Web3 JS API:

- Logs
- Events

Discount Coupon Link to UDEMY course:

https://www.udemy.com/ethereum-dapp/?couponCode=ETHDAPP101

This deck is part of a online course on "Ethereum: Design and Development of Decentralized Apps.

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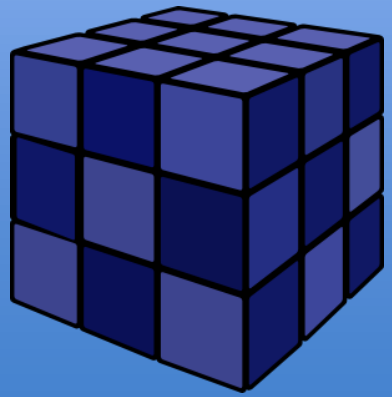


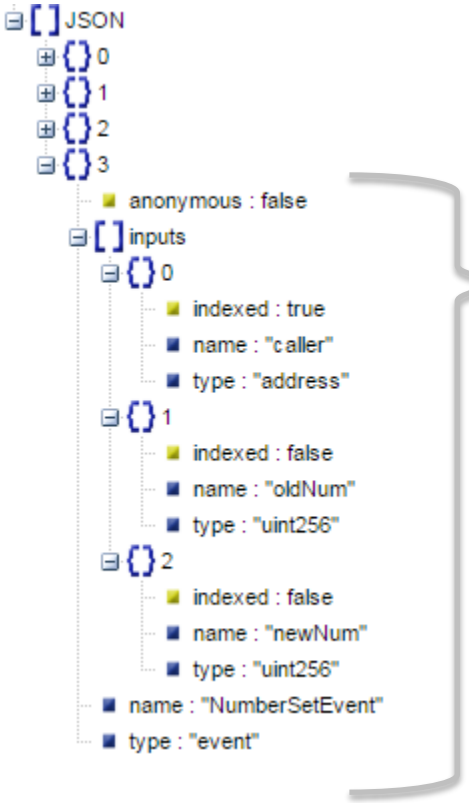
Contract Events

Contracts may emit events

```
pragma solidity ^0.4.6;
contract MyContract {

  uint   num;

  event NumberSetEvent(address indexed caller, uint oldNum, uint newNum);

  function getNum() constant returns (uint n) {return num;}

  function setNum(uint n) {
    uint old = num;
    num=n;
    NumberSetEvent(msg.sender,old,num);
  }


  function MyContract(uint x){num=x;}
}
```

Contract Events

Contracts may emit events

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contract MyContract {

  uint   num;

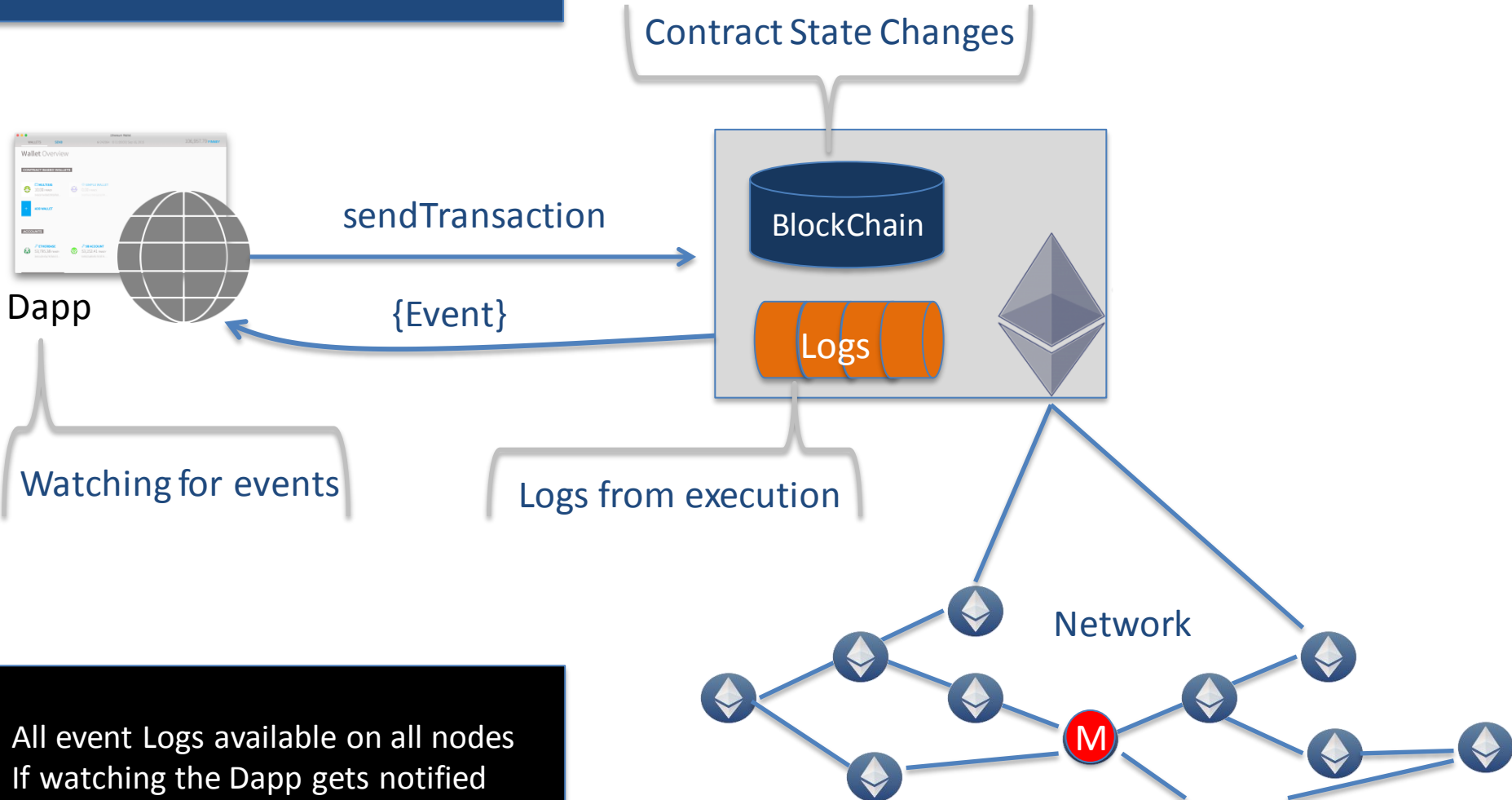
  event NumberSetEvent(address indexed caller, uint oldNum, uint newNum);

  function getNum() constant returns (uint n) {return num;}

  function setNum(uint n) {
    uint old = num;
    num=n;
    NumberSetEvent(msg.sender,old,num);
  }


