Dive into ICON - DApp

ICON foundation

Dive into ICON - DApp

Step 1. What is a DApp?

Step 2. Review

Step 3. How to build a DApp

Step 4. Hands-on Exercise

Dive into ICON - DApp

Step 1. What is a DApp?

1. Definition
2. Why should we build a DApp on ICON?

Step 2. Review

Step 3. How to build a DApp

Step 4. Hands-on Exercise

Dive into ICON - DApp

Step 1. What is a DApp?

Step 2. Review

1. Dive into ICON - Tools
2. Dive into ICON - SCORE

Step 3. How to build a DApp

Step 4. Hands-on Exercise

Dive into ICON - DApp

Step 1. What is a DApp?

Step 2. Review

Step 3. How to build a DApp

1. How to send Tx with SDK
2. How to use ICONex connect

Step 4. Hands-on Exercise

Dive into ICON - DApp

Step 1. What is a DApp?

Step 2. Review

Step 3. How to build a DApp

Step 4. Hands-on Exercise

1. Make complete example page, Welcome & Scrooge.

1. What is a DApp ?

Dive into ICON - DApp

Step 1. What is a DApp?

1. Decentralized Application
2. Why should we build a DApp on ICON?

Step 2. Review

Step 3. How to build a DApp

Step 4. Hands-on Exercise

What is a DApp?

Decentralized Application

Application

DApp

What is CryptoKitties?

CryptoKitties is a game centered around breedable, collectible, and oh-so-adorable creatures we call CryptoKitties! Each cat is one-of-a-kind and 100% owned by you; it cannot be replicated, taken away, or destroyed.

Definition DApp

1. The application must be **completely open-source**, it must operate autonomously, and with no entity controlling the majority of its tokens. The application may adapt its protocol in response to proposed improvements and market feedback but all changes must be decided by consensus of its users.

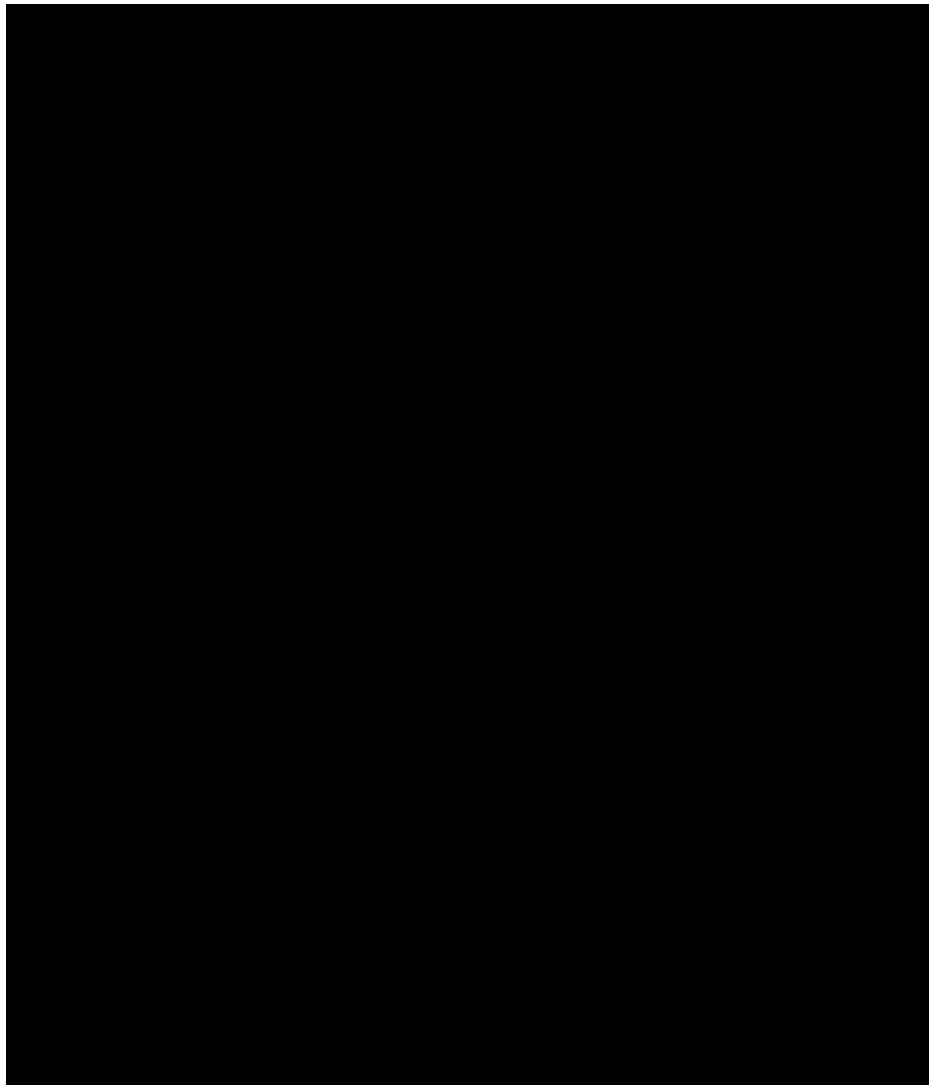
2. The application's data and records of operation must be **cryptographically stored in a public, decentralized blockchain** in order to avoid any central points of failure.

3. The application must use a **cryptographic token** (bitcoin or a token native to its system) which is necessary for access to the application and any contribution of value from (miners / farmers) should be rewarded in the application's tokens.

4. The application must generate tokens according to a standard **crytptographic algorithm** acting as a proof of the value nodes are contributing to the application (Bitcoin uses the Proof of Work Algorithm).

DApp

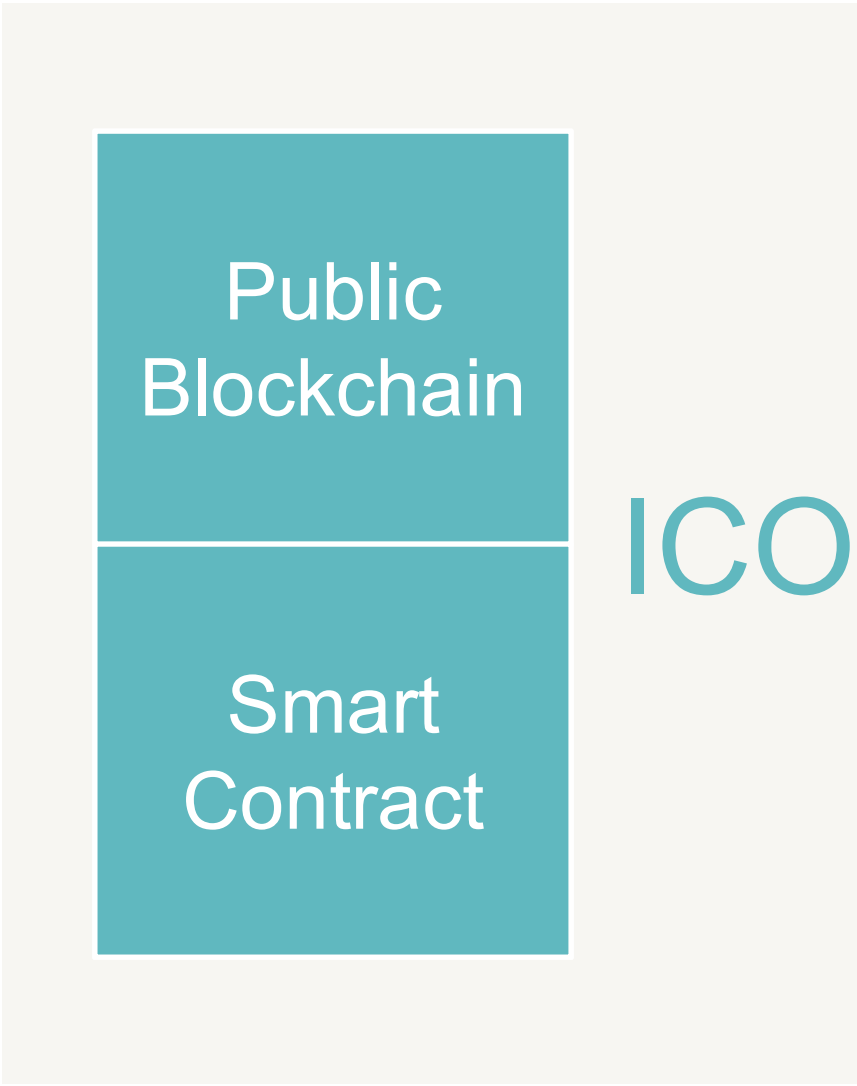
1. Contract-only
2. [Hybrid]
   Offchain Service +
   Onchain Service
3. [Save Data Only]
   Offchain Service +
   Block chain



DApp

Contract-only

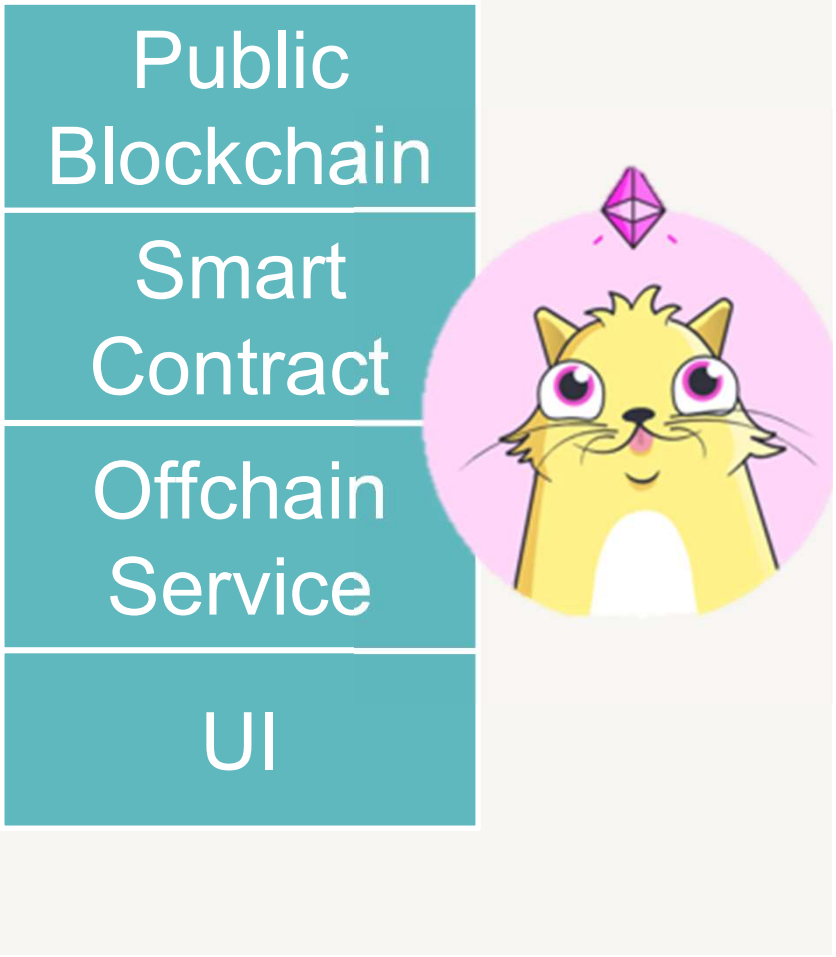
- Algorithm based Token
- Open Source
- Autonomous operation
- Save Data
  on Public Block Chain
- Smart Contract



