

# ICON Developers Meetup

ICON foundation

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# ICON Developers Meetup

Step 1. ICON Basics

Step 2. Interacting with ICON nodes

Step 3. Smart Contract Development

Appendix A. T-Bears Quickstart

Appendix B. AWS Development Network

Appendix C. Development Resources

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# ICON Developers Meetup

## Step 1. ICON Basics

- 1.1. Introduction to ICON
- 1.2. Architecture and Components

## Step 2. Interacting with ICON nodes

## Step 3. Smart Contract Development

## Appendix A. T-Bears Quickstart

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# ICON Developers Meetup

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- 2.1. Account & Transaction
- 2.2. Test Environment

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- 3.1. Smart Contract Basics
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# 1. ICON Basics

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# ICON Developers Meetup

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# 1.1. Introduction to ICON



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# Blockchain - Beginning of new Era

- Blockchain
  - Centralized  $\Rightarrow$  Decentralized world
- Problem
  - Low TPS (Transaction Per Second)
  - Limited scalability
  - Isolated blockchains

# ICON - New Generation Blockchain

1st Generation : Bitcoin and the simple alt-coins (eg. litecoin) [2009]

Programmable Smart Contract



2nd Generation : Ethereum. Turing complete Smart Contract [2015]

Performance Enhancement



3rd Generation : EOS, AION, Zilliqa, **ICON** [2017] ...

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## ICON Characteristic

- Delegated proof of contribution (DPoC)
  - One confirmation
  - 1000+ TPS
- Multi channel
  - 1000+ TPS per channel
- Low / flexible transaction fee
- Interchain
- Native python code Smart Contract + JVM

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## Summary

- 3rd Generation Blockchain
  - Programmable Smart Contract
  - Performance Enhancement
- ICON Characteristic
  - DPoC
  - Interchain
  - Native python code Smart Contract + JVM
  - Low / flexible transaction fee
  - Multi channel

## 1.2. Architecture and Components

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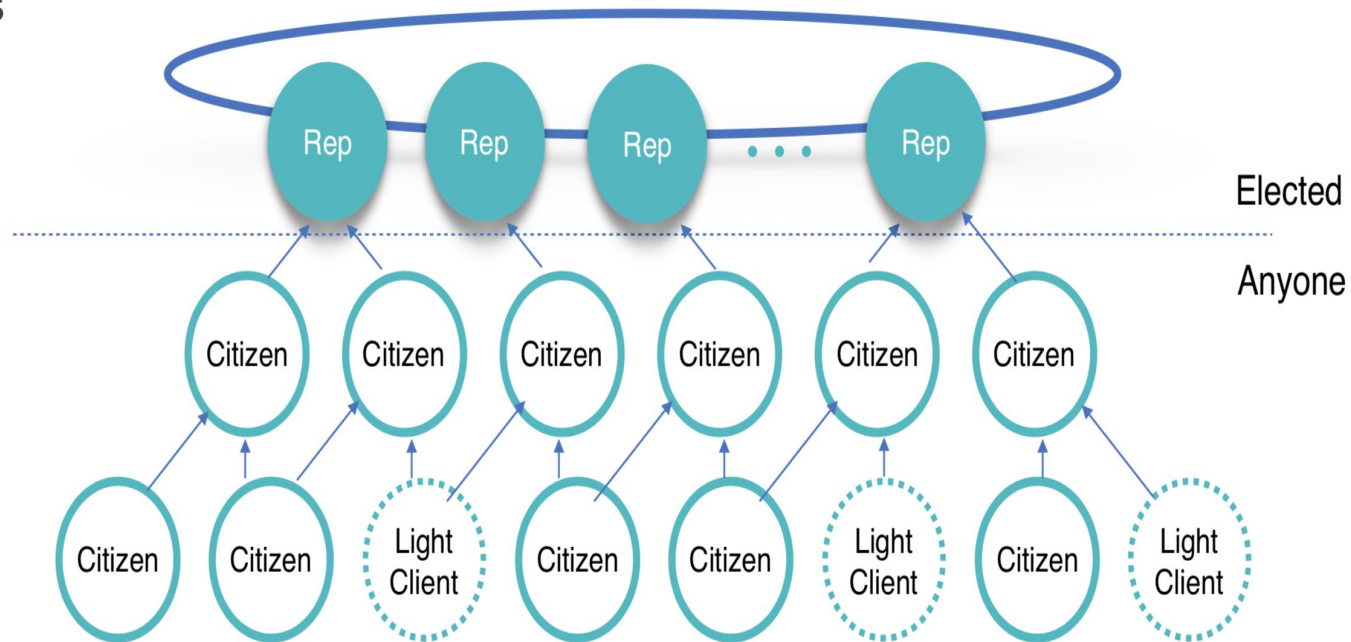
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# ICON Network

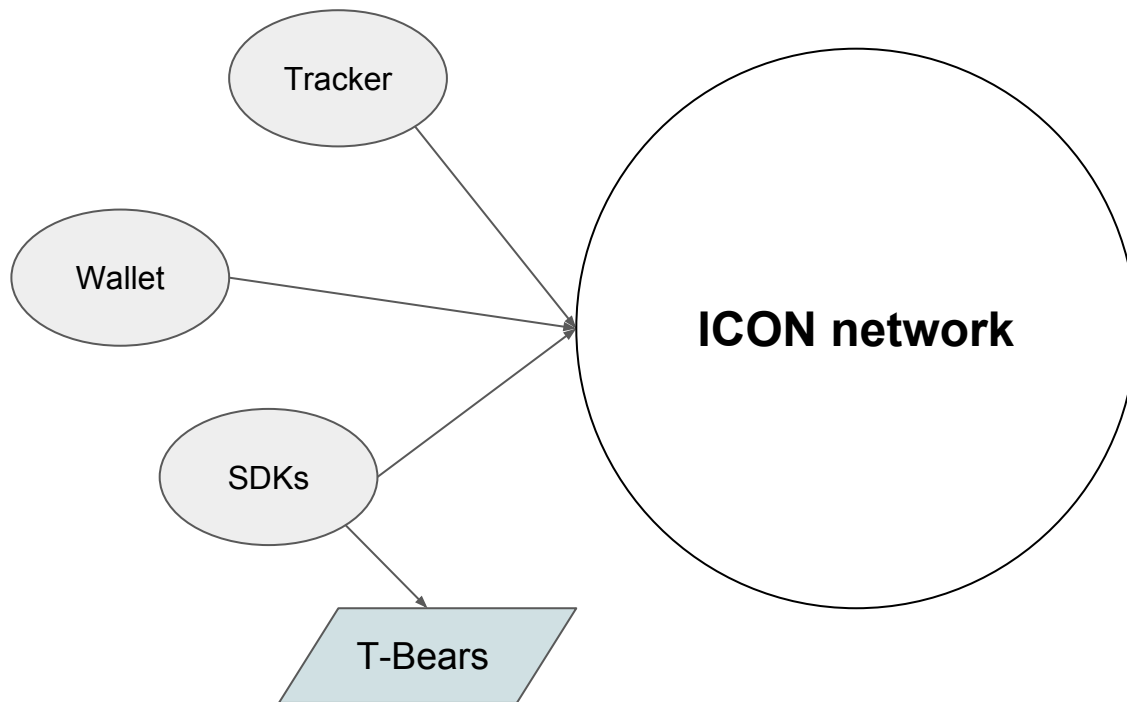
- Representatives
- Citizen
- Light Client