  function MyContract(uint x){num=x;}
}
```

Ethereum Logs & Events



PS

- All event Logs available on all nodes
- If watching the Dapp gets notified

Event/Log usage patterns

1. Receive data for transaction

2. Asynchronous trigger

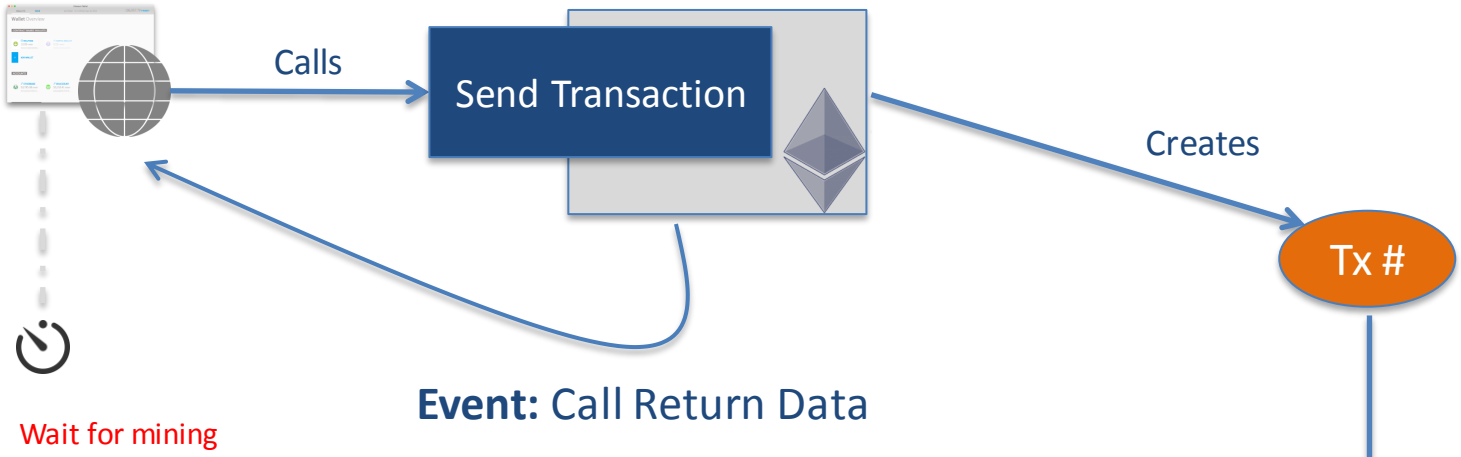
3. Cheap data storage

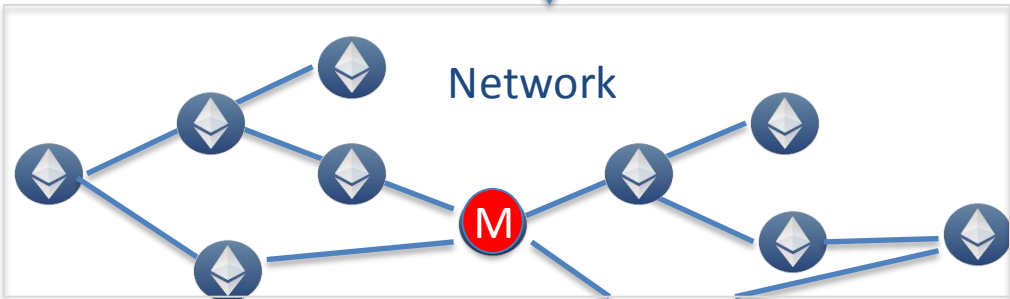
1. Receives data for transaction