DApp

Service Logic(Hybrid)

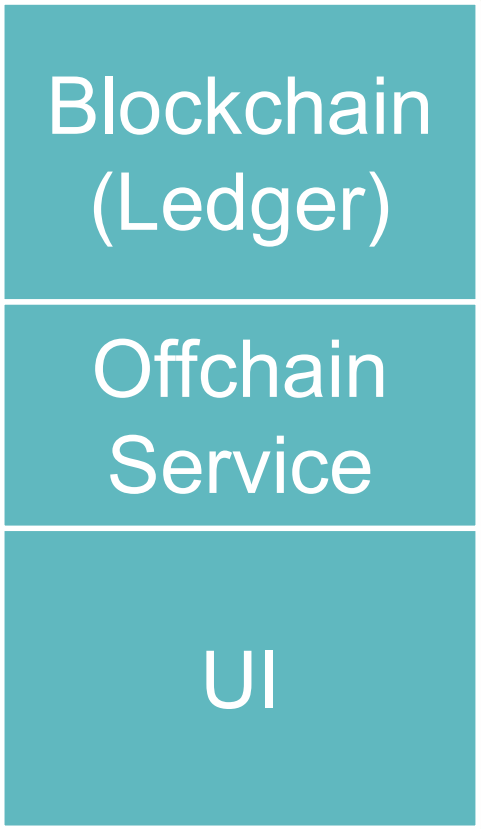
- Onchain Service + Offchain Service
- Algorithm based Token
- Open Source
- Autonomous operation
- Save Data on Public Block Chain



DApp

Save Data Only

- Offchain Service + Block chain [to save data]
- Open Source
- Save Data on Block Chain



Unfortunately,
The Block chain
was **cursed**.

The Curse of Blockchain: Transaction fee

하지만 한편으론 이더리움의 각종 불편함과 한계를
극명하게 보여줬습니다.

고양이를 살때도 수수료
고양이를 교배할때도 수수료
고양이를 판매할때도 수수료
고양이를 쓰다듬어도 수수료
고양이를 바라봐도 수수료
고양이를 고양이라고 불러도 수수료

이런 **수수료 지옥**은 처음 봤습니다.

뭔가 버튼 누르는 작업으로 이더리움과 연결되는 것은
하나도 빠짐없이 전부 수수료가 필요하며
그렇다고 신속하게 처리되는 것도 아니고
처리시 실패하면 **수수료가 전부 날아갑니다.**

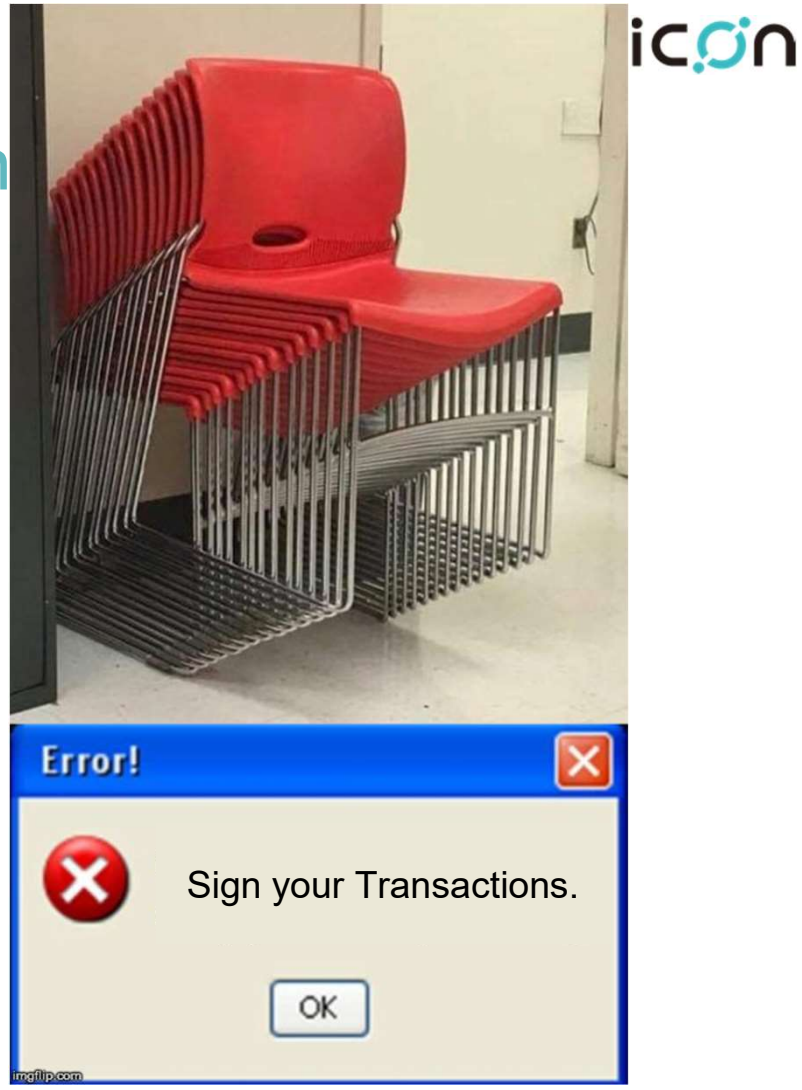
steemit / twinbraid

The Curse of Blockchain : Transaction fee

One More Thing!

Sign,
Sign,
Sign!

The Curse of Blockchain : Sign



3 Ways to break the curses of Blockchain

1. DID
   Decentralized IDentifiers
2. Hybrid(OAuth …)
3. Use Blockchain to save data only

How to Sign a Message

1. Traditional method (Wallet …)

2. Load User’s Keystore file

2 Ways to Sign

1. Traditional method (Wallet …)

2. Load User's Keystore file

Vulnerable

1.2

Why should we build DApp on ICON?


B!ock.Chain
STUDY GROUP


WE WANT U
JOIN US
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Medium

Your stories

Import a story | Write a story

Drafts 1 Published 1

ICON에서 DApp을 만들어야 하는 이유

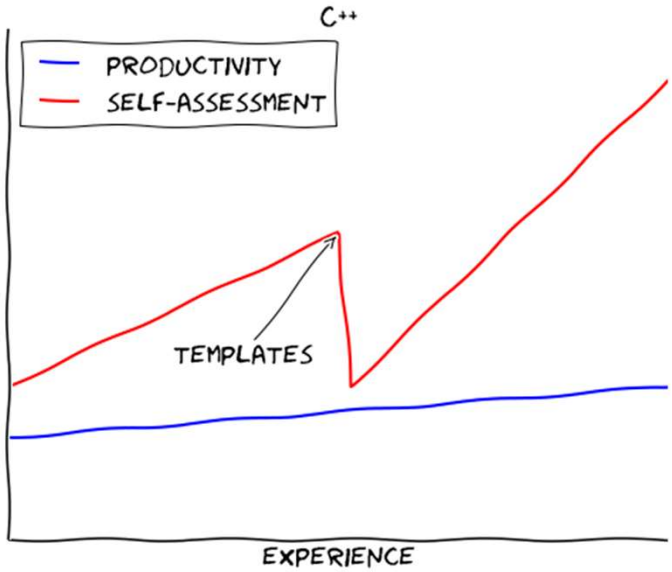
2년만에 연락해온 선배는 저의 이전글을 보았다며 곧장 물어왔습니다. 형, 봤으면 박수좀...

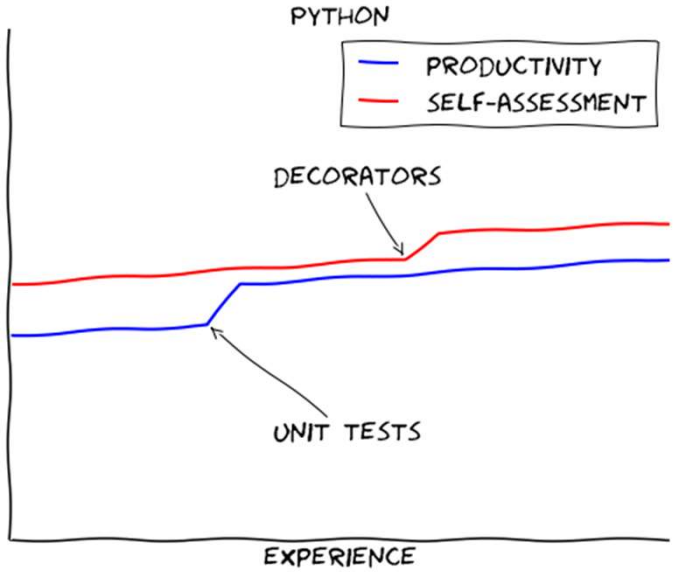
Last edited 3 days ago · 9 min read (1874 words) so far