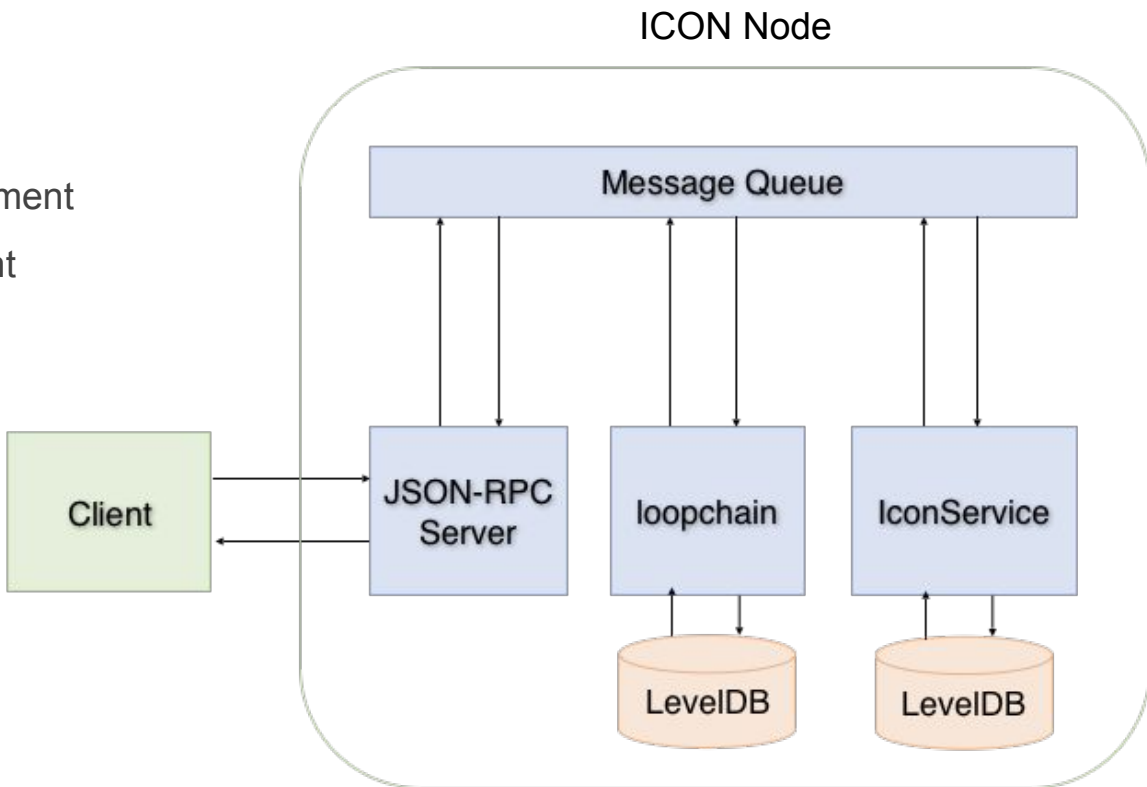
# Architecture and Components

- T-Bears
- SDK
- Wallet
- Tracker



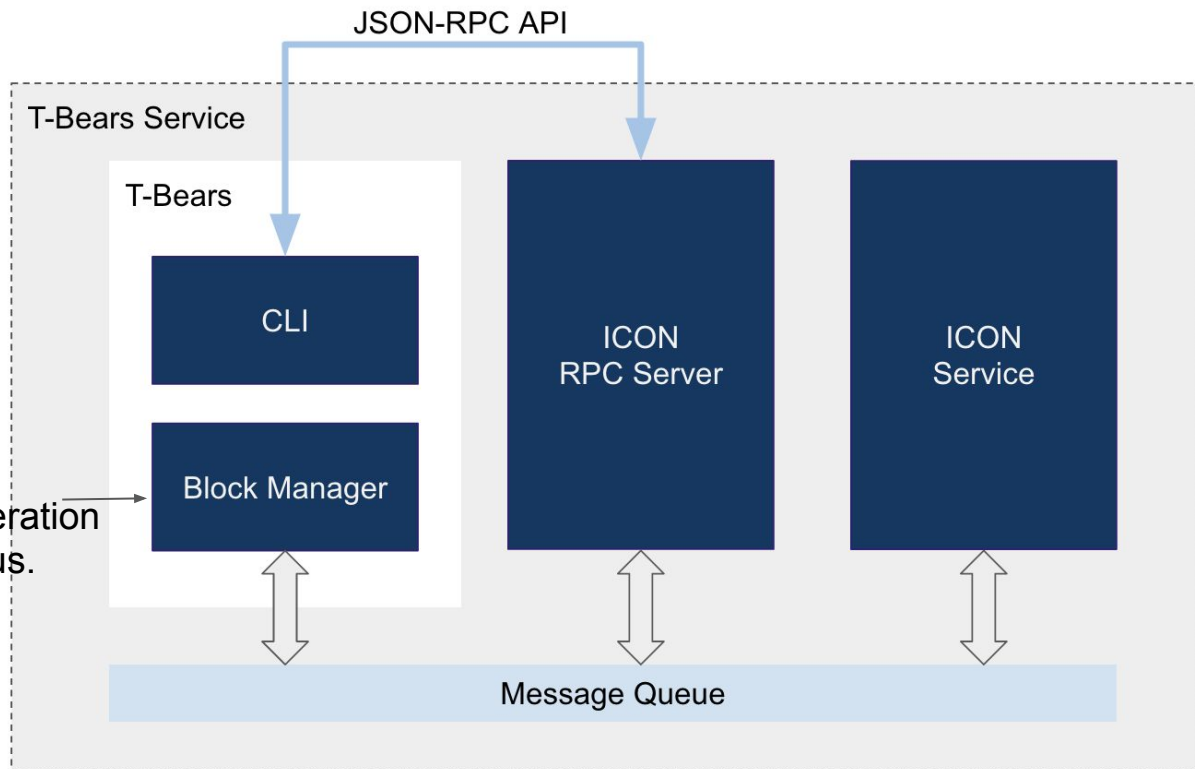
# Node View

- IconService
  - SCORE execution environment
  - ICX base coin management
  - Transaction fee calculation
- Loopchain
  - Peer management
  - Block management
  - LFT consensus engine