```
instance.setNum.sendTransaction(parameterValue,txnObject,function(error, result)
```

- Call returns a transaction hash and not a return value
  - Method execution result is not available till transaction is mined
  - Contract (methods) may return data using **events**

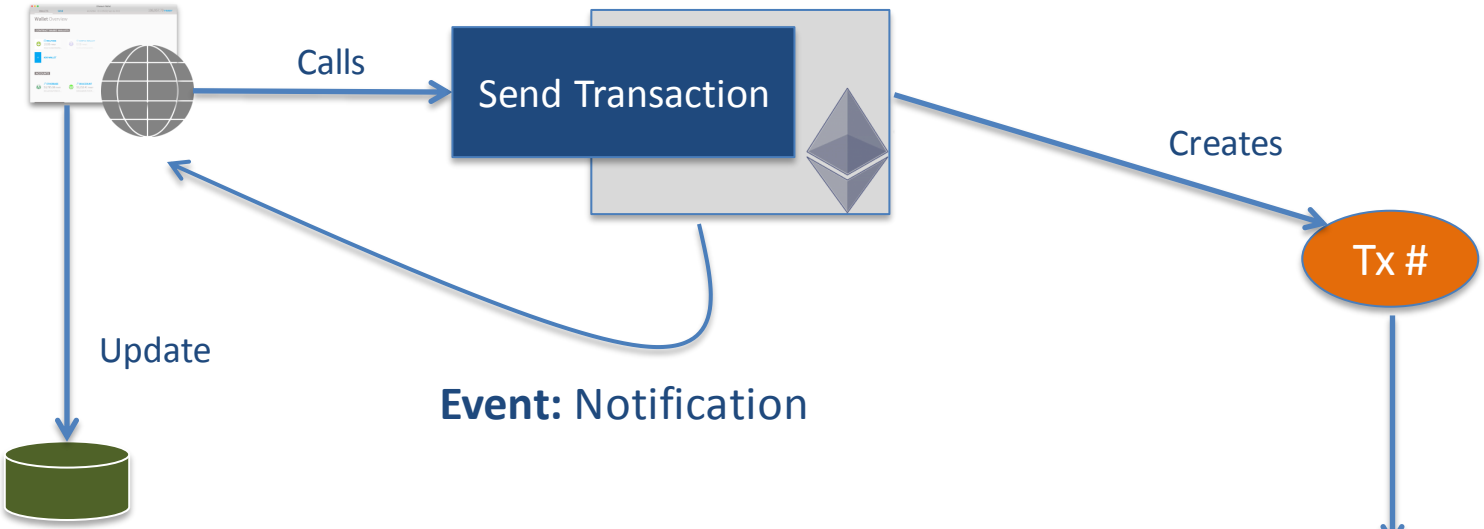
1. Receives data for transaction

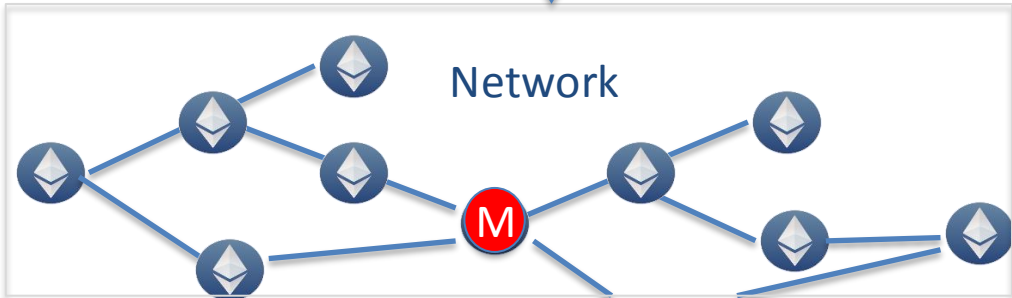




- *Example:* Sample contract

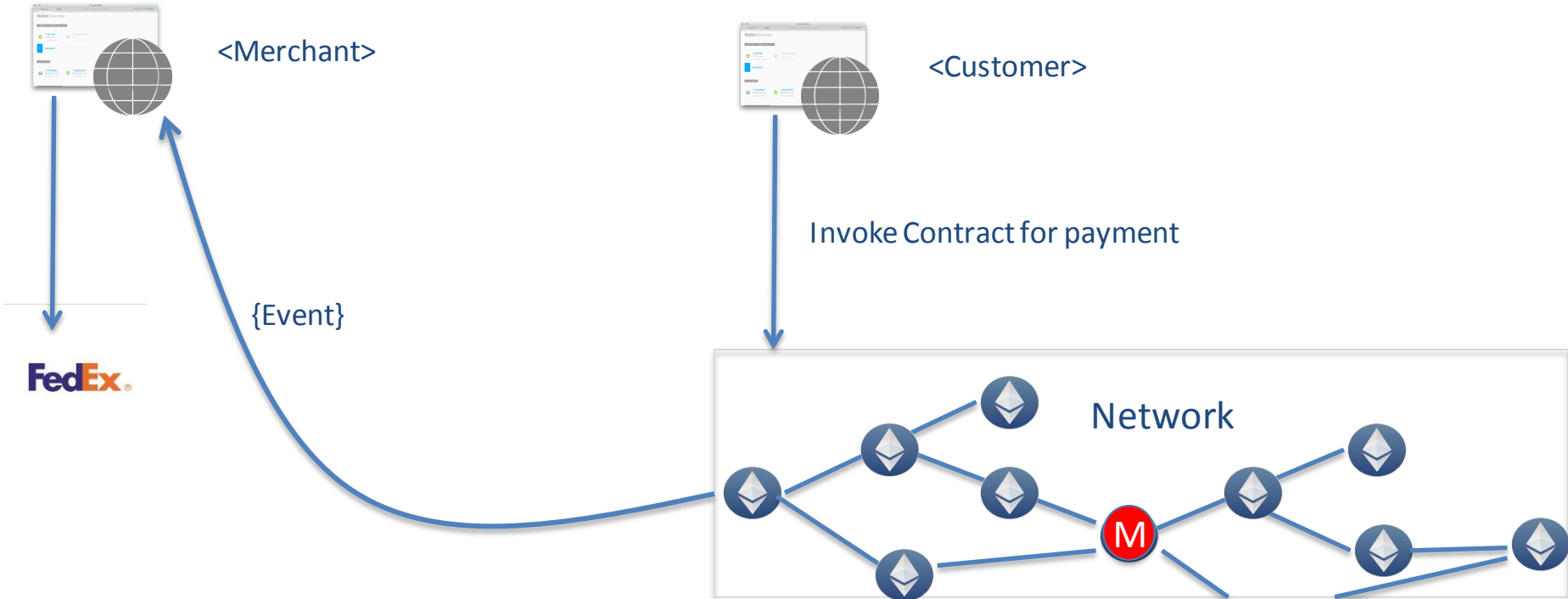
2. Asynchronous Notifications





- *Example:* Wallet app

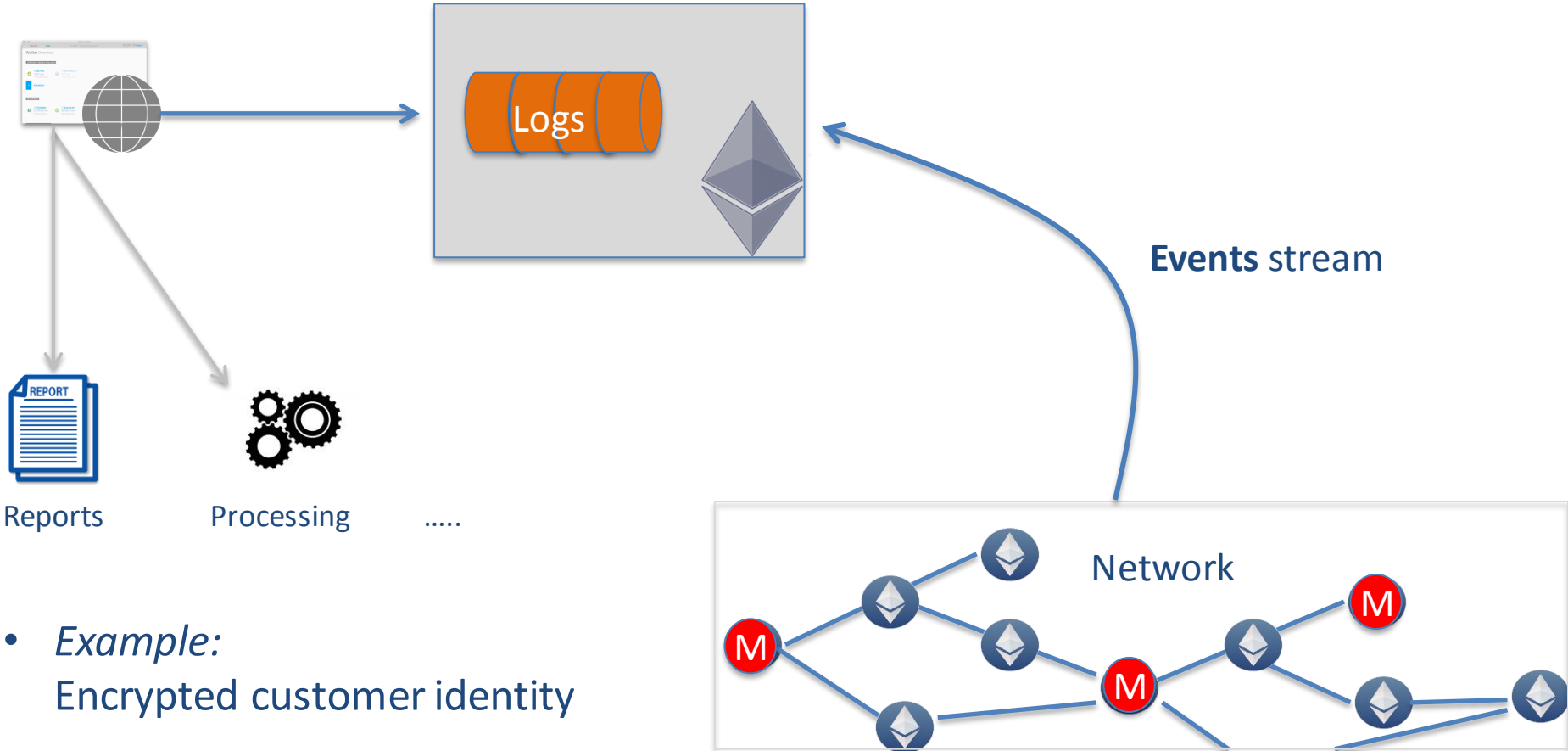
2. Asynchronous Notifications



2. Asynchronous processing

- Front end (Dapp) can **watch** for events of interest
  - Example: Wallet app receives notification on receiving ethers
  - Example: Multisig contract shows transactions waiting for approval

3. Data storage



- *Example:*
  Encrypted customer identity

3. Data storage

- Cheaper than contract storage
  - Log data storage cost 8 Gas/byte
  - Contract data storage cost 20,000 Gas/32-byte
- Logs are **NOT** accessible from contracts

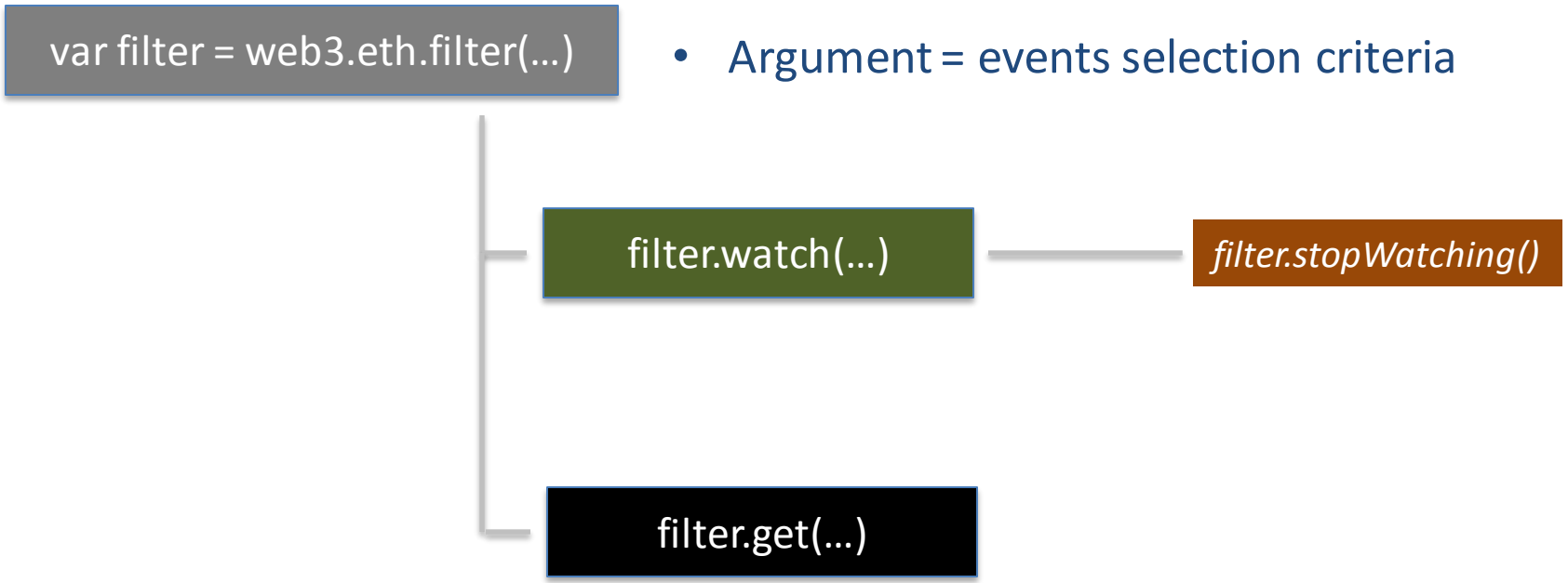
Watch & Get

- Watch
  - Listens for incoming events
- Get
  - Gets the log data

2 ways to watch & get

1. Using the Filter API
2. Using the contract instance

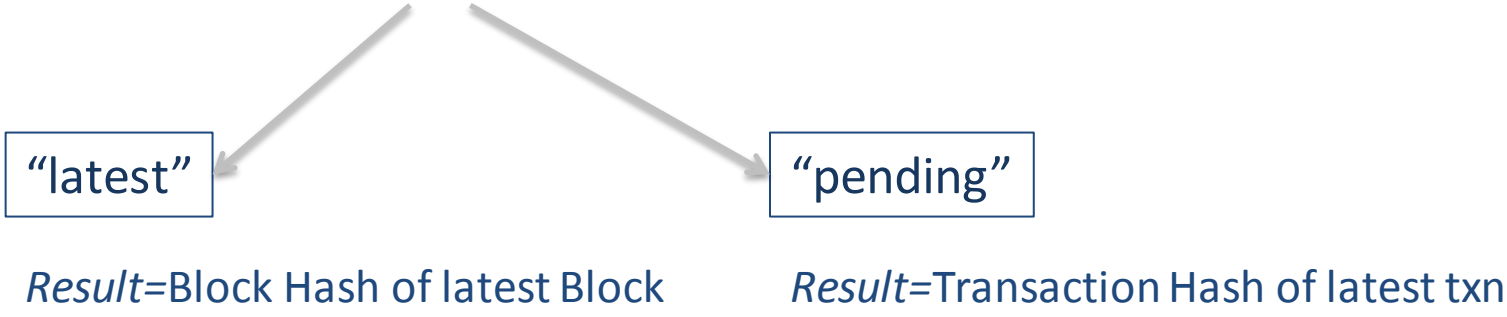
Using Filter



- Argument = events selection criteria

web3.eth.filter(…)

1. *web3.eth.filter*(string)



2. *web3.eth.filter*(options_object)

Options_object

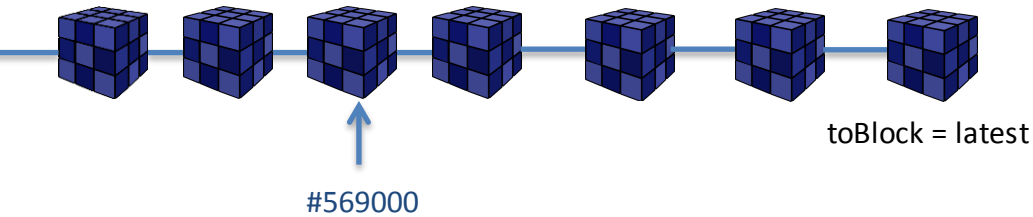
- Block range *fromBlock, toBlock*
- Specific contract instance *[address]*
- Event data
  - Data in the log fields topic: *['event-signature', 'data1', 'data2', 'data3']*
    - Fields marked *indexed* used in topics
    - Maximum of 3 indexed fields & order is important

Options JSON

Get events starting from block# 569000

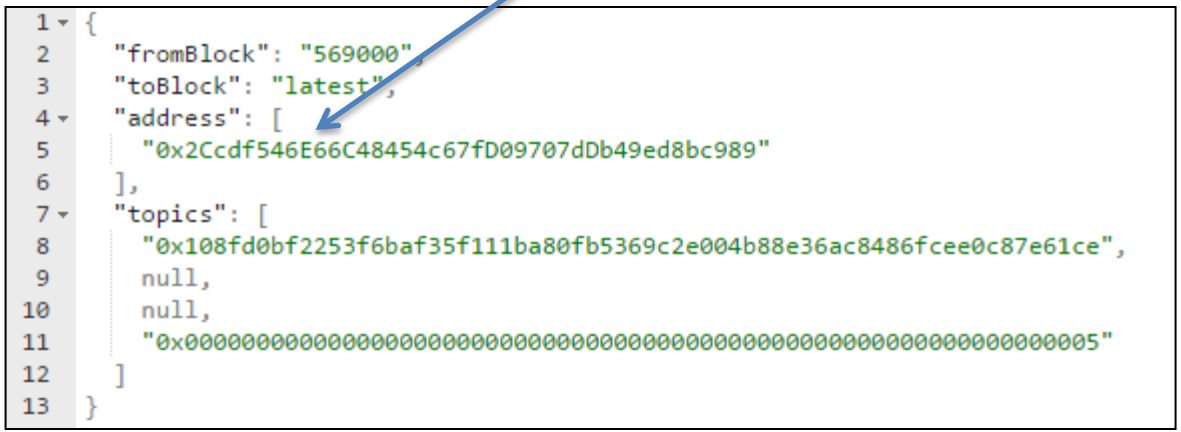
- For get() ; get events from 569000 to the current block
- For watch() continue to receive events for all blocks