Why should we build a **DApp** on **ICON?**

1. Easy to learn
2. High TPS
3. Flexible Transaction Fee Policy
4. Interchain
5. Healthy network

Easy to learn





Easy to learn

Workshop

High TPS

20 TPS

6
Confirms

1000TPS

1
Confirm

Low Transaction Fee

0.00000001 ICX, 0.001USD

0.00021 ETH, 0.03USD

Flexible Transaction Fee

Traditional Tx Fee

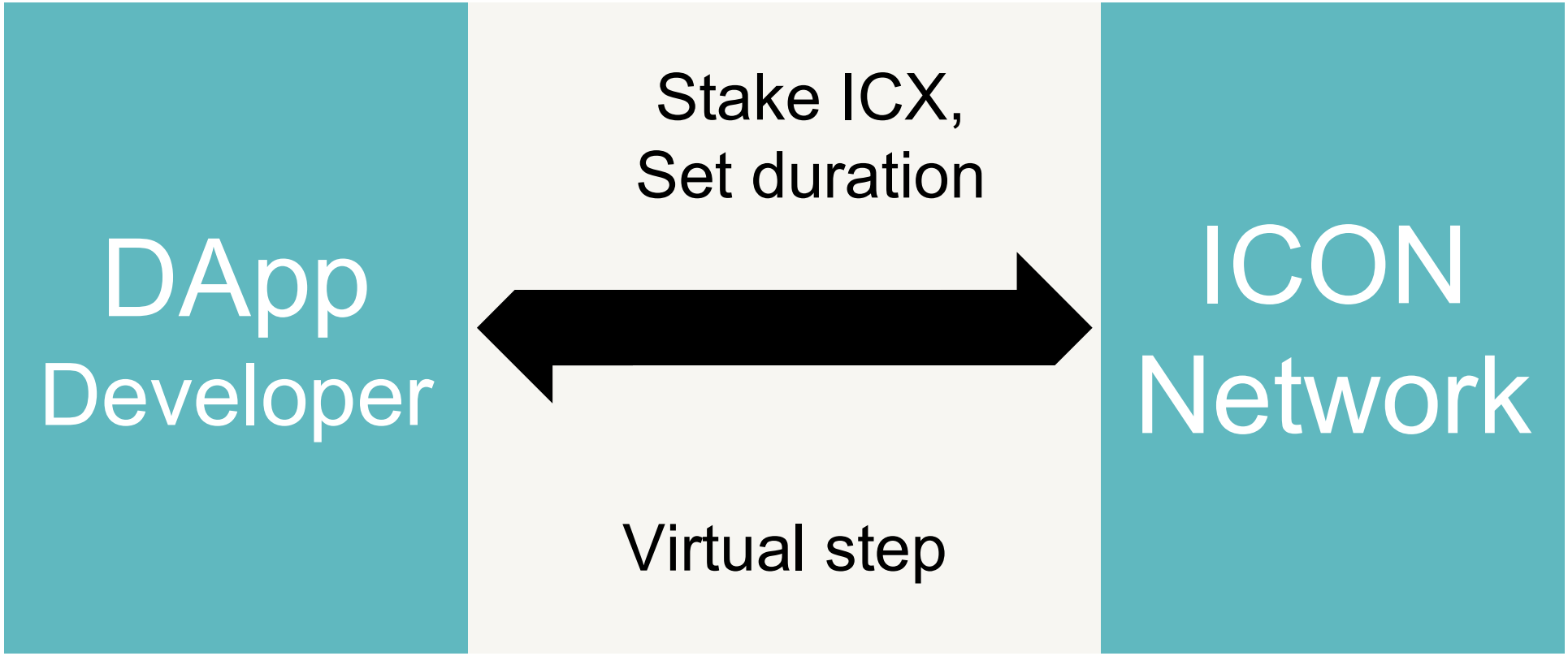
User pays 100%

Policy

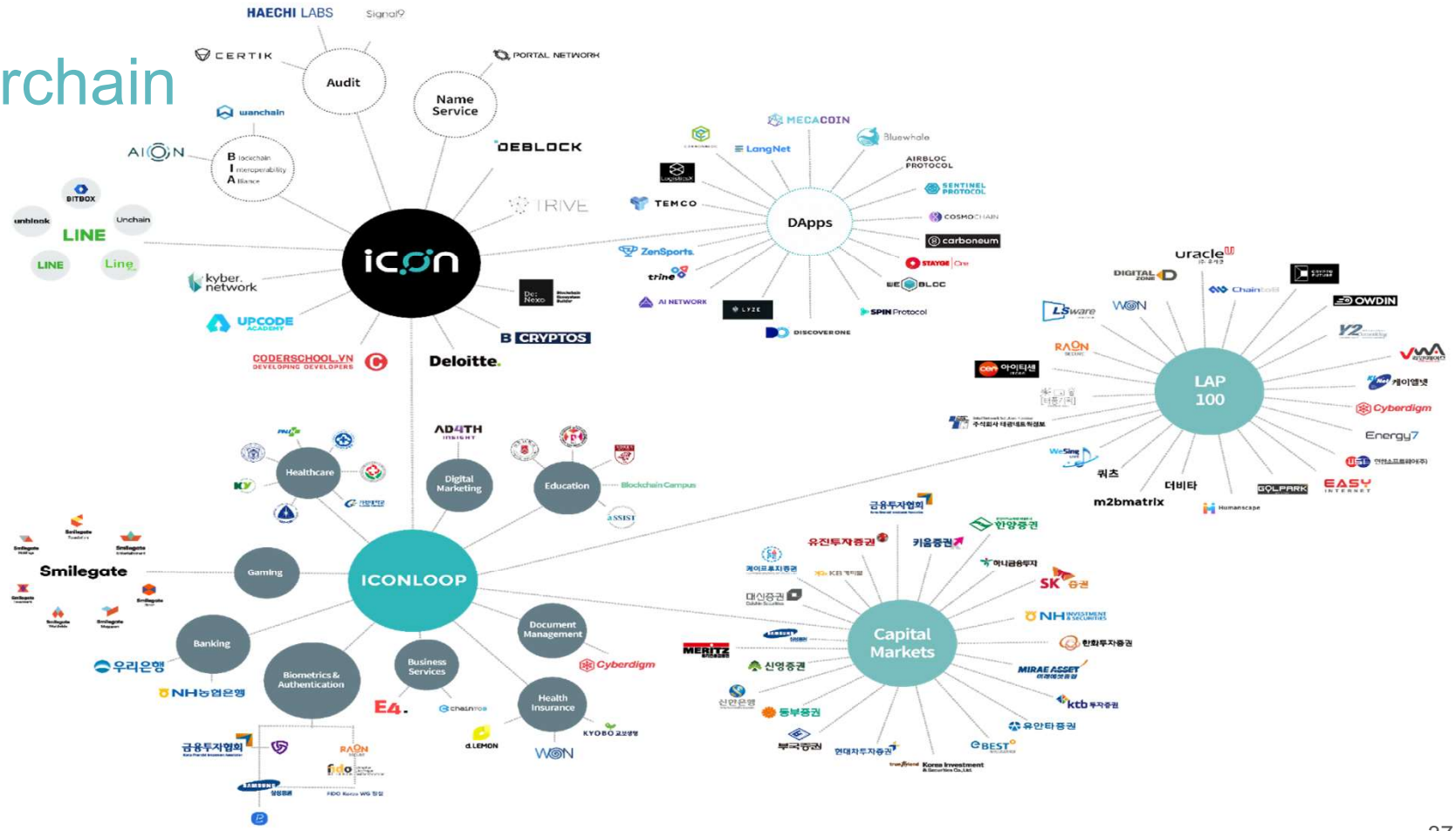
In ICON,
Developer can SET

Fee sharing rate

Flexible Transaction Fee Policy – Virtual step



Interchain


HAECHI LABS
Signal9
CERTIK
Audit
PORTAL NETWORK
Name Service
wanchain
AION
Blockchain Interoperability Alliance
DEBLOCK
IRIVE
BITBOX
unblank
Unchain
LINE
LINE
Line
kyber network
UPCODE ACADEMY
CODERSCHOOL.VN
DEVELOPING DEVELOPERS
Deloitte.
B CRYPTOS
ICON
MECACOIN
Bluewhale
LangNet
AIRBLOC PROTOCOL
TEMCO
SENTINEL PROTOCOL
COSMOCHAIN
DApps
carboneum
ZenSports
trine
STAYOK
BLOC
AI NETWORK
LYZE
SPIN Protocol
DISCOVERONE
uracle
DIGITAL ZONE
ChainCell
OWDIN
LSware
WON
Y2
RAON
VWA
아이티센
케이엘넷
Cyberdigm
Energy7
LAP 100
퀴즈
더비타
m2bmatrix
EASY INTERNET
Humanscape
AD4TH
Healthcare
Digital Marketing
Education
Blockchain Campus
ASSIST
Smilegate
Gaming
ICONLOOP
Banking
우리은행
NH농협은행
Biometrics & Authentication
Business Services
E4.
chainnos
d.LEMON
Document Management
Cyberdigm
Health Insurance
KYOBO 교보생명
WON
금융투자협회
RAON
fido
금융투자협회
안양증권
유진투자증권
키움증권
하나금융투자
SK증권
NH INVESTMENT & SECURITIES
한화투자증권
MIRAE ASSET
ktb 투자증권
유안타증권
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Capital Markets
MERITZ
신영증권
동부증권
부국증권
대신증권

Healthy Network

DPoC
Delegate Proof of Contribution

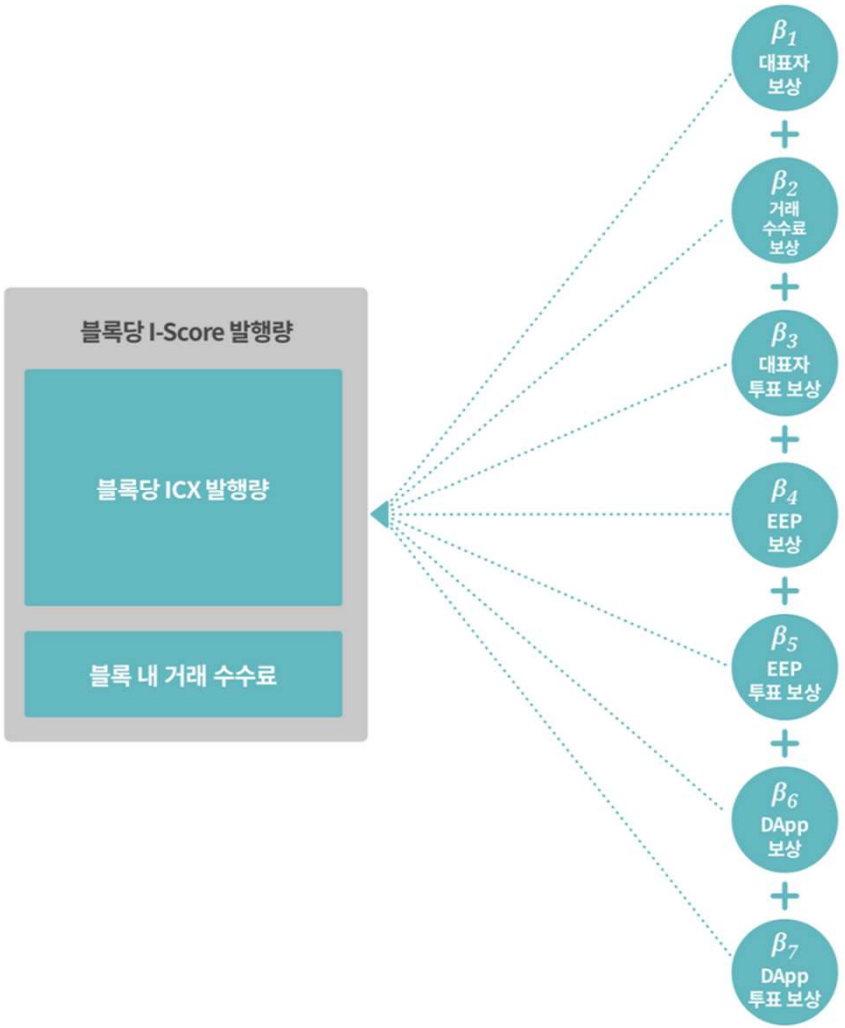
Healthy Network

IISS

ICON Incentive Scoreing System

Healthy Network

β6, β7
DApp reward



2. Review

Dive into ICON - DApp

Step 1. What is a DApp?

