VMs

What?

Global Supercomputer

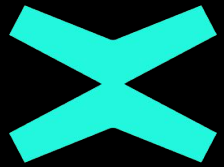
Why?

- Public Execution Layer
- Decentralized Cloud
- Distributed State Machine

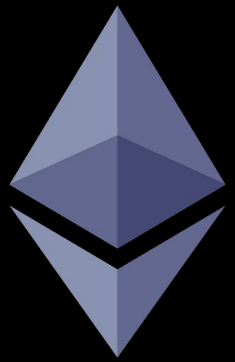
Case Study

EVM

SVM



SpaceVM



Ethereum Virtual Machine (EVM)

$$Y(S, T) = S$$

Machine state (volatile)

- Program counter (PC)
- Stack
- Gas available
- Memory

Virtual ROM (immutable)

- EVM code

World state (persistent)

- Account storage

OPCODES

Registers

Stack

stack memory

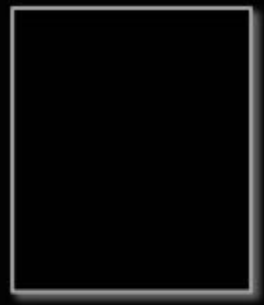
256 bits x 1024 elements

Memory

volatile memory

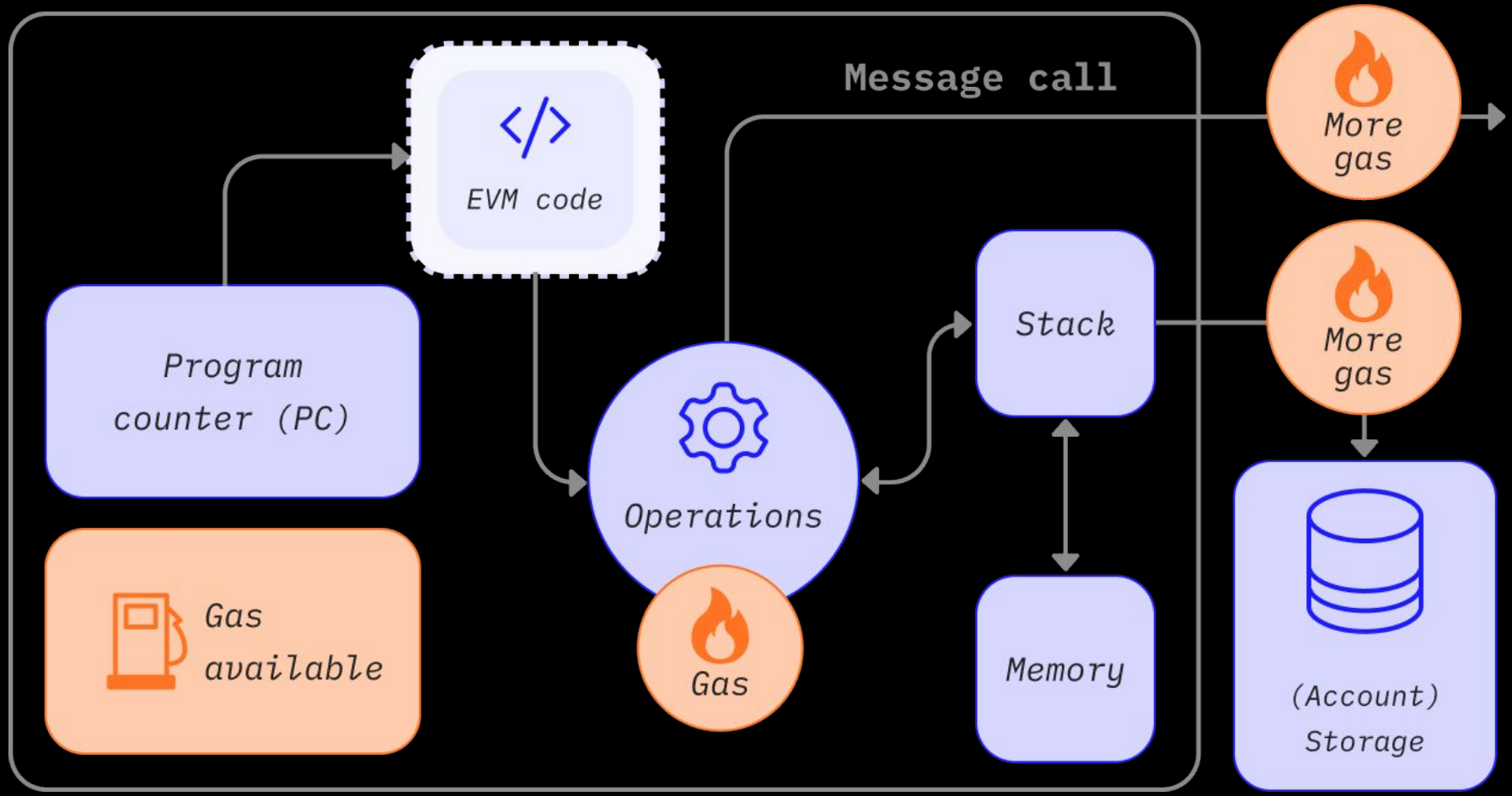
byte addressing
linear memory

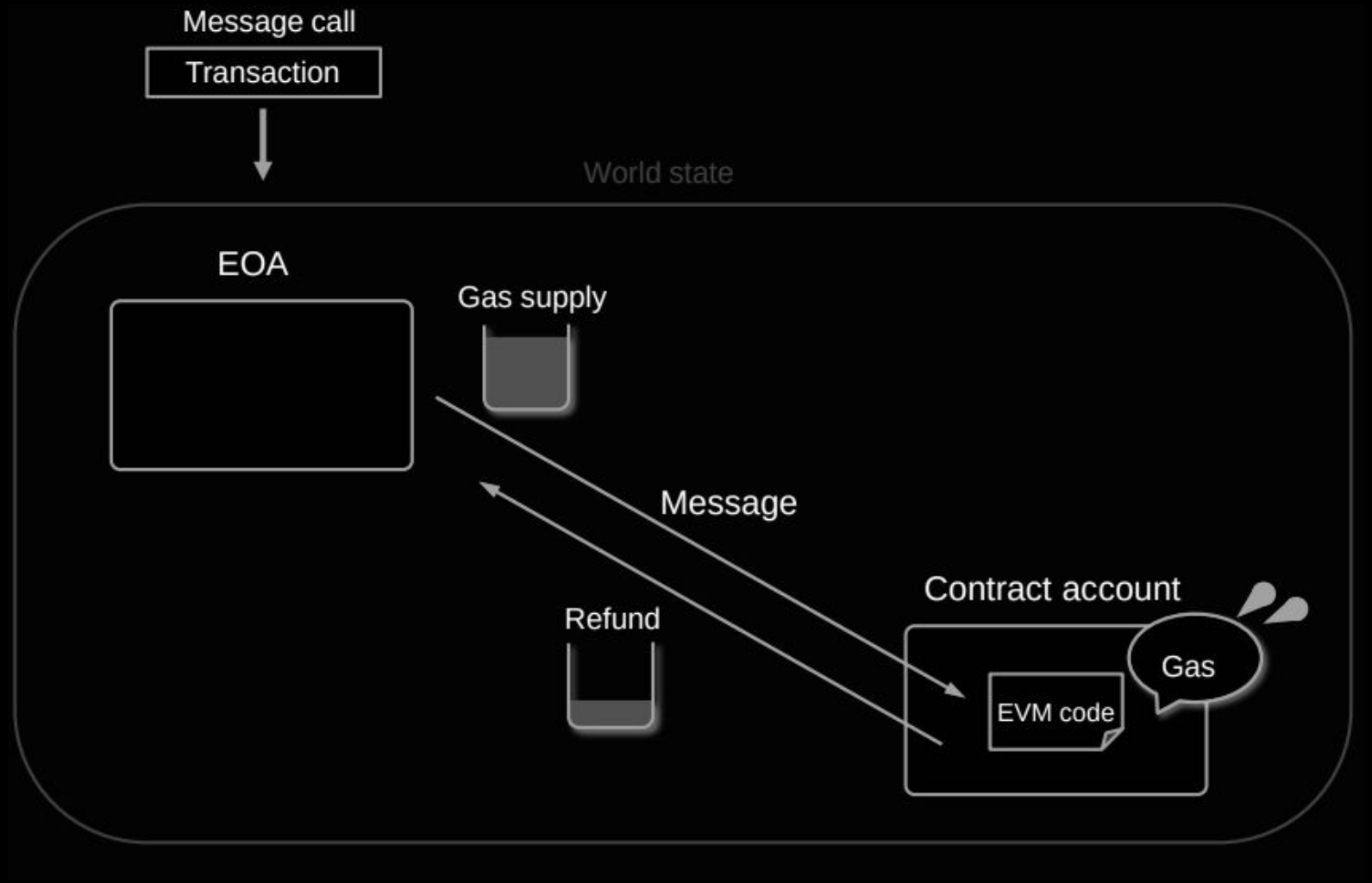
(Account) storage

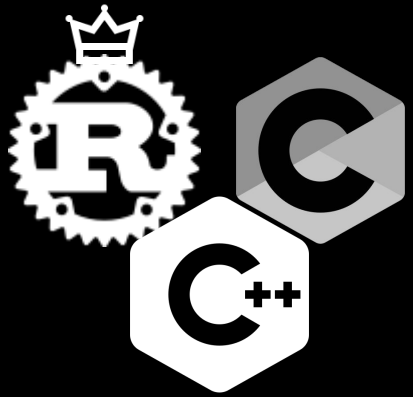


persistent memory

256 bits to 256 bits
key-value store