```
{
  "fromBlock": "569000",
  "toBlock": "latest",
  "address": [
    "0x2Ccdf546E66C48454c67fD09707dDb49ed8bc989"
  ],
  "topics": [
    "0x108fd0bf2253f6baf35f111ba80fb5369c2e004b88e36ac8486fcee0c87e61ce",
    null,
    null,
    "0x0000000000000000000000000000000000000000000000000000000000000005"
  ]
}
```



Options JSON

Array of contract addresses

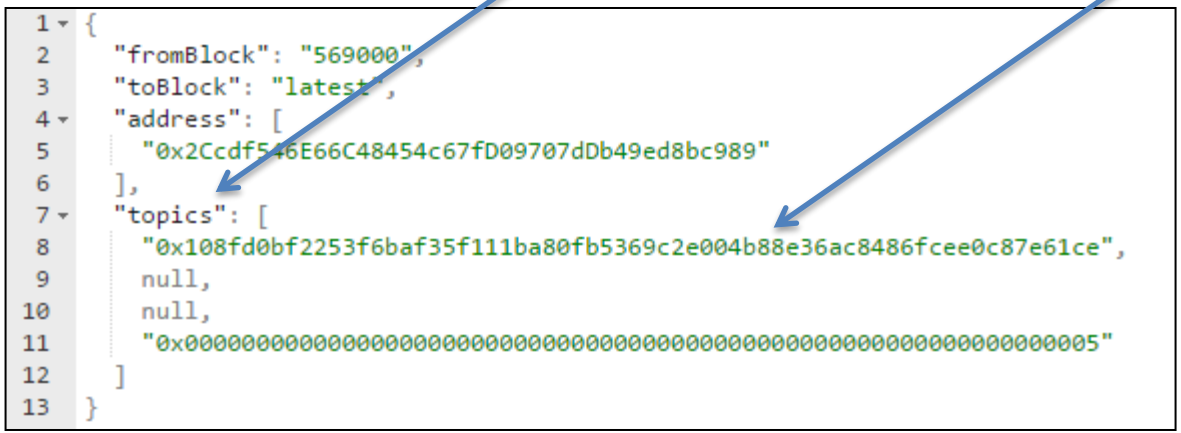