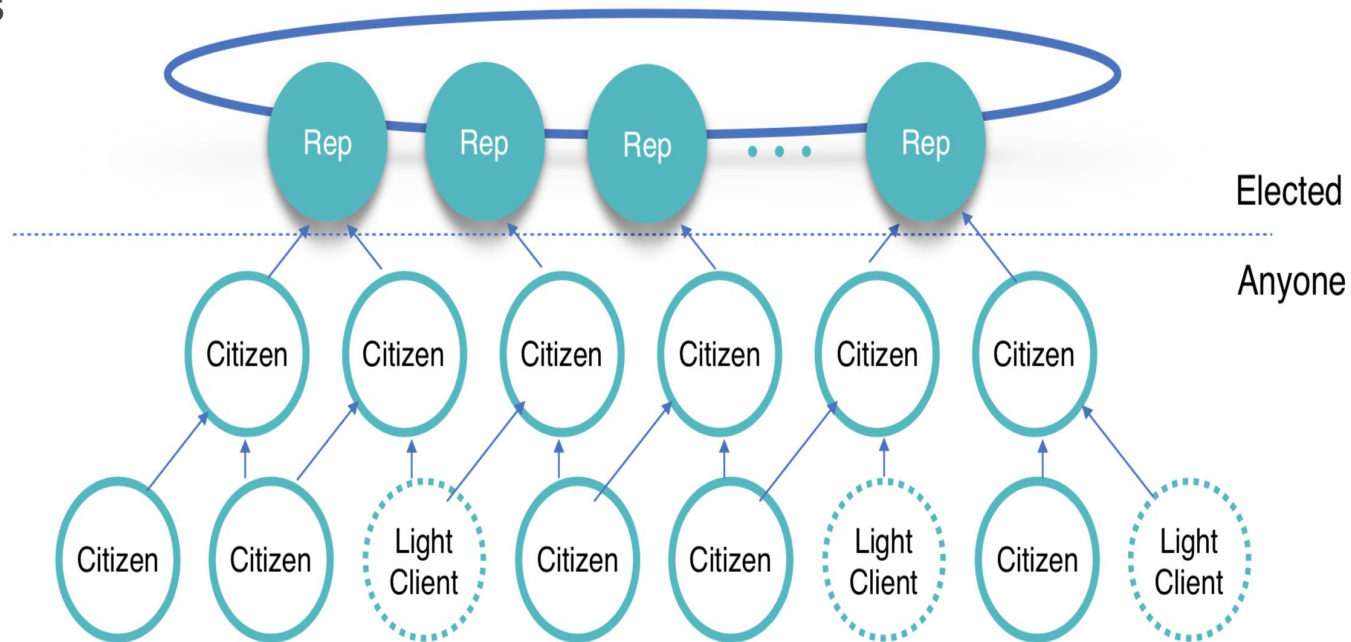
# T-Bears

Emulated node  
environment.  
Mimic block generation  
without consensus.



# Summary

- Representatives
- Citizen
- Light Client
- T-Bears
- SDK
- Wallet
- Tracker



## 2. Interacting with ICON nodes

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## 2.1. Account & Transaction

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# Transaction

## Transfer

- Used when transferring ICX.

## Message

- Used when transferring a message, and HEX string data.

## Call

- Used when calling a function in SCORE, with data which has dictionary value.

## Deploy

- Used when installing or updating a SCORE, with data which has dictionary value.

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# Summary

- Address
  - hx for EOA, cx for CA
- Transactions
  - call, deploy, transfer, message

## 2.2. Test Environment

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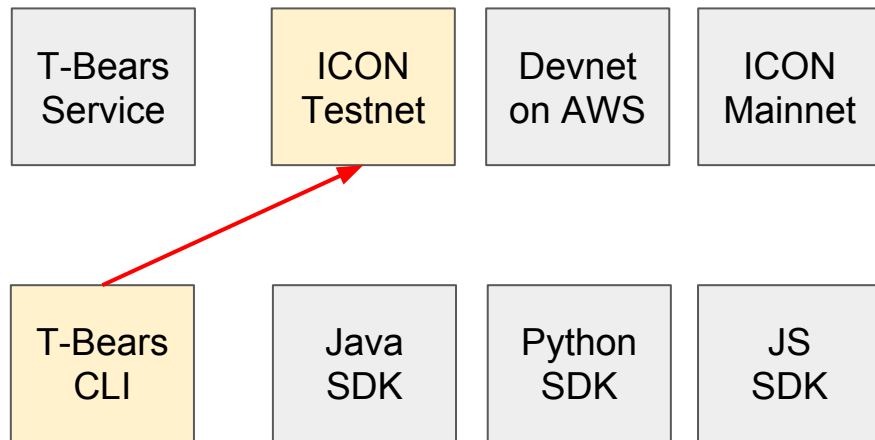
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# Test Environment

- T-Bears emulated environment
  - Transaction fee : off
  - SCORE audit : off
- ICON Testnet
  - Transaction fee : on
  - SCORE audit : off
- Private Devnet on AWS
  - Transaction fee : off
  - SCORE audit : off
- [https://icon-project.github.io/docs/icon\\_network.html](https://icon-project.github.io/docs/icon_network.html)



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## Testnet : Create an Account

- `$ tbears keystore [file_path]`
- Examine the keystore file

```
{  
  "address": "hxe7af5fcfd8dfc67530a01a0e403882687528dfcb",  
  "crypto": {  
    ....  
  },  
  "id": "e2ca66c6-b8de-4413-82cb-52c2a2200b8d",  
  "version": 3,  
  "coinType": "icx"  
}
```