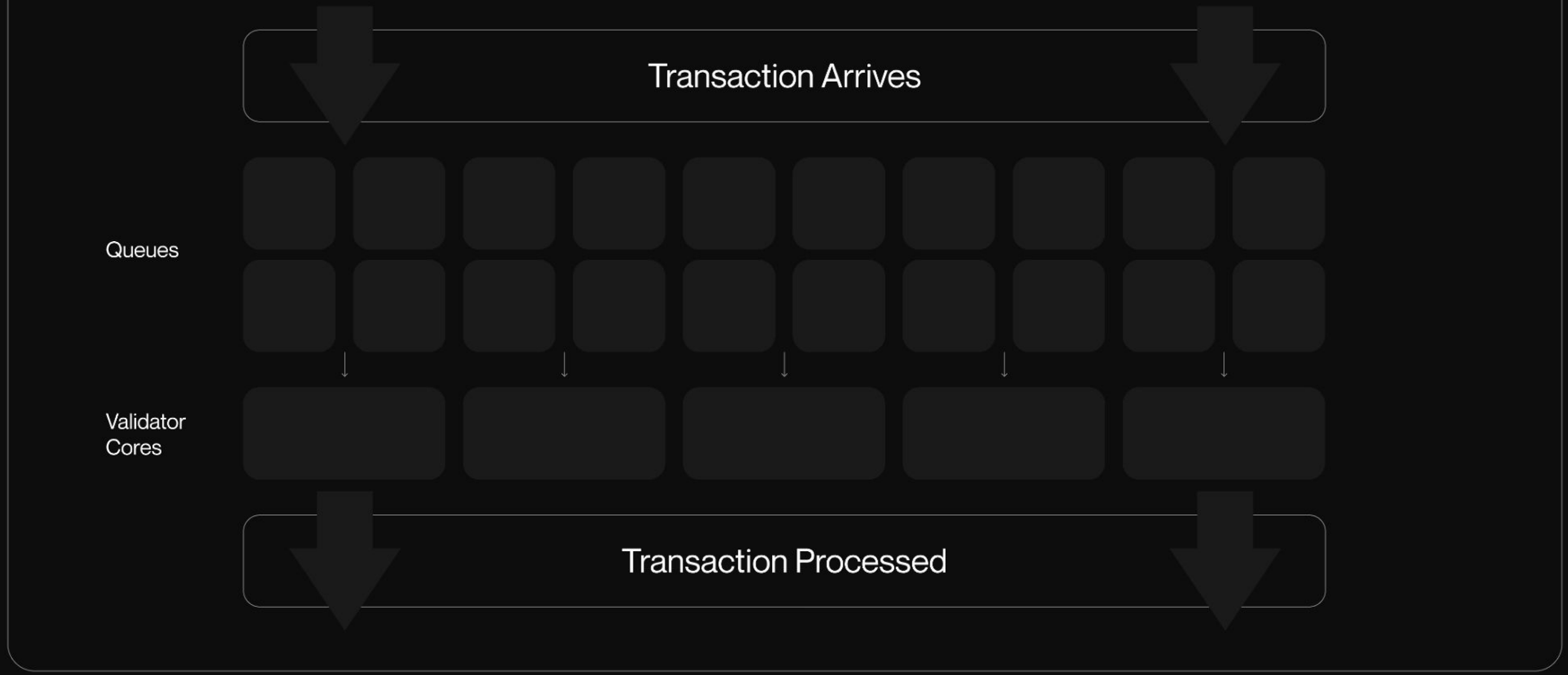

Message call
EVM code
Program counter (PC)
Gas available
Operations
Gas
Stack
Memory
More gas
More gas
(Account) Storage


Message call
Transaction
World state
EOA
Gas supply
Message
Refund
Contract account
Gas
EVM code