```
{
  "fromBlock": "569000",
  "toBlock": "latest",
  "address": [
    "0x2Ccdf546E66C48454c67fD09707dDb49ed8bc989"
  ],
  "topics": [
    "0x108fd0bf2253f6baf35f111ba80fb5369c2e004b88e36ac8486fcee0c87e61ce",
    null,
    null,
    "0x0000000000000000000000000000000000000000000000000000000000000005"
  ]
}
```

Options JSON

topics = event data criteria

topics[0] = Event Signature



```
{
  "fromBlock": "569000",
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  "address": [
    "0x2Ccdf546E66C48454c67fD09707dDb49ed8bc989"
  ],
  "topics": [
    "0x108fd0bf2253f6baf35f111ba80fb5369c2e004b88e36ac8486fcee0c87e61ce",
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    null,
    "0x0000000000000000000000000000000000000000000000000000000000000005"
  ]
}
```

Options JSON

```
{
  "fromBlock": "569000",
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  "address": [
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  ],
  "topics": [
    "0x108fd0bf2253f6baf35f111ba80fb5369c2e004b88e36ac8486fcee0c87e61ce",
    null,
    null,
    "0x0000000000000000000000000000000000000000000000000000000000000005"
  ]
}
```

event NumberSetEvent(address indexed **caller**, bytes32 indexed **oldNum**, bytes32 indexed **newNum**);

setNum(**5**) **{Event Received}**

setNum(**6**) **{NO Event Received}**

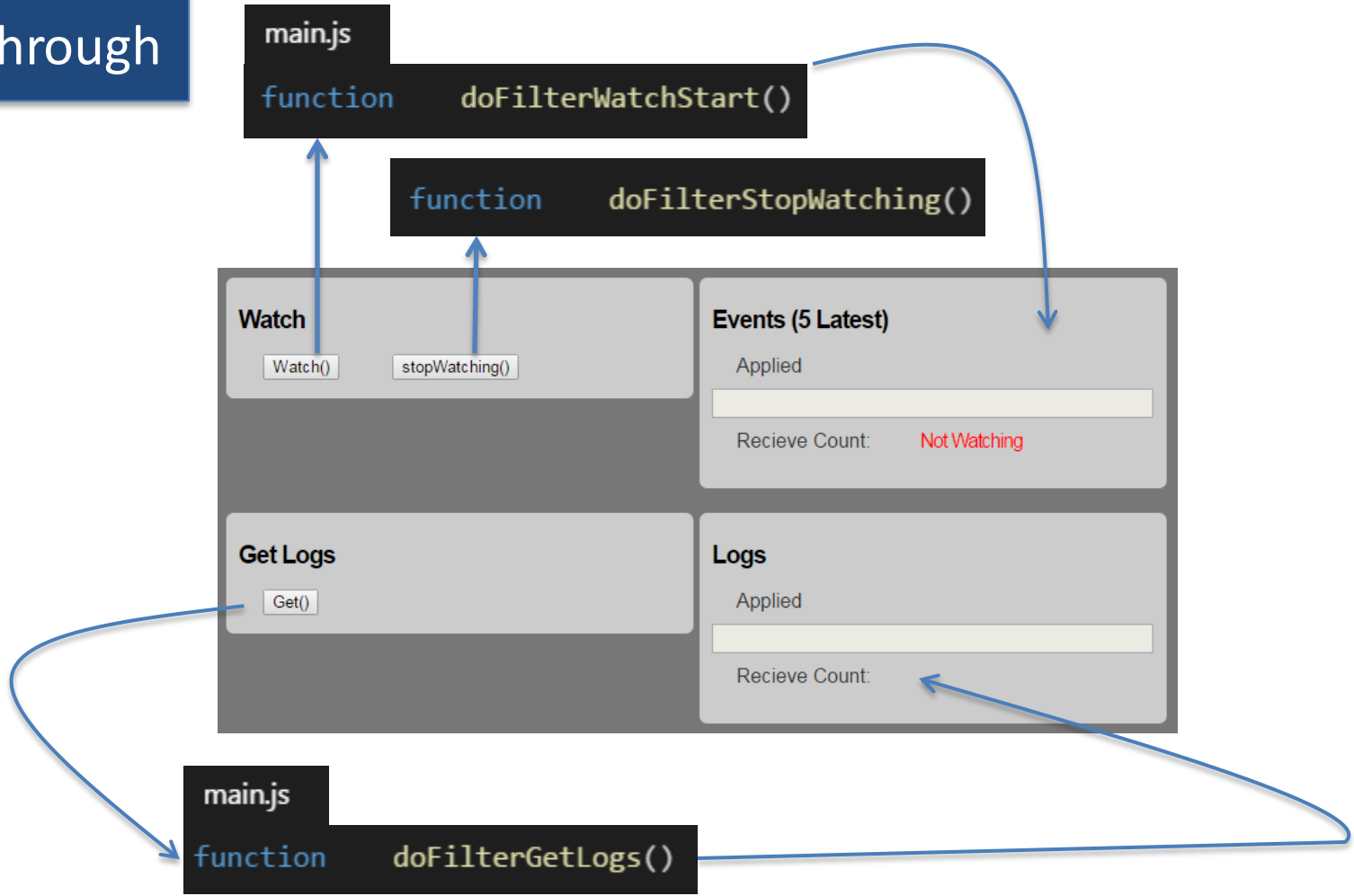
watch() & get()

- filter.**get**(callback_func)
  - Result : Array of events

- filter.**watch**(callback_func)
  - Result : event data

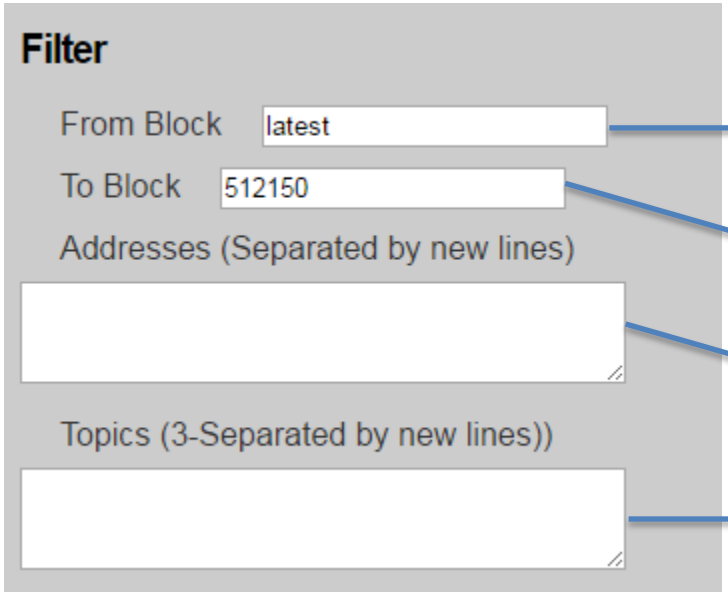
Walkthrough

Walkthrough



2. web3.eth.filter(options)

web3.eth.filter(options) for events



fromBlock: by default 'latest' ; number or hash

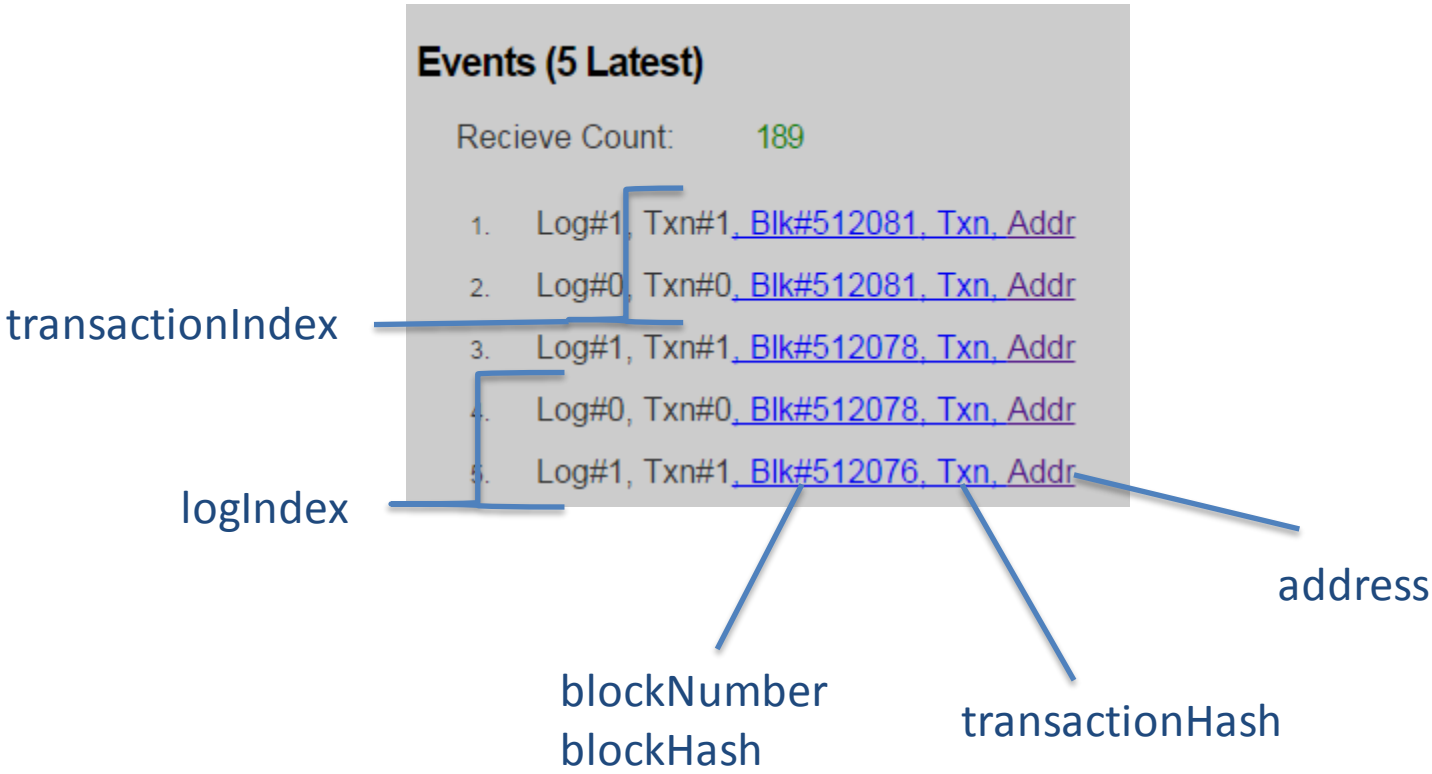
toBlock: leave blank for continuous watching

address: Contract Address(es)

topic: Indexed topic data

Event Data

Events received in real time



Get Logs

web3.eth.filter(options) for events

Options