## Testnet : Account & Balance

- To receive test ICX, send email to **testicx@icon.foundation** with following information
  - Testnet node url
  - Address to receive the testnet ICX
  - Faucet : <http://52.88.70.222>

Name	Yeouido (여의도)
Node	<b><a href="https://bicon.net.solidwallet.io">https://bicon.net.solidwallet.io</a></b>
API endpoint	<a href="https://bicon.net.solidwallet.io/api/v3">https://bicon.net.solidwallet.io/api/v3</a>
Network ID (nid)	3
Tracker	<a href="https://bicon.tracker.solidwallet.io">https://bicon.tracker.solidwallet.io</a>
Transaction fee	on
SCORE audit	off



---

## Testnet : Send Queries

- `$ tbears balance [address] -u https://bicon.net.solidwallet.io/api/v3`
- `$ tbears totalsupply -u https://bicon.net.solidwallet.io/api/v3`
- `$ tbears lastblock -u https://bicon.net.solidwallet.io/api/v3`
- `$ tbears blockbyheight 0x1 -u https://bicon.net.solidwallet.io/api/v3`

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# ICON Dev Tools

- T-Bears
  - Guide [<https://github.com/icon-project/t-bears>]
- SDK
  - Java [<https://github.com/icon-project/icon-sdk-java>]
  - Python [<https://github.com/icon-project/icon-sdk-python>]
  - Javascript [<https://github.com/icon-project/icon-sdk-js>]

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## Summary

- Test Environment
  1. T-Bears emulated environment
  2. ICON Testnet
  3. Private Devnet on AWS
- Tools
  1. T-Bears
  2. SDK(Java, Python, Javascript)

# 3. Smart Contract Development

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## 3.1. Smart Contract Basics

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# Smart Contract Basics

- What is smart contract?
- SCORE(Smart Contract On Reliable Environment)
  - What is SCORE?
    - Written in Python (Easy to learn)
    - State DB abstractions (VarDB, DictDB, ArrayDB)
    - Sandbox policy



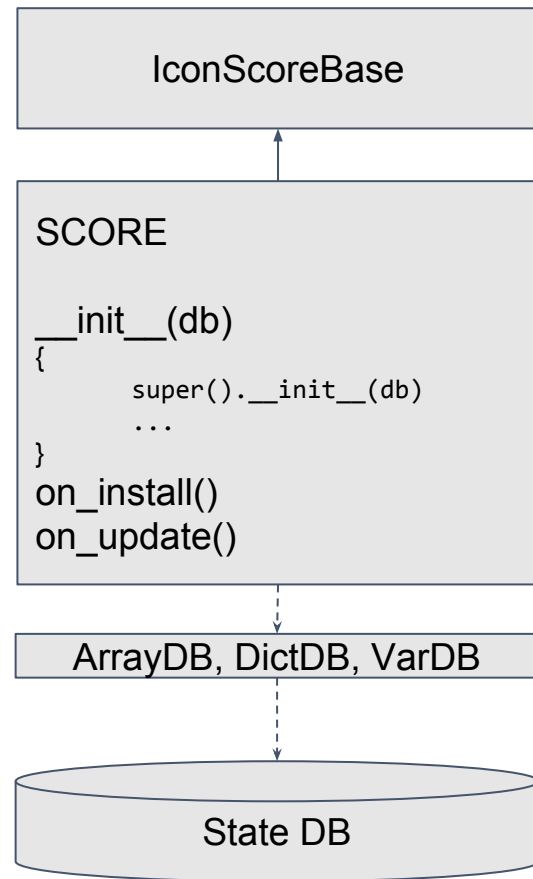
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# SCORE Implementation Guide

- SCORE
  - Sandbox policy
    - Should be deterministic
    - No random Operation
    - No outgoing network call
    - No system call (e.g. file system access, clock time)
    - No long-running operation inside the SCORE
  - Do not import python packages other than iconservice

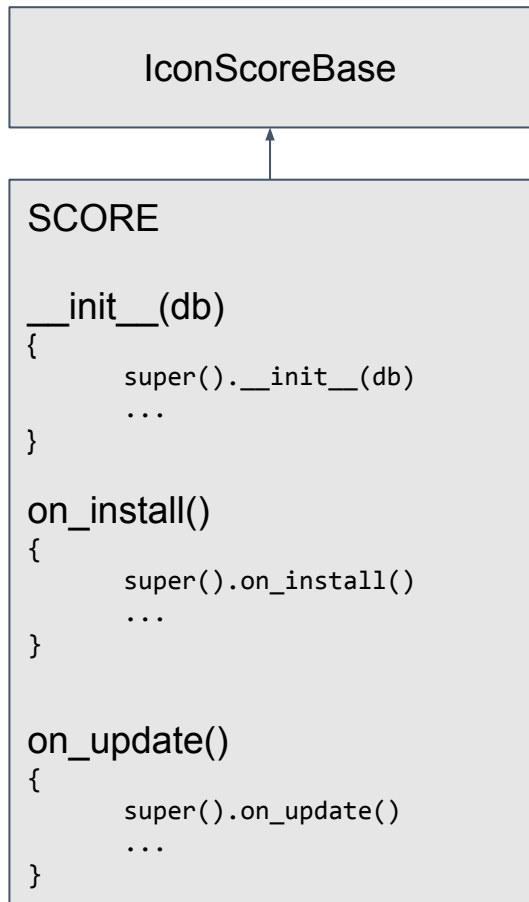
# SCORE Model

- Finite state machine
- State transition by transaction
- Must inherit IconScoreBase



## IconScoreBase - Methods

- `__init__`
  - Called when the contract is loaded at each nodes.
- `on_install`
  - Called when the SCORE is deployed
- `on_update`
  - Called when the SCORE is updated
- `fallback`
  - Reserved function executed whenever the SCORE receives plain ICX coins without data
  - Without `@payable`, icx coin transfers to the contract will fail



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## IconScoreBase - Properties

- msg : Holds information of the account who called the SCORE
  - msg.sender : Address of the account or contract who called this function
  - msg.value : Amount of icx that the sender attempts to transfer to the current SCORE
- tx : Transaction info
  - tx.origin : The account who created the transaction
  - tx.index : Transaction index
  - tx.hash : Transaction hash
  - tx.timestamp : Transaction creation time
  - tx.nonce : (Optional) random value