Step 2. Review

1. Dive into ICON - Tools
2. Dive into ICON - SCORE

Step 3. Make DApp

Step 4. Hands-on Exercise

Review

Dive into ICON - Tools

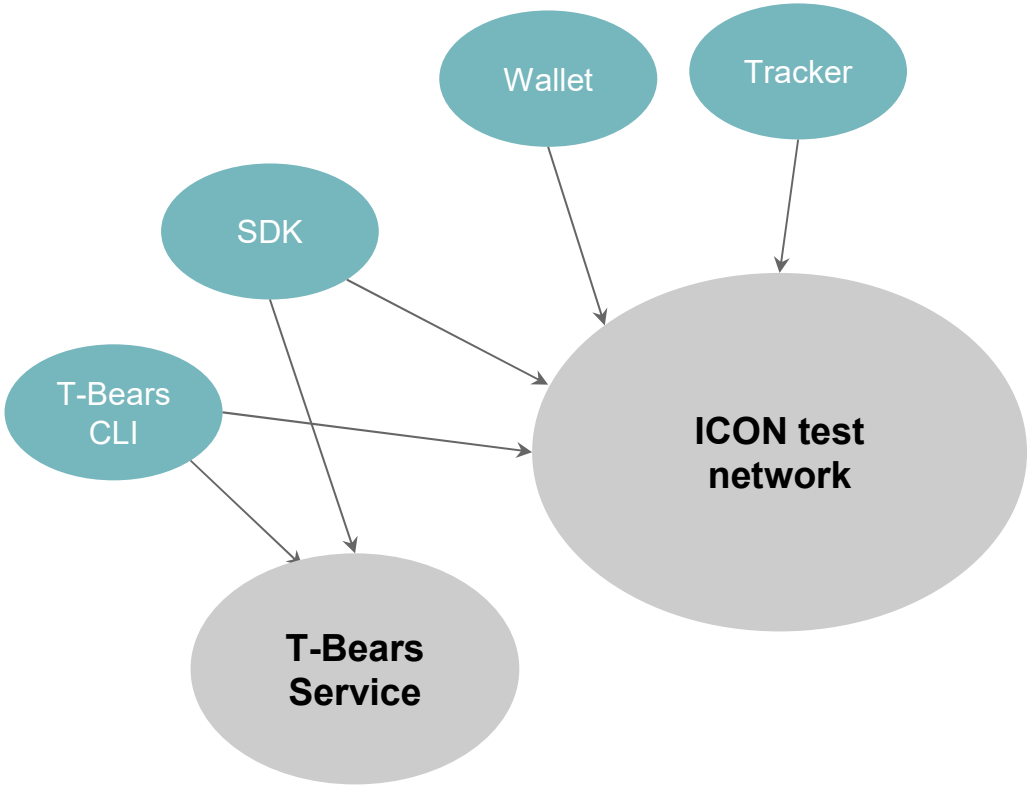
What we learned in “Dive into ICON – Tools”.

T-Bears

Python SDK

ICON Tools

- T-Bears Dev Suite
  - SCORE library
  - Service (Node emulator)
  - Test framework
  - CLI
- Client SDK
  - Java, Python, JavaScript
- ICONex
- Tracker

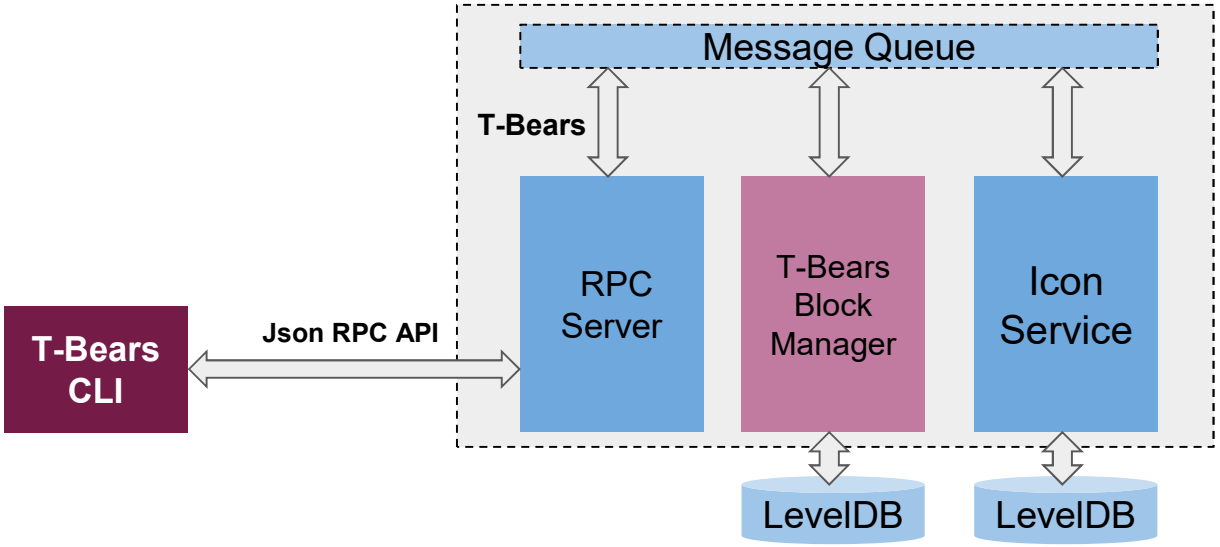


Basic Commands Of T-Bears

No	Command	Description
1	init	Initialize T-Bears project
2	deploy	Deploy SCORE
3	txresult	Get transaction result by hash
4	call	Request icx_call with user input json file.
5	sendtx	Request icx_sendTransaction with user input json file.
6	scoreapi	Get SCORE's API using given SCORE address.

How does T-Bears CLI work with RPC Server?

- T-Bears CLI interacts with RPC Server using JSON RPC API protocol



ICON JSON-RPC API V3

- icx_sendTransaction
  - Transfer designated amount of ICX coins from 'from' address to 'to' address.
  - Install a new SCORE.
  - Update the SCORE in the 'to' address.
  - Invoke a function of the SCORE in the 'to' address.
  - Transfer a message.

ICON JSON-RPC API V3

- JSON-RPC also provides various APIs like
  - icx_getLastBlock
  - icx_getBlockByHeight
  - icx_getBlockByHash
  - icx_getBalance
  - icx_getScoreApi
  - icx_getTotalSupply
  - icx_getTransactionResult
  - icx_getTransactionByHash

SCORE Implementation Guide

- ICON Developers Portal
  - https://www.icondev.io/docs/overview

- iconservice API references
  - https://iconservice.readthedocs.io/en/latest/

Review

Dive into ICON - SCORE

What We learned in “Dive into ICON – SCORE”.

SCORE

Smart Contract On Reliable Environment

What We learned in “Dive into ICON – SCORE”.

Audit

Must check checklist!

Check Audit checklist

1. **Visit audit checklist**

- https://www.icondev.io/docs/audit-checklist#section-critical

2. **Check**
Critical & Warnning List

Critical

Timeout

SCORE function must return fairly immediately. Blockchain is not for any long-running operation.
For example, if you implement token airdrop to many users, do not iterate over all users in a single function. Handle each or partial airdrop(s) one by one instead.

```
# Bad
@external
def airdrop_token(self, _value: int, _data: bytes = None):
    for target in self._very_large_targets:
        self._transfer(self.msg.sender, target, _value, _data)

# Good
@external
def airdrop_token(self, _to: Address, _value: int, _data: bytes = None):
    if self._airdrop_sent_address[_to]:
        self.revert(f"Token was dropped already: {_to}")
    self._airdrop_sent_address[_to] = True
    self._transfer(self.msg.sender, _to, _value, _data)
```

Unfinishing loop

Check Audit checklist

Critical

Timeout
Unfinishing loop
Package import
System call
Randomness
Outbound network call
IRC2 Token Standard compliance
IRC2 Token parameter name
Eventlog on Token Transfer
Eventlog without Token Transfer
ICXTransfer Eventlog
Big Number Operation
Instance Variable
Super Class
StateDB write operation
Temporary Limitation

Warnning

External Function Parameter Check
Internal Function Parameter Check
Predictable arbitrarity
Unchecked Low Level Calls
Underflow/Overflow
Vault
Reentrancy

Check Audit checklist

Critical

Timeout

Unfinishing loop
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Big Number Operation
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Super Class
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Temporary Limitation

```python
# Bad
@external
def airdrop_token(self, _value: int, _data: bytes = None):
    for target in self._very_large_targets:
        self._transfer(self.msg.sender, target, _value, _data)

# Good
@external
def airdrop_token(self, _to: Address, _value: int, _data: bytes = None):
    if self._airdrop_sent_address[_to]:
        self.revert(f"Token was dropped already: {_to}")
    self._airdrop_sent_address[_to] = True
    self._transfer(self.msg.sender, _to, _value, _data)
```

Check Audit checklist

Critical

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Temporary Limitation

Eventlog on Token Transfer

Token transfer must trigger Eventlog.

```
# Good
@eventlog(indexed=3)
def Transfer(self, _from: Address, _to: Address, _value: int, _data: bytes):
    pass

@external
def transfer(self, _to: Address, _value: int, _data: bytes = None):
    self._balances[self.msg.sender] -= _value
    self._balances[_to] += _value
    self.Transfer(self.msg.sender, _to, _value, _data)
```

Eventlog without Token Transfer

Do not trigger Transfer Eventlog without token transfer.

```
# Bad
@eventlog(indexed=3)
def Transfer(self, _from: Address, _to: Address, _value: int, _data: bytes):
    pass

@external
def doSomething(self, _to: Address, _value: int):
    #  no token transfer occurred
    self.Transfer(self.msg.sender, _to, _value, None)
```