BPF bytecode

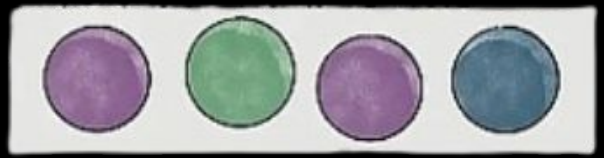
Sealevel Parallel Processing Explained

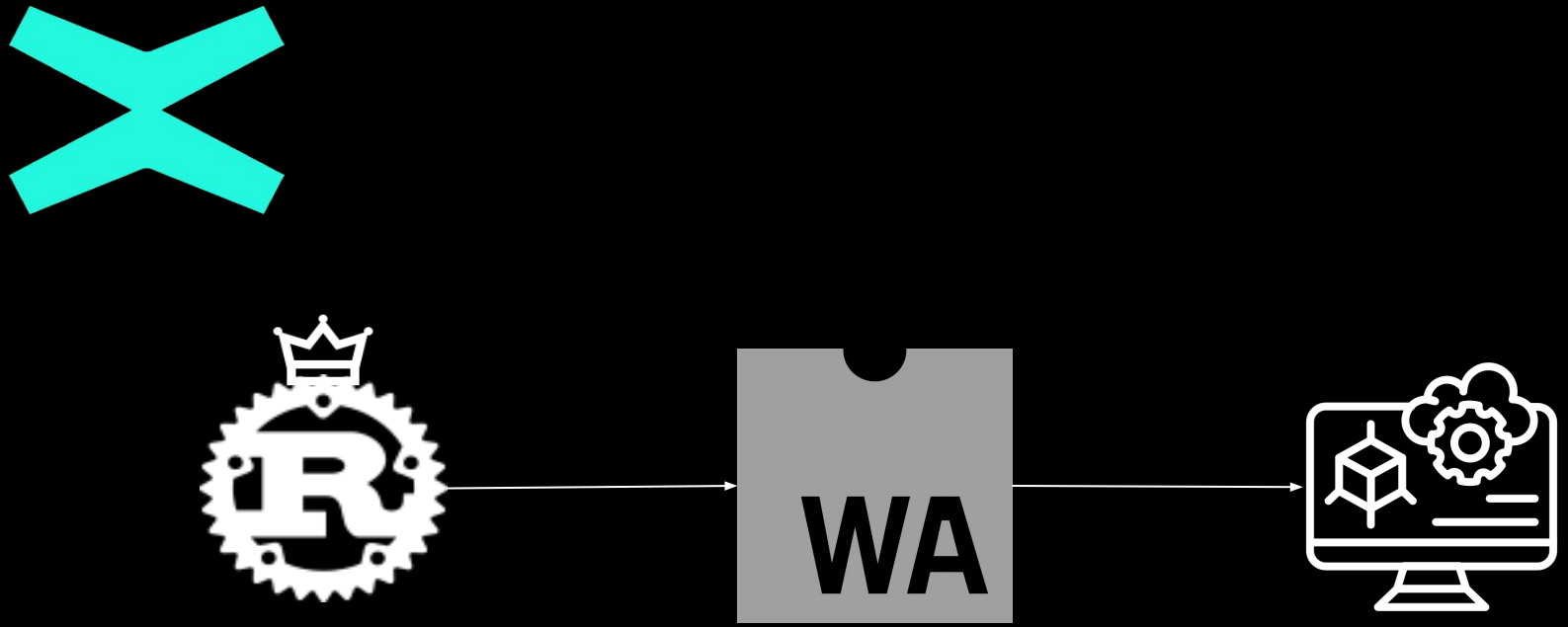


Global Fee Market

Local Fee Market

Queue




WA

Key Features

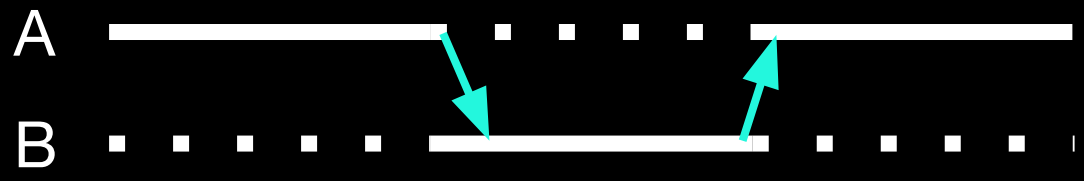
Statelessness

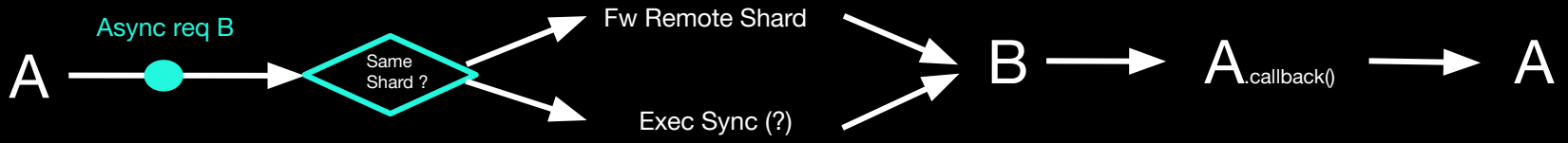
Wasmer execution

Asynchronous calls

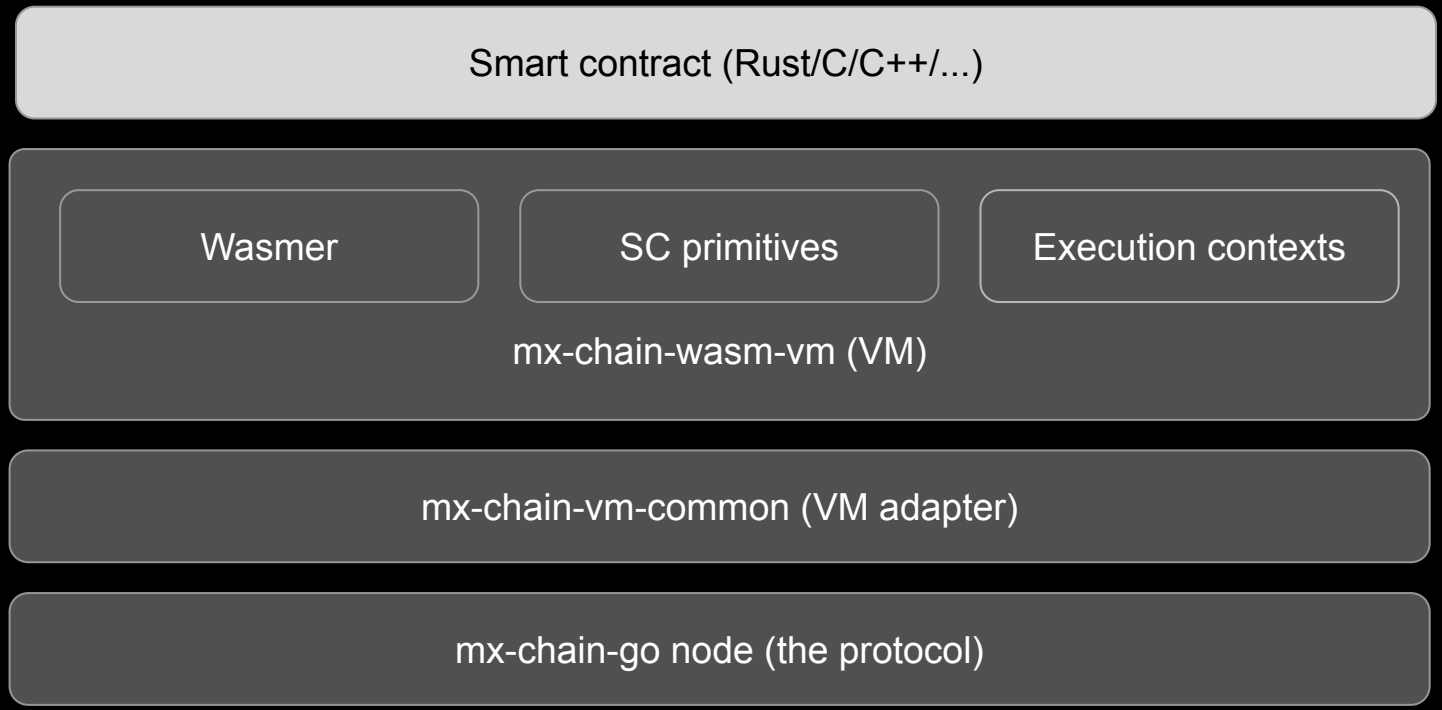
1 gas = 1 ns