---

## IconScoreBase - Properties

- `icx` : An object used to transfer icx coin
  - `icx.transfer` : Transfer designated amount of icx coin to `addr_to`. Return True or Exception can be occurred
  - `icx.send` : Sends designated amount of icx coin to `addr_to`. Return True or False
- `db` : db instance used to access state DB
- `address` : SCORE address
- `owner` : Address of the account who deployed the contract
- `block_height` : Current block height

---

## Decorators

- `@external`
  - Can be called from outside the SCORE
- `@payable`
  - Permitted to receive incoming ICX coins
- `@eventlog`
  - Include logs in its txresult as 'eventLogs'

---

## Utility Functions

- `revert` : Developer can force a revert exception. If the exception is thrown, all the changes in the state DB in current transaction will be rolled back.
- `sha3_256` : Computes hash using the input data
- `json_dumps` : Converts a python object to a JSON string
- `json_loads` : Parses a JSON string and converts to a python object

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## State DB

- VarDB
  - Simple key-value state
- DictDB
  - Behaves more like python dict. DictDB does not maintain order.
- ArrayDB
  - Supports one dimensional array only. ArrayDB maintains order.



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## InterfaceScore

- InterfaceScore
  - InterfaceScore is an interface class used to invoke other SCORE's external function as if it is a local function call.
  - Get InterfaceScore by using IconScoreBase's built-in function `create_interface_score`
- IconScoreBase's `create_interface_score`
  - `create_interface_score` returns an object, through which you have an access to the designated SCORE's external functions

# Logger

- Log Configuration Files
  - T-Bears : tbears\_server\_config.json

```
TAG = 'MyScore'
```

```
Logger.debug(f'on_install: total_supply={total_supply}', TAG)  
Logger.info(f'on_install: total_supply={total_supply}', TAG)  
Logger.warning(f'on_install: total_supply={total_supply}', TAG)  
Logger.error(f'on_install: total_supply={total_supply}', TAG)
```

---

# Address

- Address
  - prefix : AddressPrefix.EOA(0) or AddressPrefix.CONTRACT(1)
  - body : 20-byte address body part
  - is\_contract : Whether the address is SCORE
  - to\_bytes : Returns data as bytes from the address object
  - from\_string : Static method creates an address object from given 42-char string
  - from\_data : Static method creates an address object using given bytes data

---

## Audit Checklist

- Loop : Make sure that the code always reaches the exit condition
- import : Package import is prohibited generally except iconservice
- Randomness : Execution result of SCORE must be deterministic
- ...

Checklist : Github repository [Link - [Click](#)]

---

## Summary

- IconScoreBase
  - Must inherit this class to create SCORE
- InterfaceScore
  - Interface class used to invoke other SCORE's external function as if it is a local function call
- Utility Functions
  - json\_dumps, json\_loads, sha3\_256, revert
- State DB
  - VarDB, DictDB, ArrayDB

## 3.2. Introduction to T-Bears

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Week 3. Smart Contract Development

- 3.1. Smart Contract Basics
- [3.2. Introduction to T-Bears](#)
- 3.3. Smart Contract Development

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# Introduction to T-Bears

- Docker container for T-Bears

```
$ docker run -it -p 9000:9000 --name tbears-container iconloop/tbears  
$ docker start -i tbears-container
```

- Server configuration

- Transaction fee, Log, Test accounts, Block generation ...

- Basic commands for SCORE development

- init, deploy
  - scoreapi, call
  - sendtx, txresult



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## About T-Bears

No	Command	Description
1	start	Start tbears service
2	stop	Stop tbears service
3	deploy	Deploy SCORE
4	clear	Clear all SCOREs deployed on tbears service
5	init	Initialize tbears project

---

## About T-Bears

No	Command	Description
6	test	Run the unittest in the SCORE
7	scoreapi	Get SCORE's API using given SCORE address.
8	call	Request icx_call with user input json file.
9	txresult	Get transaction's result by transaction hash
10	sendtx	Request icx_sendTransaction with user input json file.

# Basic commands for SCORE development

- tbears <command> -h

```
tbears <command> -h
```

*This will show you <Help> message about <commands>*

*e.g) tbears init -h*

```
usage: tbears init [-h] project scoreClass
```

Initialize SCORE development environment. Generate <project>.py, package.json and test code in <project> directory. The name of the score class is <scoreClass>.

positional arguments:

project	Project name
scoreClass	SCORE class name

optional arguments:

-h, --help show this help message and exit

---

## Summary

- Basic commands for SCORE development
  - init : Initialize T-Bears project
  - scoreapi : Get score's api using given score address
  - call : Request icx\_call with user input json file
  - sendtx : Request icx\_sendTransaction with user input json file and keystore file.
  - txresult : Get transaction result by transaction hash
  - deploy : Deploy the SCORE

## 3.3. Smart Contract Development

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- **3.3. Smart Contract Development**

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# SCORE Development

- Today's Goal : SCORE Development & Test code implementation
  - `$ tbears init [projectName] [className]`
- To do List on today
  - Objective : Getting familiar with SCORE
  - Requirement 1 : Use database [VarDB, ArrayDB, DictDB]
  - Requirement 2 : fallback & tokenFallback
  - Requirement 3 : Test code

Sample SCORE : Git Repository [Link - [Click](#)]

# SCORE Review - GreedyHello.py

```
from iconservice import *
TAG = 'Scrooge'

class Scrooge(IconScoreBase):
    _CONTRIBUTOR_ICX = "contributor_icx"
    _CONTRIBUTOR_VALUE = "contributor_value"
    _CONTRIBUTOR_LIST = "contributor_list"
    _ICX_BALANCE = "icx_balance"
    _TOKEN_BALANCE = "token_balance"

    def __init__(self, db: IconScoreDatabase) -> None:
        super().__init__(db)
        self._ADB_contributor_list = ArrayDB(self._CONTRIBUTOR_LIST, db, value_type=Address)
        self._DDB_contributor_icx = DictDB(self._CONTRIBUTOR_ICX, db, value_type=int)
        self._DDB_contributor_token = DictDB(self._CONTRIBUTOR_VALUE, db, value_type=int)
        self._VDB_icx_balance = VarDB(self._ICX_BALANCE, db, value_type=int)
        self._VDB_token_balance = VarDB(self._TOKEN_BALANCE, db, value_type=int)
        print(f"__init__ : {TAG}")

    def on_install(self) -> None:
        super().on_install()
        print(f"on_install : {TAG}")

    def on_update(self) -> None:
        super().on_update()
        print(f"on_update : {TAG}")
```

...