```
{
  "fromBlock": "510000",
  "address": [
    "0x15fa74080C6F99Ef298AE0954F9e3B33ed06D4Dd"
  ]
}
```

Array of logs

Logs

Recieve Count: 2

1. Log#0, Txn#0, Blk#514748, Txn, Addr
2. Log#0, Txn#0, Blk#511239, Txn, Addr

filter.watch

- Watch for events => installs the filter on node
  - *watch*() callback receives events based on the filter
  - *stopWatching*() for events; removes the filter on node

- Read the past logs
  - *get*()

Contract Object

var contract = web3.eth.**contract**(*abiDefinition Array*)

1. Deploying the contract code to EVM

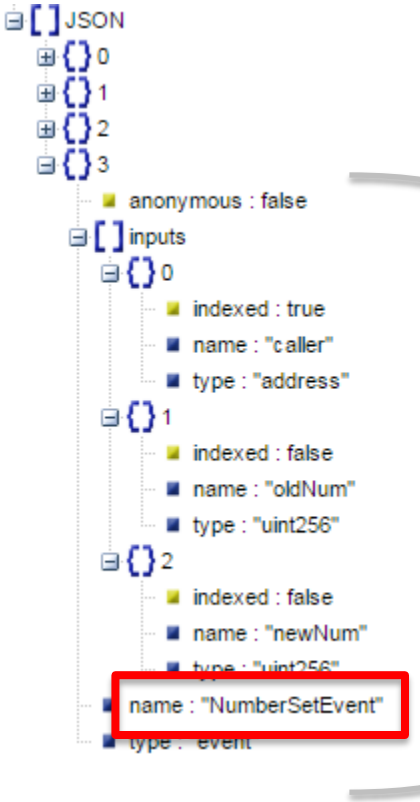
var contractInstance = contract.**at**(*contract_address*)

2. Invoking a contract function

3. Watch for events & Get events data from *Log*

Contract Events

Like methods, events are part of *abiDefinition*

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contract MyContract {

  uint   num;

  event NumberSetEvent(address indexed caller, bytes32 indexed oldNum, bytes32 indexed newNum);

   function getNum()  returns (uint n) {
     return num;
   }

   function setNum(uint n) {
      uint old = num;
      num=n;
      NumberSetEvent(msg.sender,bytes32(old),bytes32(num));
   }

   function MyContract(uint x){num=x;}
}
```
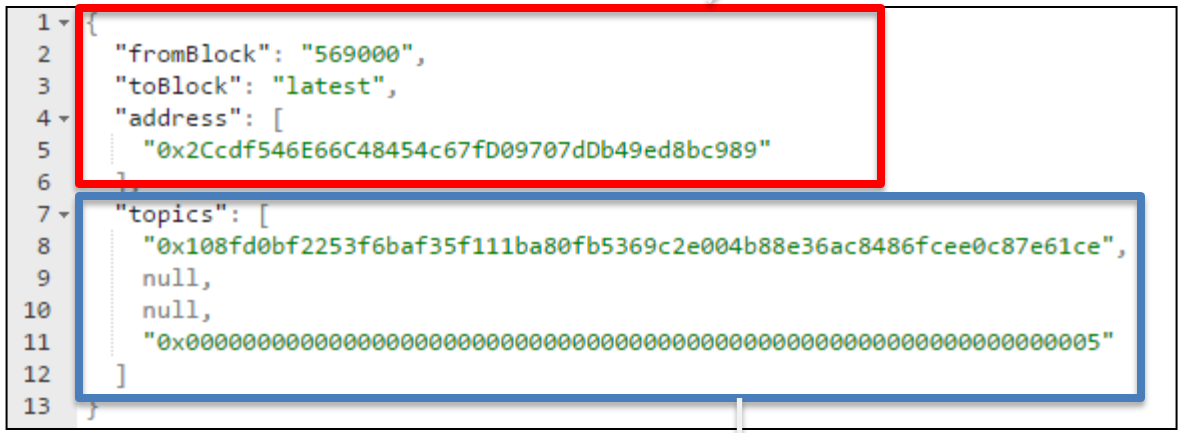