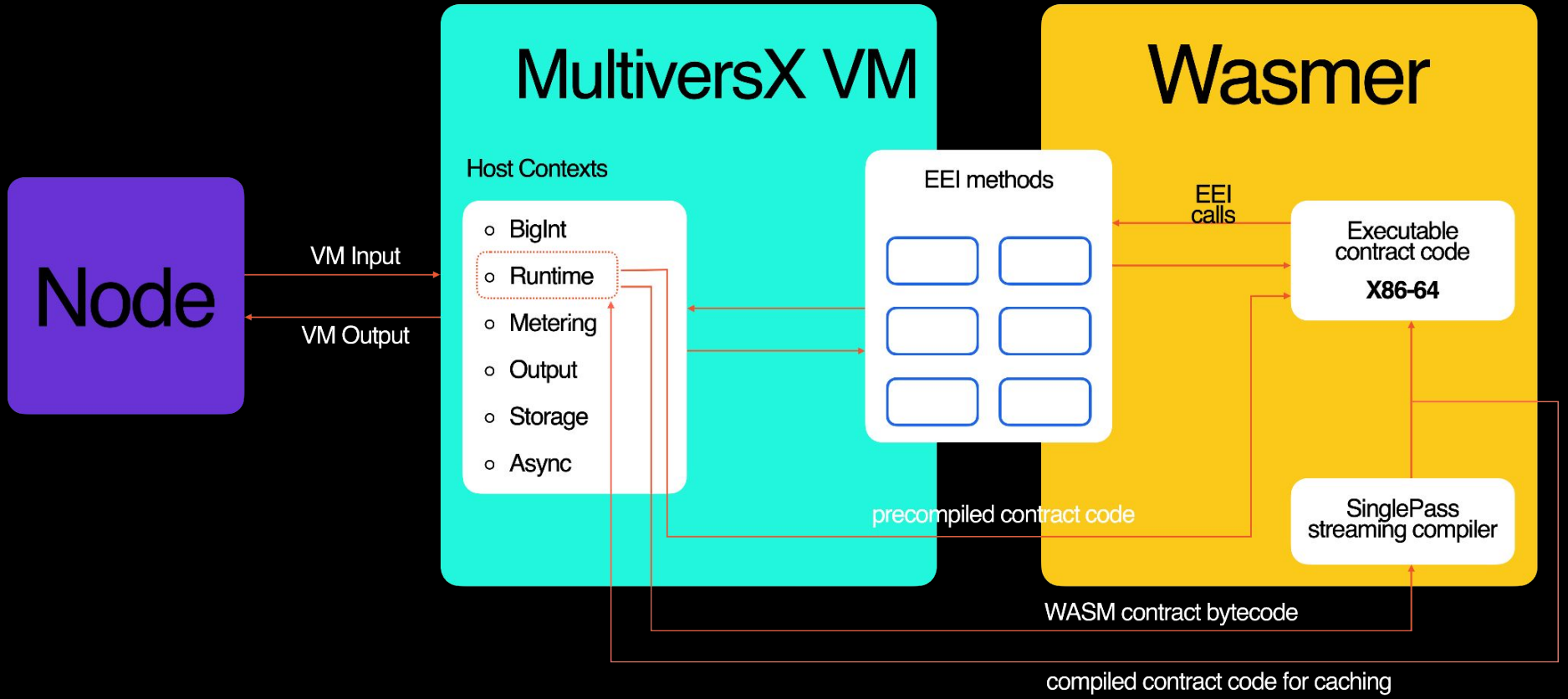
Asynchronous calls

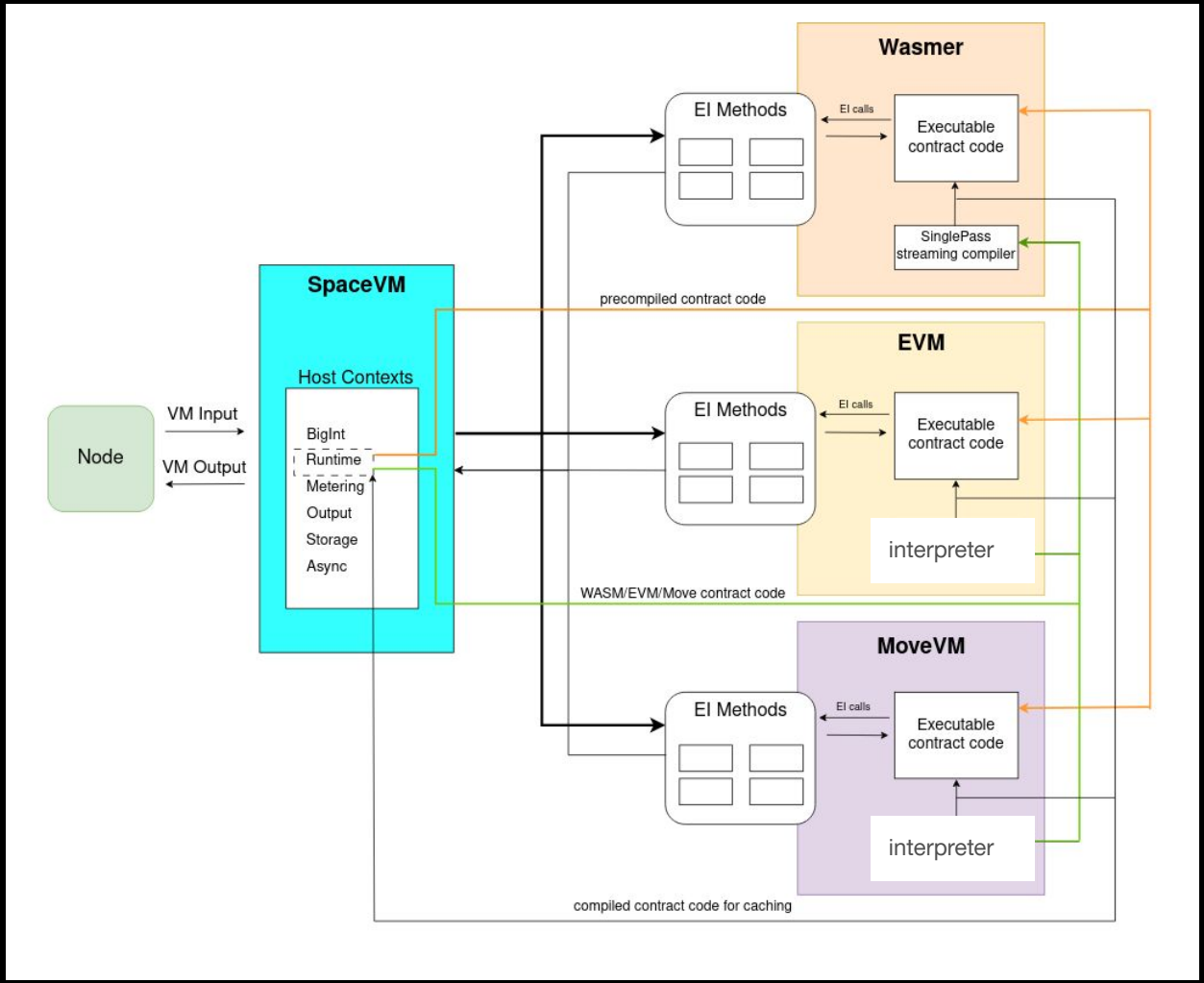




VM overview


Smart contract (Rust/C/C++/...)
Wasmer
SC primitives
Execution contexts
mx-chain-wasm-vm (VM)
mx-chain-vm-common (VM adapter)
mx-chain-go node (the protocol)


Node
VM Input
VM Output
MultiversX VM
Host Contexts
BigInt
Runtime
Metering
Output
Storage
Async
EEI methods
EEI calls
Wasmer
Executable contract code
X86-64
SinglePass streaming compiler
precompiled contract code
WASM contract bytecode
compiled contract code for caching


Wasmer
EI Methods
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SpaceVM
Host Contexts
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Storage
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VM Input
VM Output
EVM
EI Methods
EI calls
Executable contract code
interpreter
WASM/EVM/Move contract code
MoveVM
EI Methods
EI calls
Executable contract code
interpreter
compiled contract code for caching

Aspect	Traditional VMs	Blockchain VMs
Architecture	Hardware	Nodes
Execution Environment	Local	Decentralized network
Resource Management	Host	Consensus
Security Model	Host isolation	Consensus
State Management	Host OS	Blockchain
Determinism	Pretty bad	100%

Questions