# SCORE Review - GreedyHello.py

```
...
@external
def tokenFallback(self, _from: Address, _value: int, _data: bytes):
    if self.msg.sender not in self._ADB_contributor_list:
        self._ADB_contributor_list.put(self.msg.sender)
    print("Total contributors : " + str(len(self._ADB_contributor_list)))

    self._DDB_contributor_token[self.msg.sender] += _value
    self._VDB_token_balance.set(self._VDB_token_balance.get() + _value)
    print(f'Token is Acceptable. {_from} sent {_value} tokens to {TAG} SCORE Class')
    print("Get SCORE's token balance : " + str(self._VDB_token_balance.get()))

@payable
def fallback(self) -> None:
    if self.msg.sender not in self._ADB_contributor_list:
        self._ADB_contributor_list.put(self.msg.sender)
    print("Total contributors : " + str(len(self._ADB_contributor_list)))

    self._DDB_contributor_icx[self.msg.sender] += self.msg.value
    self._VDB_icx_balance.set(self._VDB_icx_balance.get() + self.msg.value)
    print(f'ICX is Acceptable. {self.msg.sender} sent {self.msg.value} ICX to {TAG} SCORE Class')
    print("Get SCORE's balance : " + str(self._VDB_icx_balance.get()))
```

---

## How to Run a SCORE Test

- How to run a test & Why?
  - `$ tbears test <SCORE project's path>`
- Benefits when you write test code
  - Takes less time to test SCORE via serial transaction call
  - Test is available without deployment
  - Can check the variable on running environment by print method

Source Reference : Git Repository [Link - [Click](#)]

# SCORE Review - test\_GreedyHello.py

```
import os

from iconsdk.builder.call_builder import CallBuilder
from iconsdk.builder.transaction_builder import DeployTransactionBuilder, TransactionBuilder, CallTransactionBuilder
from iconsdk.libs.in_memory_zip import gen_deploy_data_content
from iconsdk.signed_transaction import SignedTransaction
from tbears.libs.icon_integrate_test import IconIntegrateTestBase, SCORE_INSTALL_ADDRESS

DIR_PATH = os.path.abspath(os.path.dirname(__file__))

class TestScrooge(IconIntegrateTestBase):
    SCORE_PROJECT = os.path.abspath(os.path.join(DIR_PATH, '..'))
    SAMPLE_TOKEN = os.path.abspath(os.path.join(DIR_PATH, '../{SampleTokenSCORE's path}'))

    def setUp(self):
        super().setUp()

        self.icon_service = None
        self._score_address = self._deploy_score(self.SCORE_PROJECT)['scoreAddress']
    ...
```

# SCORE Review - test\_GreedyHello.py

```
...
def _deploy_score(self, scorepath: str, to: str = SCORE_INSTALL_ADDRESS, _params: dict = None) -> dict:
    transaction = DeployTransactionBuilder() \
        .from_(self._test1.get_address()) \
        .to(to) \
        .step_limit(100_000_000_000) \
        .nid(3) \
        .content_type("application/zip") \
        .content(gen_deploy_data_content(scorepath)) \
        .params(_params) \
        .build()

    signed_transaction = SignedTransaction(transaction, self._test1)
    tx_result = self.process_transaction(signed_transaction, self.icon_service)

    self.assertTrue('status' in tx_result)
    self.assertEqual(1, tx_result['status'])
    self.assertTrue('scoreAddress' in tx_result)

    return tx_result
...
```

# SCORE Review - test\_GreedyHello.py

...

```
def test_score_update(self):
    tx_result = self._deploy_score(scorepath=self.SCORE_PROJECT, to=self._score_address)

    self.assertEqual(1, tx_result['status'])
    self.assertTrue('scoreAddress' in tx_result)
    self.assertEqual(self._score_address, tx_result['scoreAddress'])

def test_fallback(self):
    transaction = TransactionBuilder() \
        .from_(self._test1.get_address()) \
        .to(self._score_address) \
        .value(1) \
        .step_limit(1000000000) \
        .nid(3) \
        .build()

    signed_transaction = SignedTransaction(transaction, self._test1)
    tx_result = self.process_transaction(signed_transaction, self.icon_service)

    self.assertTrue('status' in tx_result)
    self.assertEqual(1, tx_result['status'])
```

...

# SCORE Review - test\_GreedyHello.py

```
...
def test_token_fallback(self):
    input_params = {"_initialSupply": 1000, "_decimals": 1}
    token_deploy_result = self._deploy_score(scorepath=self.SAMPLE_TOKEN, _params=input_params)
    score_address = token_deploy_result['scoreAddress']

    transaction = CallTransactionBuilder().from_(self._test1.get_address()) \
        .to(score_address) \
        .step_limit(10000000000) \
        .nid(3) \
        .method("transfer") \
        .params({"_to": self._score_address, "_value": 10}) \
        .build()

    signed_transaction = SignedTransaction(transaction, self._test1)
    tx_result = self.process_transaction(signed_transaction, self.icon_service)

    self.assertEqual(1, tx_result['status'])

    call = CallBuilder().from_(self._test1.get_address()) \
        .to(score_address) \
        .method("balanceOf") \
        .params({"_owner": self._score_address}) \
        .build()

    response = self.process_call(call, self.icon_service)
    self.assertEqual('0xa', response)
```

# SCORE Review - Expected Output

```
$ tbears test <SCORE project's path>
```

```
__init__ : Scrooge
on_install : Scrooge
Total contributors : 1
ICX is Acceptable. hxe7af5fcfd8dfc67530a01a0e403882687528dfcb sent 1 ICX to Scrooge SCORE Class
Get SCORE's balance : 1
.__init__ : Scrooge
on_install : Scrooge
__init__ : Scrooge
on_update : Scrooge
.__init__ : Scrooge
on_install : Scrooge
Total contributors : 1
Token is Acceptable. hxe7af5fcfd8dfc67530a01a0e403882687528dfcb sent 10 tokens to Scrooge SCORE Class
Get SCORE's token balance : 10
.
-----
Ran 3 tests in 0.244s
```

OK

---

## Summary

- How to run a test & Why ?
  - `$ tbears test <SCORE project's path>`
  - Benefits when you write test code
    - Takes less time to test SCORE via serial transaction call
    - Test is available without deployment
    - Can check the variable on running environment by print method



# Appendix A. T-Bears Quickstart

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- [A.1 Deploy, Call and SendTransaction](#)