Check Audit checklist

Critical

Timeout
Unfinishing loop
Package import
System call
Randomness
Outbound network call
IRC2 Token Standard compliance
IRC2 Token parameter name
Eventlog on Token Transfer
Eventlog without Token Transfer
ICXTransfer Eventlog
Big Number Operation
Instance Variable

Super Class

StateDB write operation
Temporary Limitation

```python
# Bad
class MyClass(IconScoreBase):
    def __init__(self, db: IconScoreDatabase) -> None:
        self._context__name = VarDB('context.name', db, str)
        self._context__cap = VarDB('context.cap', db, int)

    def on_install(self, name: str, cap: str) -> None:
        # doSomething

    def on_update(self) -> None:
        # doSomething

# Good
class MyClass(IconScoreBase):
    def __init__(self, db: IconScoreDatabase) -> None:
        super().__init__(db)
        self._context__name = VarDB('context.name', db, str)
        self._context__cap = VarDB('context.cap', db, int)

    def on_install(self, name: str, cap: str) -> None:
        super().on_install()
        # doSomething

    def on_update(self) -> None:
        super().on_update()
        # doSomething
```

Check Audit checklist

Critical

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Big Number Operation
Instance Variable
Super Class
StateDB write operation

Temporary Limitation

Temporary Limitation

Due to the known issue of ArrayDB, declaring ArrayDB as a class member variable in __init__() may not work as intended. Following workaround is needed. ArrayDB instance must be initialized every time it is used.

```
# Problematic (Original Usage)
def __init__(self, db: IconScoreDatabase) -> None:
    super().__init__(db)
    self.test_array = ArrayDB('test_array', db, value_type=int)

def func(self) -> None:
    self.test_array.put(0)


# Good (Temporary)
@property
def test_array(self) -> ArrayDB:
    return ArrayDB('test_array', db, value_type=int)

def __init__(self, db: IconScoreDatabase) -> None:
    super().__init__(db)
    # no declaration

def func(self) -> None:
    self.test_array.put(0)
```

What We learned in “Dive into ICON – SCORE”.

IIPs

ICON Improvement **P**roposals

Check IIPs

1. **Visit IIPs**

- https://github.com/icon-project/IIPs

2. **Check**

Specification of proposal

3. How to build a DApp ?

Dive into ICON - DApp

Step 1. What is a DApp?

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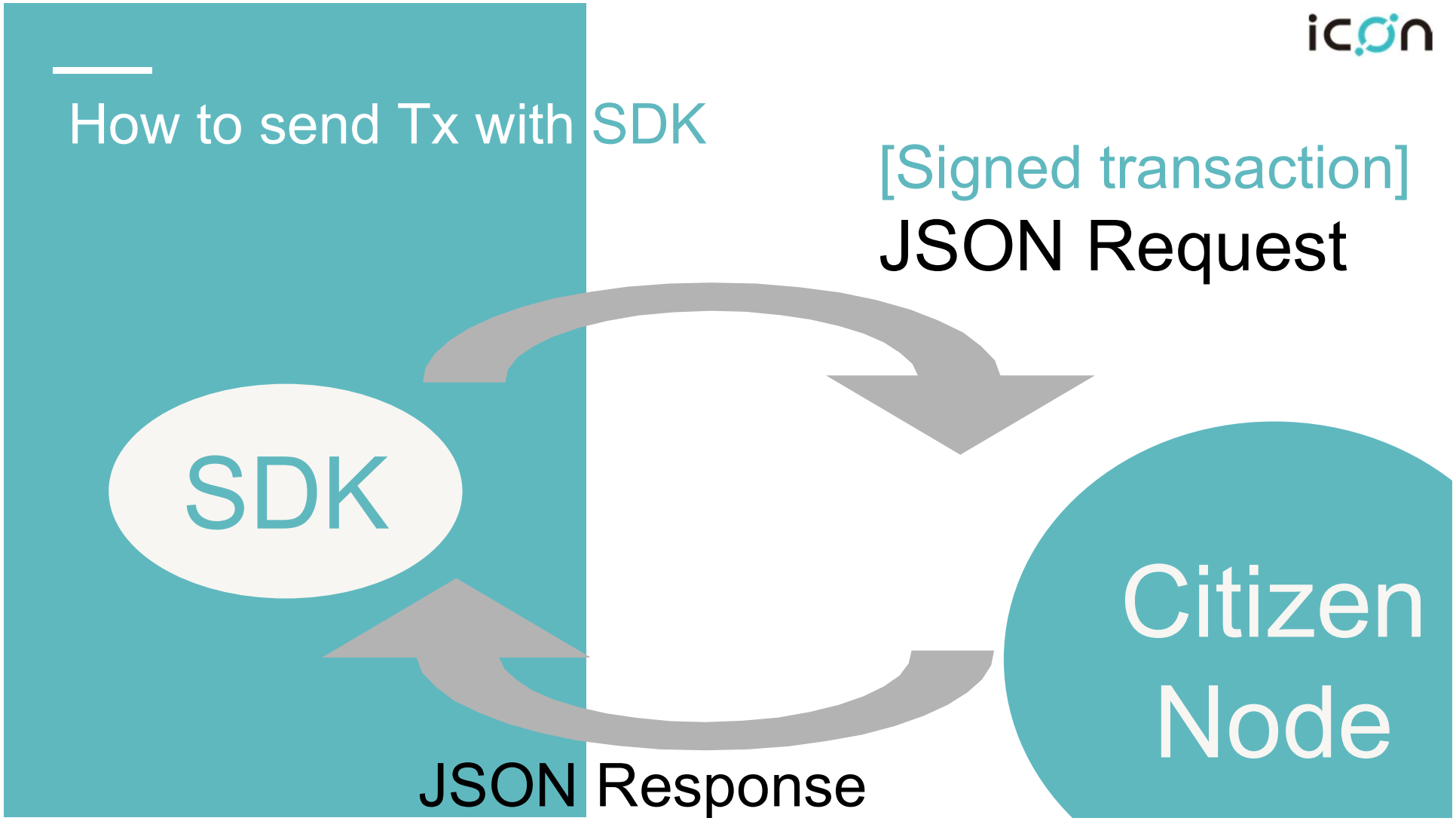
Step 3. How to build a DApp

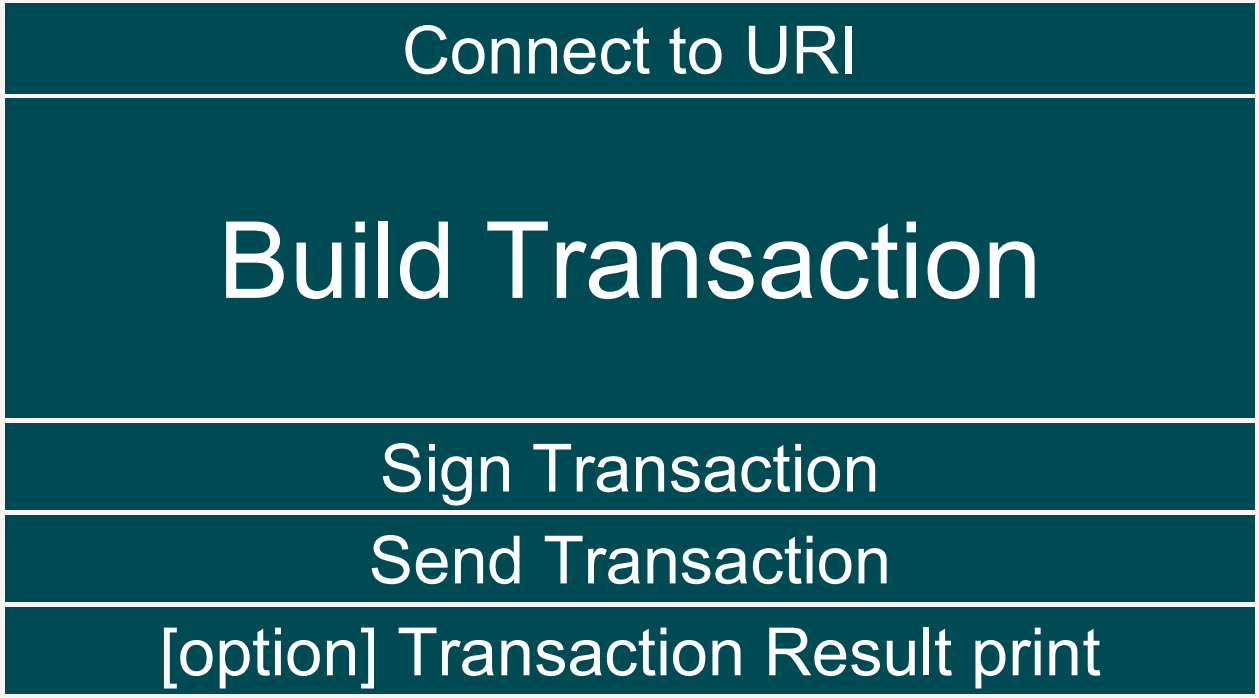
1. How to send Tx with SDK
2. How to use ICONex connect

Step 4. Hands-on Exercise


How to send Tx with SDK
[Signed transaction]
JSON Request
SDK
Citizen Node
JSON Response

How to send Tx with SDK

SDK code



How to send Tx with SDK

Python SDK

```
icon_service = IconService(HTTPProvider('https://bicon.net.solidwallet.io/api/v3'))

wallet = KeyWallet.create()

transaction = CallTransactionBuilder()\
    .from_(wallet.get_address())\
    .to("cxbff5fa7adc97f515070f2490d5a47aa927859549") \
    .nid(3) \
    .step_limit(1000000)\
    .value(10000000)\
    .version(3)\
    .method("scrooge")\
    .params({
        "_to": "hx9505040fc8883f9d4b287d1dbcd49bb2cd80748a",
        "_ratio": 2
    })\
    .build()

signed_transaction = SignedTransaction(transaction, wallet)

tx_hash = icon_service.send_transaction(signed_transaction)
```