Event Filtering

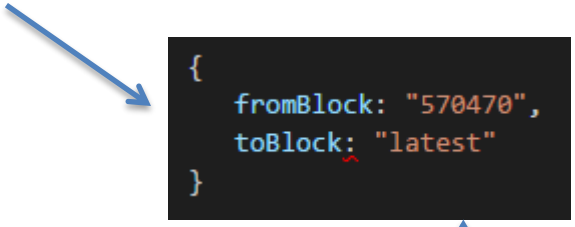
additionalOptions



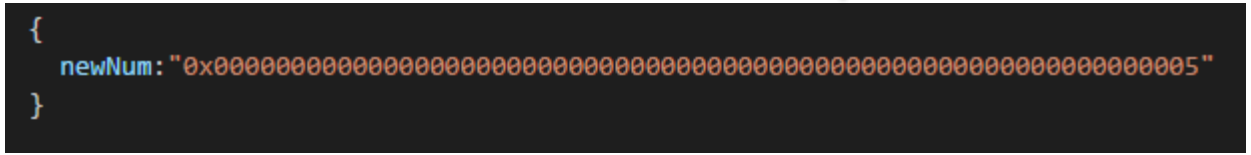
Indexed or topics options

Contract Event

var contractEvent =
contractInstance.**allEvent**(*additionalOptions*)



var contractEvent =
contractInstance.**NumberSetEvent**(*indexedOptions, additionalOptions*)



get(), watch(), stopWatching()

1. contractEvent .**get**(callback_function)
   - Result : Array of events

2. contractEvent .**watch**(callback_function)
   - Result : Event data

3. contractEvent .**stopWatching**()

Filter : get/watch

- All events from any source
- May be used for writing tools etc
- Indexed data in options/topics array

Event : get/watch

- Events from specific contract instance
- For Dapp only
- Indexed/Topic data is a JSON object

Web3 JS API:

- DAPP Infrastructure

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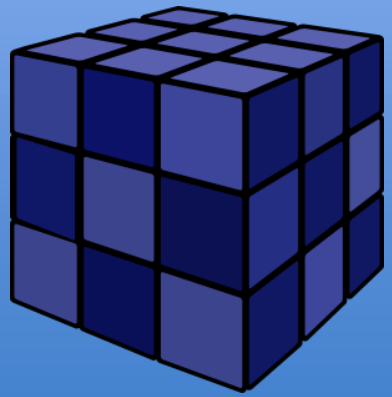
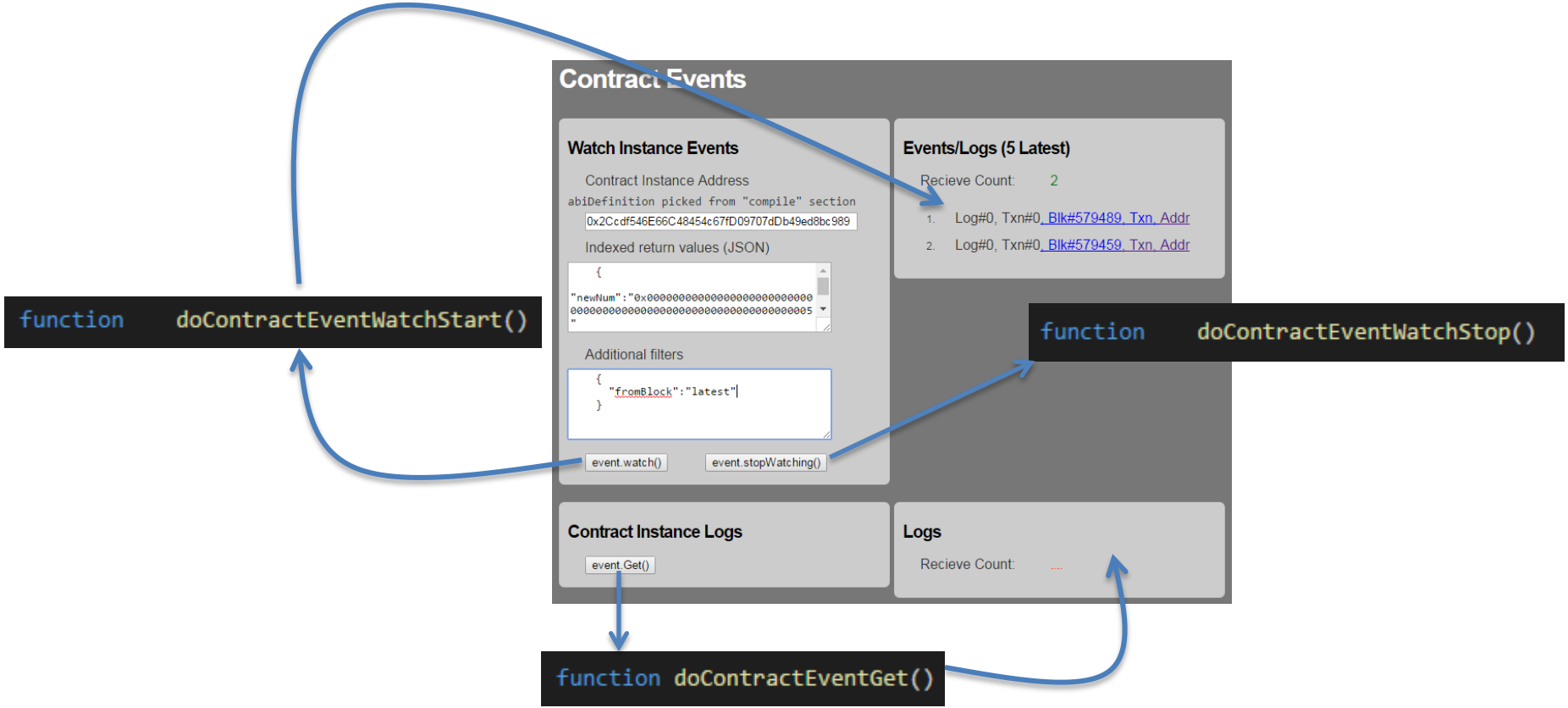
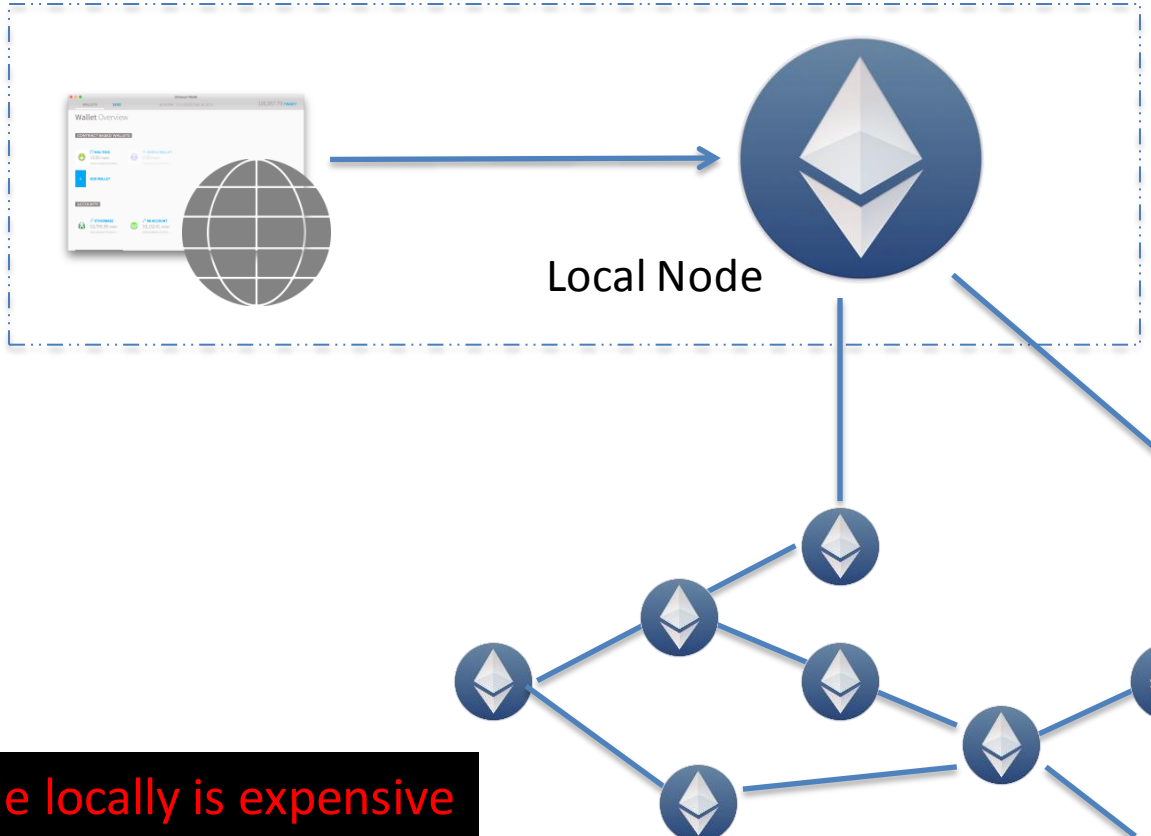