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# How to Deploy & Update with T-Bears

```
$ vi deploy.json
```

```
{
  "uri": <API endpoint URI> e.g) "https://bicon.net.solidwallet.io/api/v3",
  "nid": "0x3",
  "to": "cx0000000000000000000000000000000000000000000000000000000000000000" for install or <SCORE address> for update,
  "deploy": {
    "stepLimit": <steplimit> e.g) "0x12a05f200",
    "mode": "install" or "update",
    "scoreParams": {
      <key> e.g) "initialSupply" : <value> e.g) "1000"
    }
  },
}
```

```
$ tbears deploy <project> -c deploy.json -k <keystore>
```

## How to Call with T-Bears

```
$ vi call.json
```

```
{
  "jsonrpc": "2.0",
  "method": "icx_call",
  "params": {
    "to": <SCORE address>,
    "dataType": "call",
    "data": {
      "method": <readonly method to call> e.g) "hello"
    }
  },
  "id": 1
}
```

```
$ tbears call call.json -u <endpoint_URL>
```

# How to SendTransaction with T-Bears

```
$ vi sendtx.json
```

```
{
  "jsonrpc": "2.0",
  "method": "icx_sendTransaction",
  "params": {
    "version": "0x3",
    "value": <ICX value> e.g) "0x0",
    "stepLimit": <stepLimit> e.g) "0x3000000",
    "timestamp": <timestamp> e.g) "0x573117f1d6568",
    "nid": "0x3",
    "to": <SCORE address>,
    "dataType": "call",
    ...
  },
  "data": {
    "method": <method to call> e.g) "setValue",
    "params": {
      <key> e.g) "value": <value> e.g) "0x123"
    }
  },
  "id": 1
}
```

```
$ tbears sendtx sendtx.json -k <keystore> -u <endpoint_URL>
```

---

## Summary

- T-Bears Quickstart
  - Deploy & Update : `tbears deploy`
  - Call : `tbears call`
  - SendTransaction : `tbears sendtx`

T-Bears Documentaion : Git Repository [Link - [Click](#)]

# Appendix B. AWS Development Network

---

# ICON Developers Meetup

Step 1. ICON Basics

Step 2. Interacting with ICON nodes

Step 3. Smart Contract Development

Appendix A. T-Bears Quickstart

Appendix B. AWS Development Network

- [B.1 AWS Marketplace : ICON Development Network](#)
- B.2 AWS CloudFormation
- B.3 Interacting with Development Network

Appendix C. Development Resources



---

# AWS Marketplace

## AWS Marketplace - ICON Development Network

### Why?

- Easy to install
- Scalable to 4 ~ 12 nodes
- Provides various monitoring tools

# AWS Marketplace

## 1. Visit Marketplace [Link : [Click](#)]

The screenshot shows the AWS Marketplace interface for the 'ICON Development Network'. The header includes the AWS Marketplace logo, navigation links (Categories, Delivery Methods, Solutions), a search bar, and user information (Hello, test.bc). The main content area features the product title 'ICON Development Network' by 'Icon Foundation', with a 'Continue to Subscribe' button and a 'Save to List' button. The pricing is listed as '\$0.192/hr'. Below this, there are tabs for Overview, Pricing, Usage, Support, and Reviews. The 'Overview' tab is selected, showing a 'Product Overview' section with a description of the platform. To the right of the overview is a 'Highlights' box with three bullet points: 'Easy to install', 'Scalable to 4 ~ 12 nodes', and 'Provides various monitoring tools'. Below the overview is a 'Pricing Information' section with a table of specifications and a button to 'Estimating your costs'.

aws marketplace

Categories ▾ Delivery Methods ▾ Solutions ▾ Migration Mapping Assistant Your Saved List

Partners Sell in AWS Marketplace Amazon Web Services Home Help

Hello, test.bc ▾

Continue to Subscribe

Save to List

Typical Total Price  
**\$0.192/hr**  
Total pricing per instance for services hosted on m5.xlarge in US East (N. Virginia). View Details

Overview Pricing Usage Support Reviews

### Product Overview

ICON Development Network platform will provide an easy-to-use development-ready environment. This enables developers to bootstrap their own private ICON Network, adapted to their own convenience and need, in order to build, test or validate their project running on top of the ICON Protocol. A private network built via AWS Cloud could be used to operate its own service as well in the context of a DApp and its production environment.

Version	1.1
By	Icon Foundation
Categories	Application Development
Operating System	Linux/Unix, Amazon Linux 2018.06.22
Delivery Methods	CloudFormation Template

### Highlights

- Easy to install
- Scalable to 4 ~ 12 nodes
- Provides various monitoring tools

### Pricing Information

Use this tool to estimate the software and infrastructure costs based on your configuration choices. Your usage and costs might be different from this estimate. They will be reflected on your monthly AWS billing reports.

Estimating your costs

Choose your region and fulfillment option to see the pricing details. Then,

# AWS Marketplace

## 2. Go to Usage Information

The screenshot displays the AWS Marketplace interface for the 'ICON Development Network'. The top navigation bar includes the AWS Marketplace logo, a search bar, and user information ('Hello, test.bc'). Below the navigation bar, the product name 'ICON Development Network' is prominently displayed, along with a 'Continue to Subscribe' button. The main content area is divided into several sections: 'Usage Information', 'Fulfillment Options', 'End User License Agreement', and 'Support Information'. The 'Usage Information' section is currently active, showing tabs for Overview, Pricing, Usage, Support, and Reviews. Under 'Usage Information', there are links for 'View Template Components', 'View Usage Instructions', and 'View CloudFormation Template', with the latter being highlighted by a red box. The 'Fulfillment Options' section lists the 'ICON DevNet Setup' CloudFormation Template and provides links to view its components and usage instructions. The 'End User License Agreement' section states that by subscribing, the user agrees to the terms and conditions outlined in the product's EULA. The 'Support Information' section provides contact details for the 'ICON Development Network' and 'AWS Infrastructure' support. On the right side of the page, there are two 'Additional Resources' boxes: one for 'How it Works' and another for 'AWS CloudFormation Template'.

aws marketplace

Categories ▾ Delivery Methods ▾ Solutions ▾ Migration Mapping Assistant Your Saved List