JavaScript SDK

```
var IconService = window['icon-sdk-js']
var provider = new IconService.HttpProvider('https://bicon.net.solidwallet.io/api/v3')
var iconService = new IconService(provider)
var IconConverter = IconService.IconConverter
var IconBuilder = IconService.IconBuilder
var IconAmount = IconService.IconAmount
```

```
requestScore.onclick = function() {
  var callTransactionBuilder = new IconBuilder.CallTransactionBuilder;
  var callTransactionData = callTransactionBuilder
            .from(fromAddress)
            .to("cxbff5fa7adc97f515070f2490d5a47aa927859549")
            .nid(IconConverter.toBigNumber(3))
            .timestamp((new Date()).getTime() * 1000)
            .stepLimit(IconConverter.toBigNumber(10000000))
            .value(IconAmount.of(amount_loop.value, IconAmount.Unit.ICX).toLoop())
            .version(IconConverter.toBigNumber(3))
            .method('scrooge')
            .params({
                "_to": "hx9505040fc8883f9d4b287d1dbcd49bb2cd80748a",
                "_ratio": IconConverter.toHex(2)
            })
            .build()

        scoreData.value = JSON.stringify({
            "jsonrpc": "2.0",
            "method": "icx_sendTransaction",
            "params": IconConverter.toRawTransaction(callTransactionData),
            "id": 8015
        })
```

How to send Tx with SDK

Python SDK

```python
icon_service = IconService(HTTPProvider('https://bicon.net.solidwallet.io/api/v3'))

wallet = KeyWallet.create()

transaction = CallTransactionBuilder()\
    .from_(wallet.get_address())\
    .to("cxbff5fa7adc97f515070f2490d5a47aa927859549") \
    .nid(3) \
    .step_limit(1000000)\
    .value(10000000)\
    .version(3)\
    .method("scrooge")\
    .params({
        "_to": "hx9505040fc8883f9d4b287d1dbcd49bb2cd80748a",
        "_ratio": 2
    })\
    .build()

signed_transaction = SignedTransaction(transaction, wallet)

tx_hash = icon_service.send_transaction(signed_transaction)
```

JavaScript SDK

```javascript
var IconService = window['icon-sdk-js']
var provider = new IconService.HttpProvider('https://bicon.net.solidwallet.io/api/v3')
var iconService = new IconService(provider)
