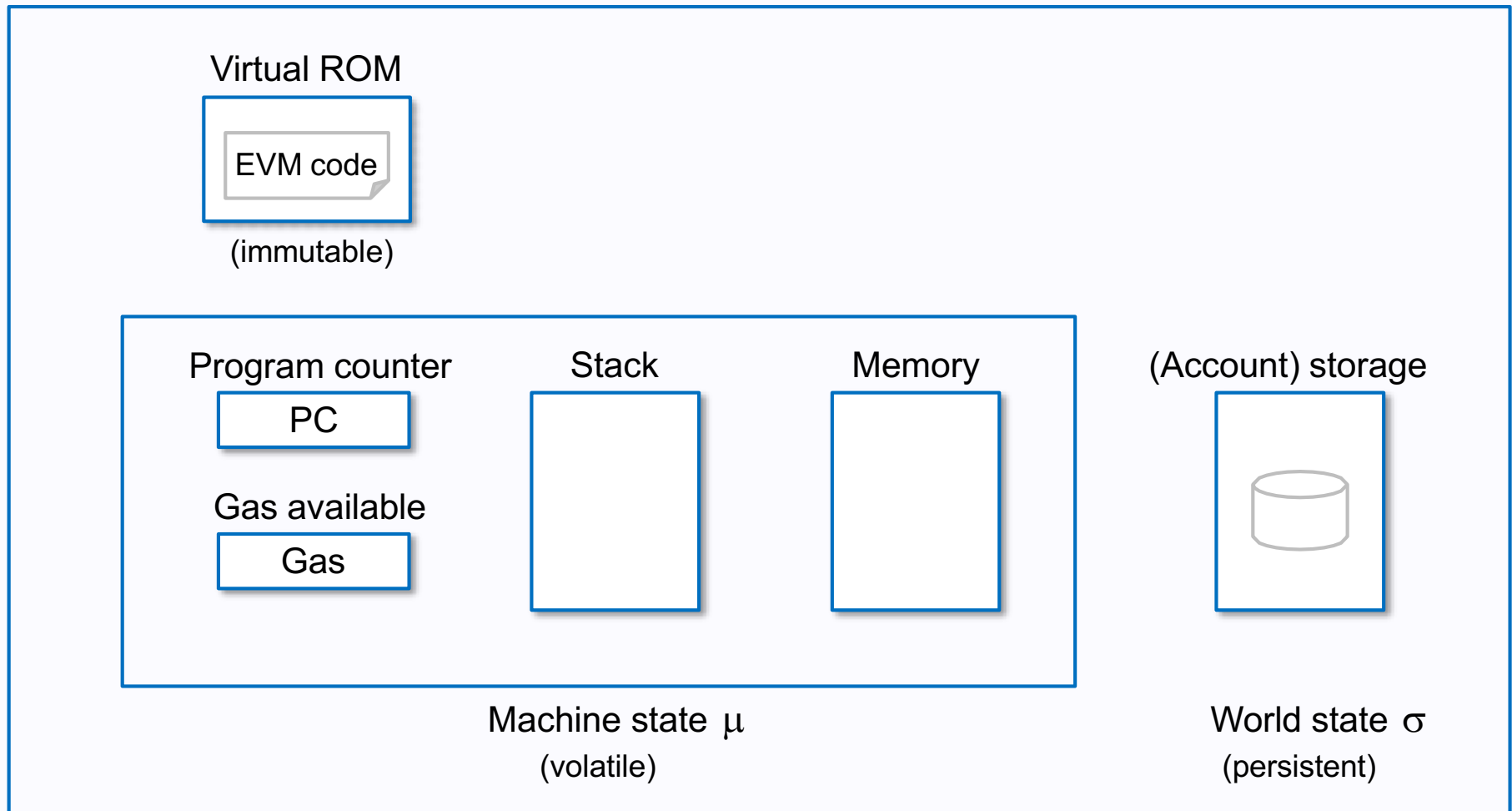
Ethereum virtual machine



EVM code is executed on Ethereum Virtual Machine (EVM).

EVM architecture

Ethereum Virtual Machine (EVM)



The EVM is a simple stack-based architecture.

Execution model

EVM