get(), watch(), stopWatching()



DAPP Infrastructure

Option#1 DAPP co-located with the client

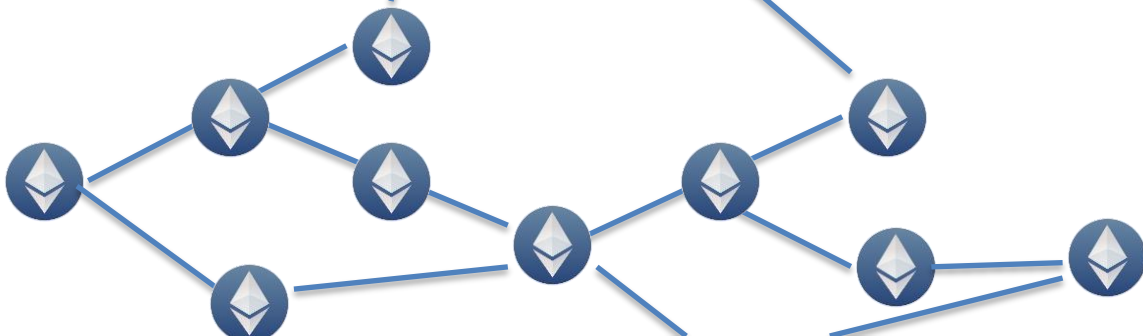


Deploying node locally is expensive

DAPP Infrastructure

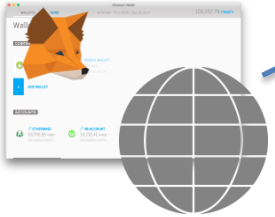
Option#2 Client in midtier

Hosted
By
Organization

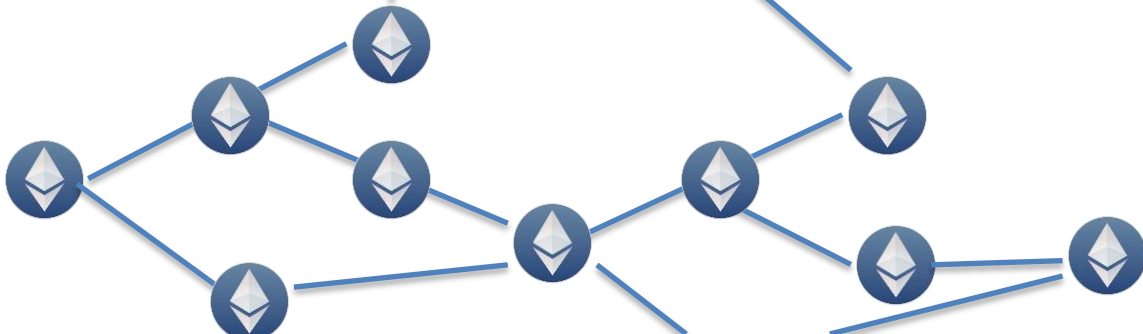


DAPP Infrastructure

Option#3 Meta Mask Chrome Plugin



Hosted
By
MetaMask



- Manage accounts in a browser vault
  - Export/Import accounts
  - Send Funds
- Exposes web3 object to browser app
  - Single Page Applications
- Supports multiple endpoints
- Does not support mining

Web3 JS API:

- Compilation

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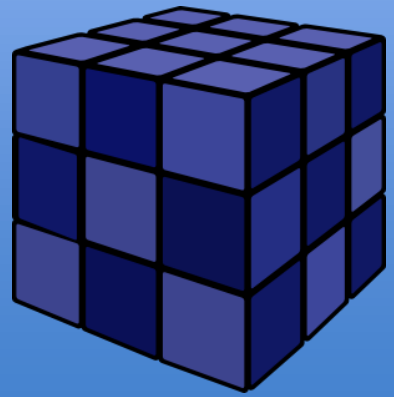


Compilation Output

Bytecode / EVM
code

- Deployed to the blockchain

Application Binary Interface
abiDefinition

- Interface definition
- Needed for contract deployment
- Needed for invoking contracts

Compiler options

remix

web3

OLC

node

solc

public

build passing

Web3 Compilation

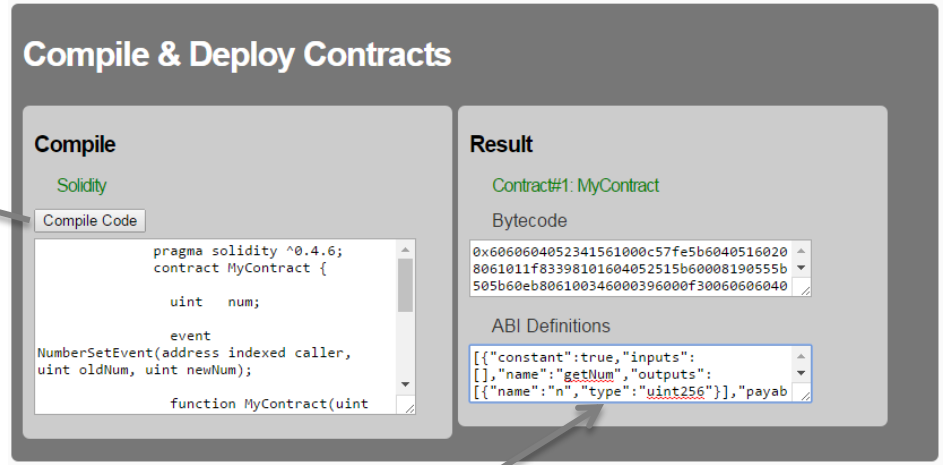
- Supported till geth version 1.5.9

  web3.eth.**compile.solidity**(source_string, callback_func)

- TestRPC supports this API; but may not support it in future

- MetaMask does not support it

Solidity Compiler




```
function    doCompileSolidityContract()
```

web3.eth.compile.solidity(source_string, callback_func)