var IconConverter = IconService.IconConverter
var IconBuilder = IconService.IconBuilder
var IconAmount = IconService.IconAmount
```

```javascript
requestScore.onclick = function() {
  var callTransactionBuilder = new IconBuilder.CallTransactionBuilder;
  var callTransactionData = callTransactionBuilder
            .from(fromAddress)
            .to("cxbff5fa7adc97f515070f2490d5a47aa927859549")
            .nid(IconConverter.toBigNumber(3))
            .timestamp((new Date()).getTime() * 1000)
            .stepLimit(IconConverter.toBigNumber(10000000))
            .value(IconAmount.of(amount_loop.value, IconAmount.Unit.ICX).toLoop())
            .version(IconConverter.toBigNumber(3))
            .method('scrooge')
            .params({
                "_to": "hx9505040fc8883f9d4b287d1dbcd49bb2cd80748a",
                "_ratio": IconConverter.toHex(2)
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            .build()

        scoreData.value = JSON.stringify({
            "jsonrpc": "2.0",
            "method": "icx_sendTransaction",
            "params": IconConverter.toRawTransaction(callTransactionData),
            "id": 8015
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            .nid(IconConverter.to[illegible]Number(3))
            .timestamp((new Date()).getTime()[illegible]1000)
            .stepLimit(IconConverter.toBig[illegible]r(10000000))
            .value(IconAmount.of(amount_[illegible].value, IconAmount.Unit.ICX).toLoop())
            .version(IconConverter.toBi[illegible]mber(3))
            .method('scrooge')
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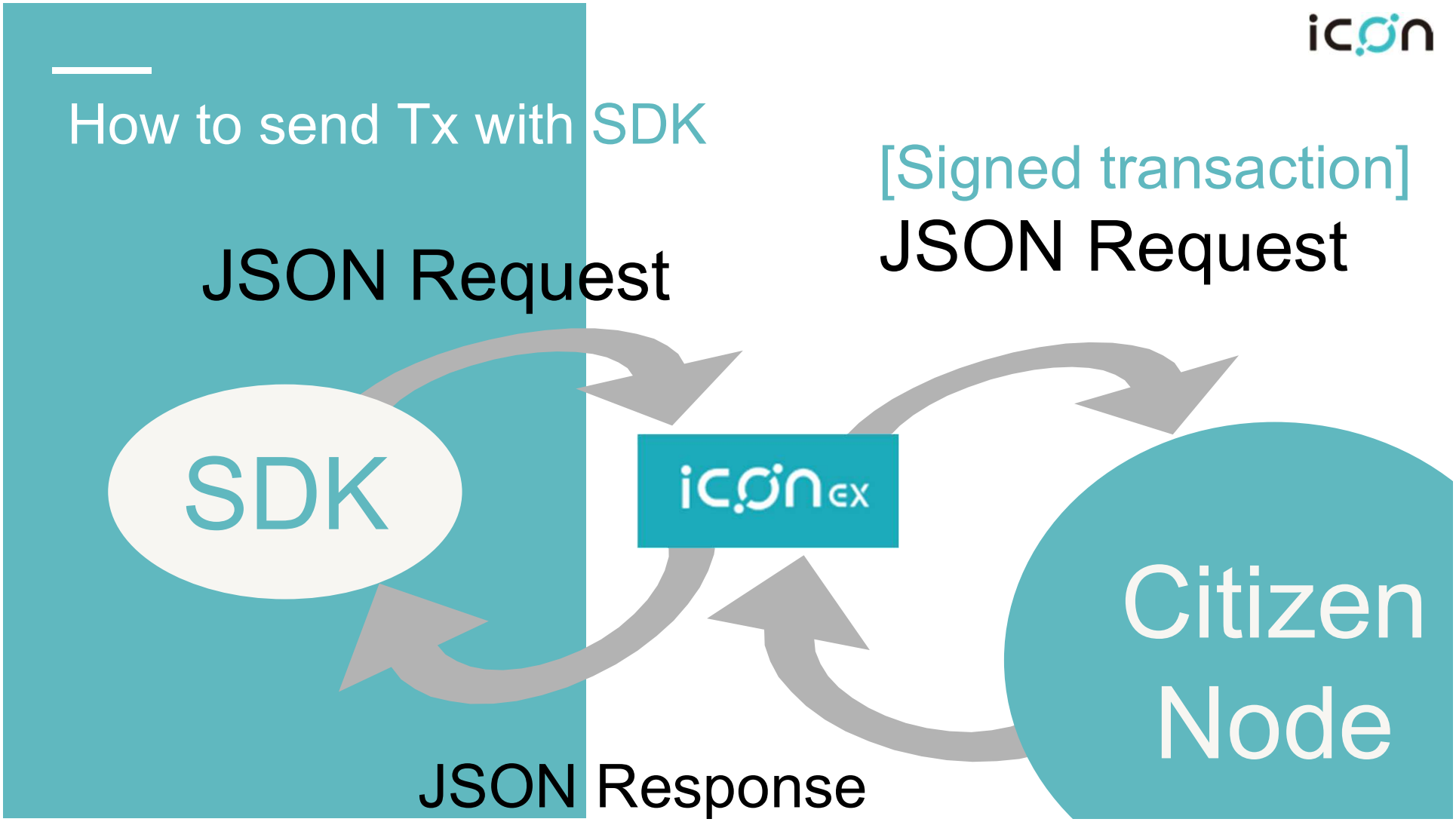
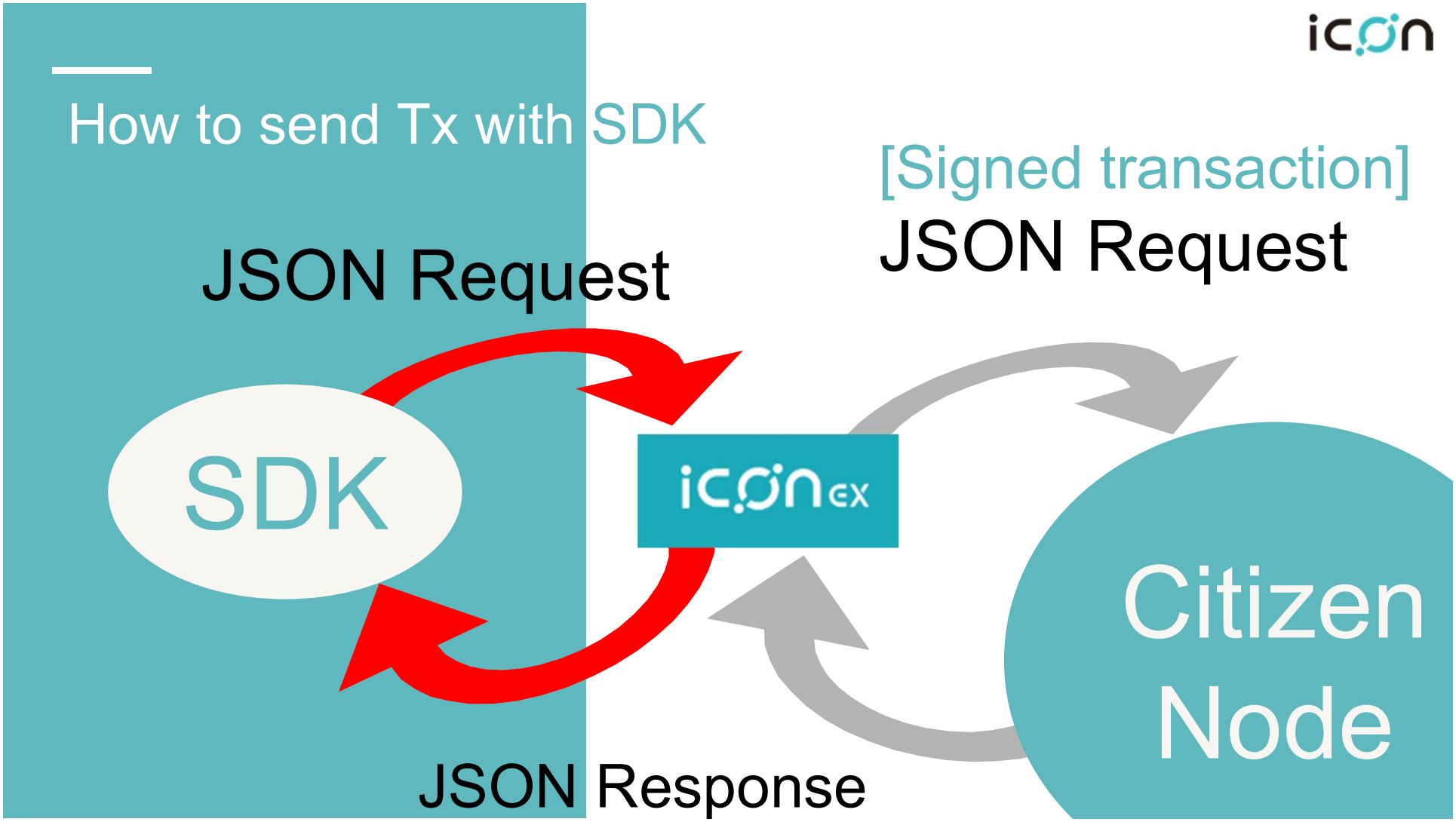
How to send Tx with SDK




icon ex

How to send Tx with SDK



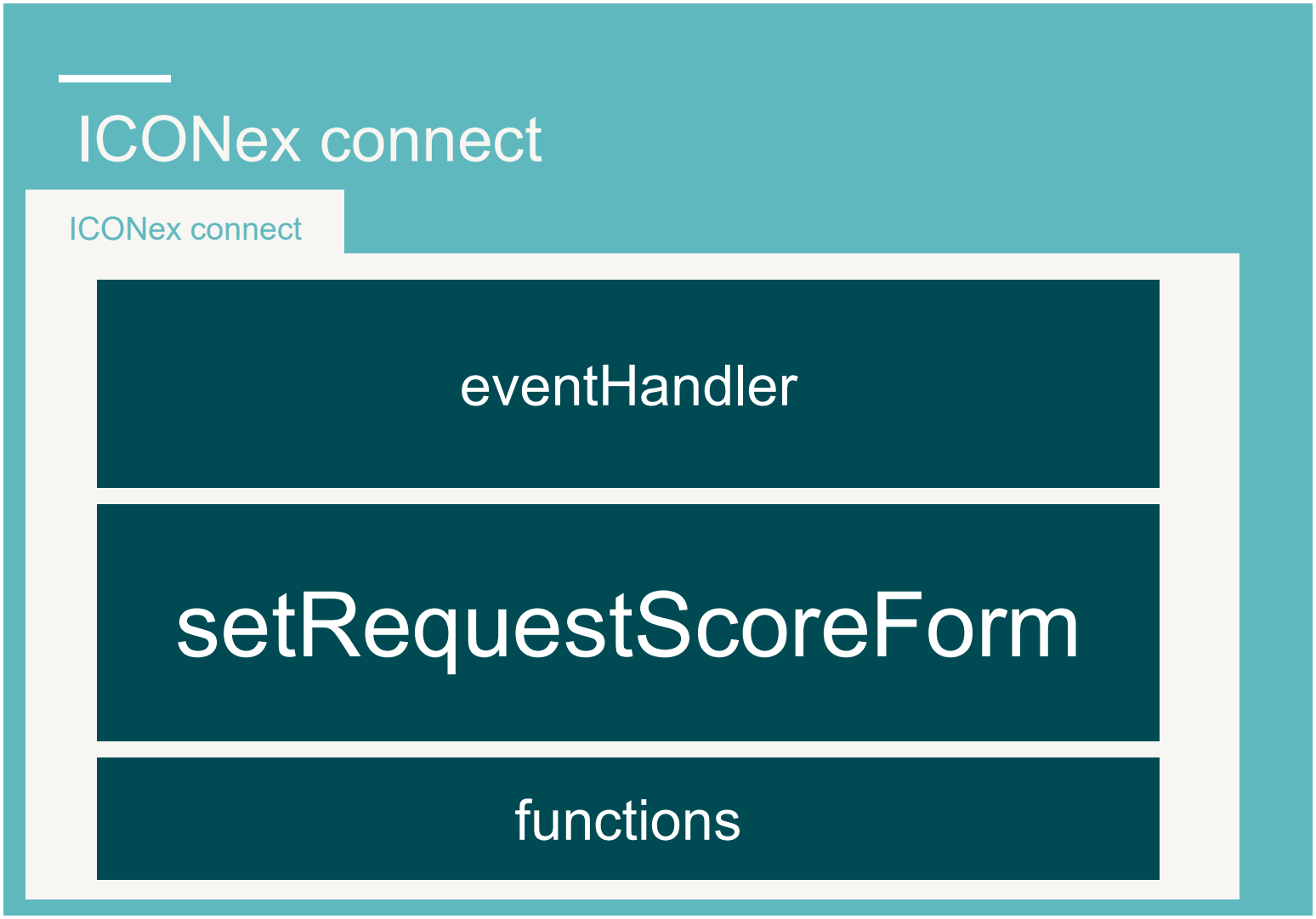
How to send Tx with SDK

REQUEST_HAS_ACCOUNT
REQUEST_HAS_ADDRESS
REQUEST_ADDRESS
REQUEST_JSON-RPC
REQUEST_SIGNING

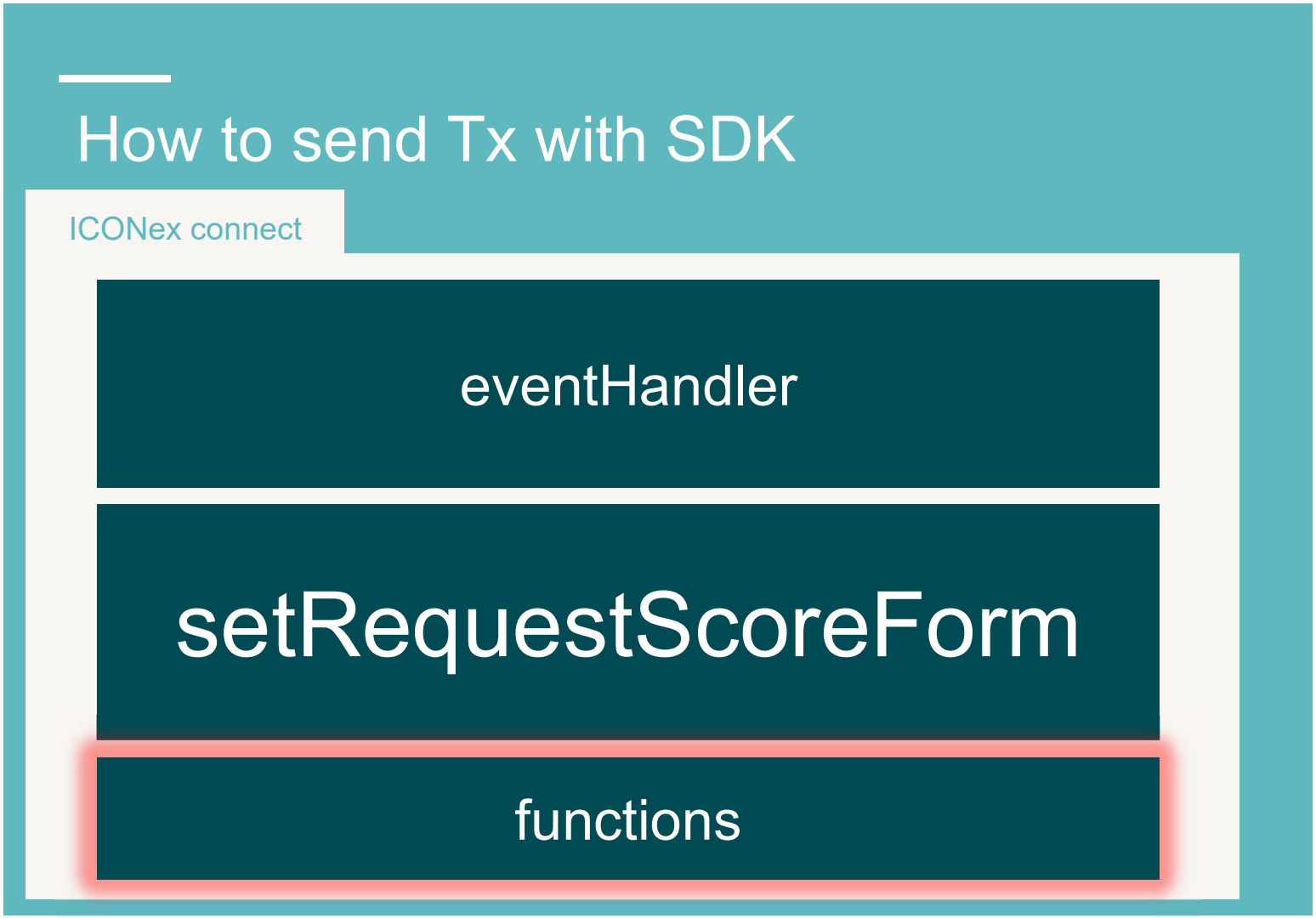
SDK

RESPONSE_HAS_ACCOUNT
RESPONSE_HAS_ADDRESS
RESPONSE_ADDRESS
RESPONSE_JSON-RPC
RESPONSE_SIGNING

ICONex connect



How to send Tx with SDK



How to send Tx with SDK

Functions(request)

```
requestHasAccount.onclick = function () {
    window.dispatchEvent(new CustomEvent('ICONEX_RELAY_REQUEST', {
        detail: {
            type: "REQUEST_HAS_ACCOUNT"
        }
    }))
}

requestHasAddress.onclick = function () {
    window.dispatchEvent(new CustomEvent('ICONEX_RELAY_REQUEST', {
        detail: {
            type: 'REQUEST_HAS_ADDRESS',
            payload: requestHasAddressData.value || requestHasAddressData.placeholder
        }
    }))
}

requestAddress.onclick = function () {
    window.dispatchEvent(new CustomEvent('ICONEX_RELAY_REQUEST', {
        detail: {
            type: 'REQUEST_ADDRESS'
        }
    }))
}
```

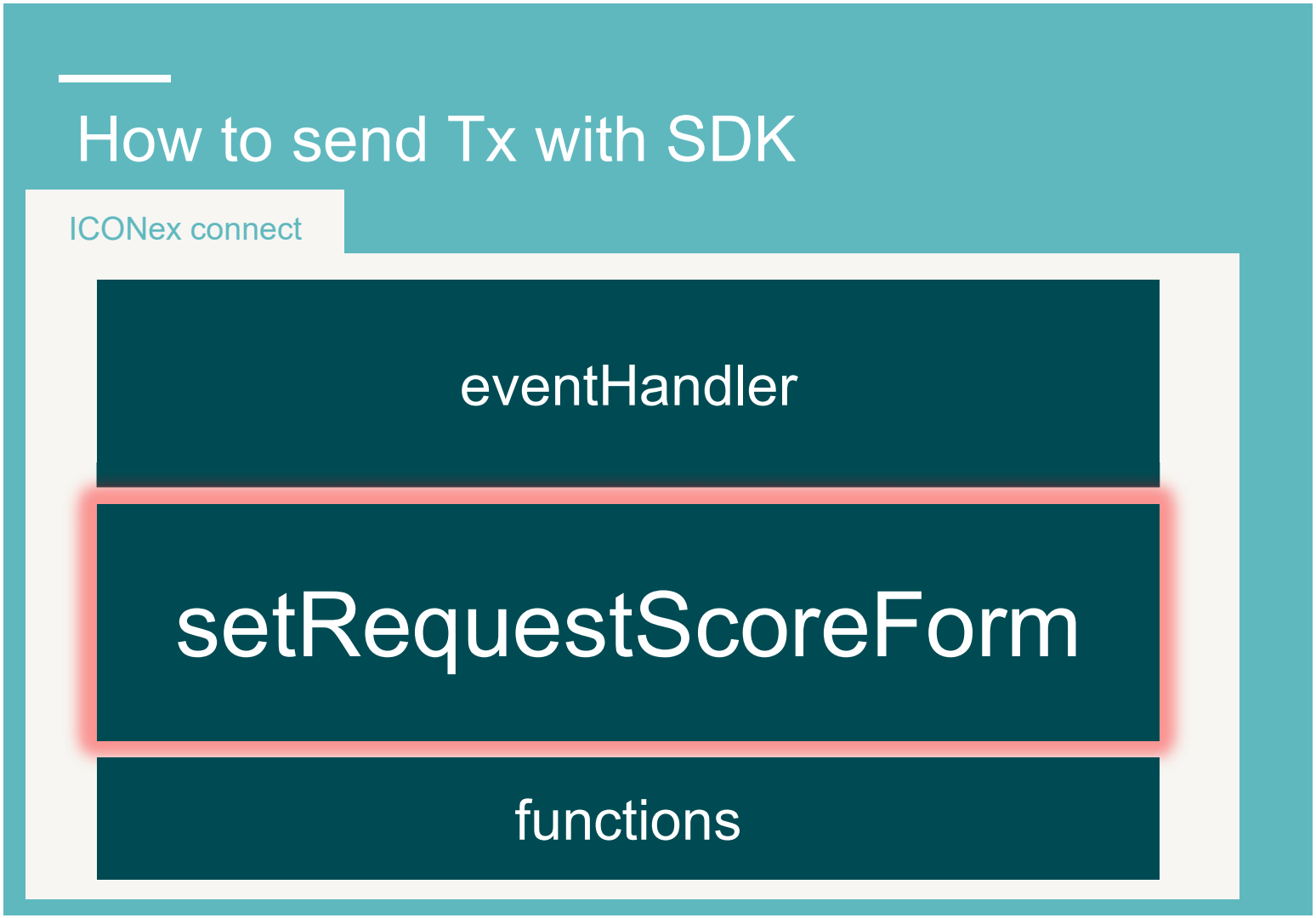
How to send Tx with SDK

REQUEST_HAS_ACCOUNT
REQUEST_HAS_ADDRESS
REQUEST_ADDRESS
REQUEST_JSON-RPC
REQUEST_SIGNING

SDK

RESPONSE_HAS_ACCOUNT
RESPONSE_HAS_ADDRESS
RESPONSE_ADDRESS
RESPONSE_JSON-RPC
RESPONSE_SIGNING

How to send Tx with SDK



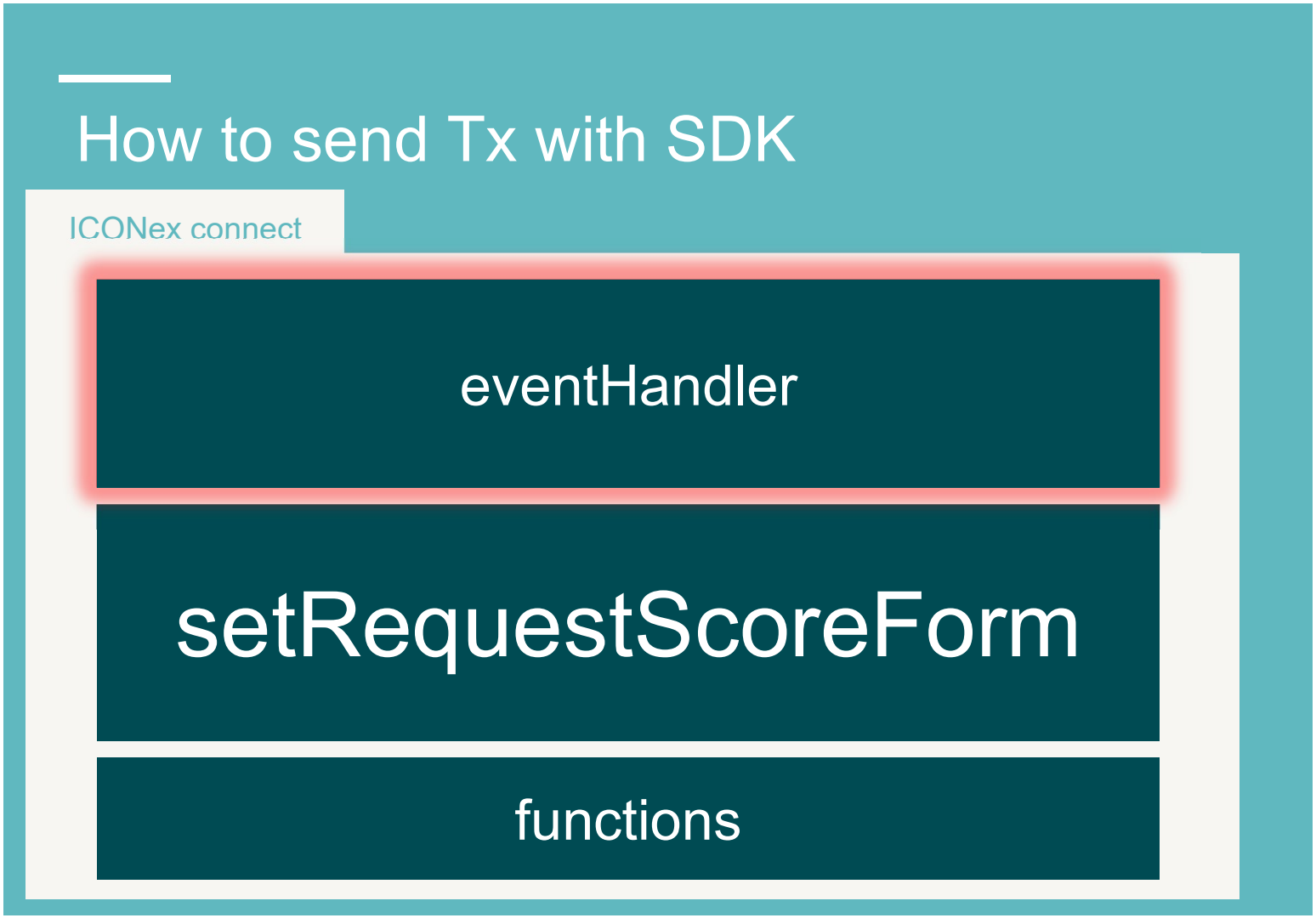
How to send Tx with SDK

setRequestScoreForm

```
function setRequestScoreForm() {
    var data = new FormData(requestScoreForm);
    var type = '';
    for (const entry of data) { type = entry[1] };
    switch (type) {
        case 'read-only':
            var callBuilder = new IconBuilder.CallBuilder;
            var readOnlyData = callBuilder
                .from(fromAddress)
                .to('cx43f59485bd34d0c7e9312835d65cb399f6d29651')
                .method("hello")
                .build()
            scoreData.value = JSON.stringify({
                "jsonrpc": "2.0",
                "method": "icx_call",
                "params": readOnlyData,
                "id": 50889
            })
            break;

        case 'send-transaction':
            var callTransactionBuilder = new IconBuilder.CallTransactionBuilder;
            var callTransactionData = callTransactionBuilder
                .from(fromAddress)
                .to("cxb20b5ff06ba50aef42c7832958af59f9ae0651e7")
                .nid(IconConverter.toBigNumber(3))
                .timestamp((new Date()).getTime() * 1000)
```

How to send Tx with SDK



How to send Tx with SDK

eventHandler

```
window.addEventListener("ICONEX_RELAY_RESPONSE", eventHandler, false);

function eventHandler(event) {
    var type = event.detail.type
    var payload = event.detail.payload
    switch (type) {
        case "RESPONSE_HAS_ACCOUNT":
            responseHasAccount.innerHTML = "> Result : " + payload.hasAccount + " (" + typeof payload.hasAccount + ")";
            break
        case "RESPONSE_HAS_ADDRESS":
            responseHasAddress.innerHTML = "> Result : " + payload.hasAddress + " (" + typeof payload.hasAddress + ")";
            break
        case "RESPONSE_ADDRESS":
            fromAddress = payload
            responseAddress.innerHTML = "> Selected ICX Address : " + payload;
            jsonRpc0.disabled = false
            jsonRpc1.disabled = false
            jsonRpc2.disabled = false
            jsonRpc3.disabled = false
            break
        case "RESPONSE_JSON-RPC":
            responseScore.value = JSON.stringify(payload);
            break
        case "CANCEL_JSON-RPC":
            responseScore.value = null;
            break
        case "RESPONSE_SIGNING":
            signingData.value = null
            responseSigning.innerHTML = "> Signature : " + JSON.stringify(payload);
            break
        case "CANCEL_SIGNING":
            signingData.value = null
            responseSigning.value = "> Signature : ";
            break
        default:
    }
}
```

How to send Tx with SDK

REQUEST_HAS_ACCOUNT
REQUEST_HAS_ADDRESS
REQUEST_ADDRESS
REQUEST_JSON-RPC
REQUEST_SIGNING

SDK

RESPONSE_HAS_ACCOUNT
RESPONSE_HAS_ADDRESS
RESPONSE_ADDRESS
RESPONSE_JSON-RPC
RESPONSE_SIGNING

Dive into ICON – SCORE

Blackjack

```
$ cd ./samplepage
```

```
$ python manage.py runserver 0.0.0.0:8000
```

4. Hands on Exercise

Dive into ICON - DApp

Step 1. What is a DApp?

Step 2. Review

Step 3. How to build a DApp

Step 4. Hands-on Exercise

1. Make complete example page, Welcome & Scrooge.

Make complete example SCORE, Scrooge

Scrooge SCORE

```
$ cd ./exercise/sampleSCORE
```

Select easy or hard

Guide
./exercise/sampleSCORE/README.md

Make complete example SCORE, Scrooge

Scrooge page

```
$ cd ./exercisepage
```

```
$ python manage.py runserver 0.0.0.0:8000
```

Guide
./exercisepage/README.md