Partners Sell in AWS Marketplace Amazon Web Services Home Help

ICON Development Network

Continue to Subscribe

Overview Pricing Usage Support Reviews

### Usage Information

#### Fulfillment Options

**ICON DevNet Setup**  
CloudFormation Template

LoopChain Log Server, Monitoring Server, RadioStation Server, Peer Server Setup

- [View Template Components](#)
- [View Usage Instructions](#)
- [View CloudFormation Template](#)

#### End User License Agreement

By subscribing to this product you agree to terms and conditions outlined in the product [End User License Agreement \(EULA\)](#)

### Support Information

**ICON Development Network**  
Please allow 24 hours  
<https://www.icondev.io>

**AWS Infrastructure**  
AWS Support is a one-on-one support channel that is staffed 24x7x365 with experienced

#### Additional Resources

[How it Works](#)

#### CloudFormation Template

AWS CloudFormation templates are JSON or YAML formatted text files that simplify provisioning and management on AWS. The templates describe the service or application architecture you want to deploy and AWS CloudFormation uses those templates to provision and configure the required services (such as Amazon EC2 instances or Amazon RDS DB instances). The deployed application and associated resources is called a "stack". [Learn more](#)

#### Additional Resources

[AWS Infrastructure Support](#)

# AWS Marketplace

## 3. Download CloudFormation Template

The screenshot displays the AWS Marketplace interface for the 'ICON Development Network'. The page is titled 'Usage Information' and includes a 'Continue to Subscribe' button. The 'Fulfillment Options' section lists the 'ICON DevNet Setup' as a CloudFormation Template. Below this, there are links to 'View Template Components', 'View Usage Instructions', and 'Close CloudFormation Template'. A diagram illustrates the architecture, showing a central 'LoopChain Log Server' connected to various 'RadioStation Server' and 'Peer Server' components. At the bottom, a red box highlights the 'Download CloudFormation Template' link, with a sub-link 'View Template in CloudFormation Designer'. The 'End User License Agreement' section is also visible, stating that by subscribing, the user agrees to the terms and conditions outlined in the product's EULA.

aws marketplace

Categories ▾ Delivery Methods ▾ Solutions ▾ Migration Mapping Assistant Your Saved List

ICON Development Network

Continue to Subscribe

Overview Pricing Usage Support Reviews

Usage Information

Fulfillment Options

ICON DevNet Setup  
CloudFormation Template

LoopChain Log Server, Monitoring Server, RadioStation Server, Peer Server Setup

View Template Components

View Usage Instructions

Close CloudFormation Template

Additional Resources

How It Works

CloudFormation Template

AWS CloudFormation templates are JSON or YAML formatted text files that simplify provisioning and management on AWS. The templates describe the service or application architecture you want to deploy and AWS CloudFormation uses those templates to provision and configure the required services (such as Amazon EC2 instances or Amazon RDS DB instances). The deployed application and associated resources is called a "stack".  
[Learn more](#)

Download CloudFormation Template

View Template in CloudFormation Designer

End User License Agreement

By subscribing to this product you agree to terms and conditions outlined in the product [End User License Agreement \(EULA\)](#)

---

# ICON Developers Meetup

Step 1. ICON Basics

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Step 3. Smart Contract Development

Appendix A. T-Bears Quickstart

Appendix B. AWS Development Network

- B.1 AWS Marketplace : ICON Development Network
- [B.2 AWS CloudFormation](#)
- B.3 Interacting with Development Network

Appendix C. Development Resources

---

# AWS CloudFormation

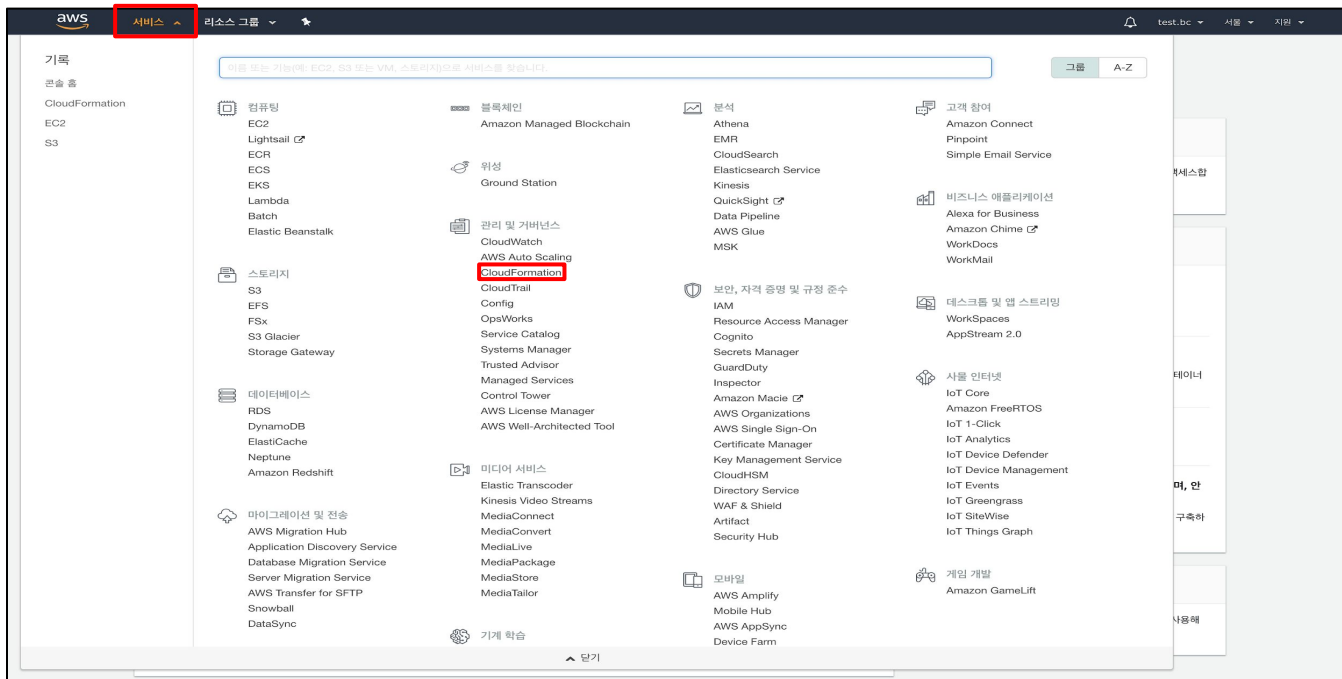
## AWS CloudFormation - Create AWS Stack

### Resource

- CloudFormation Template - ICON Development Network
- e.g) `icon_dev_network.template`

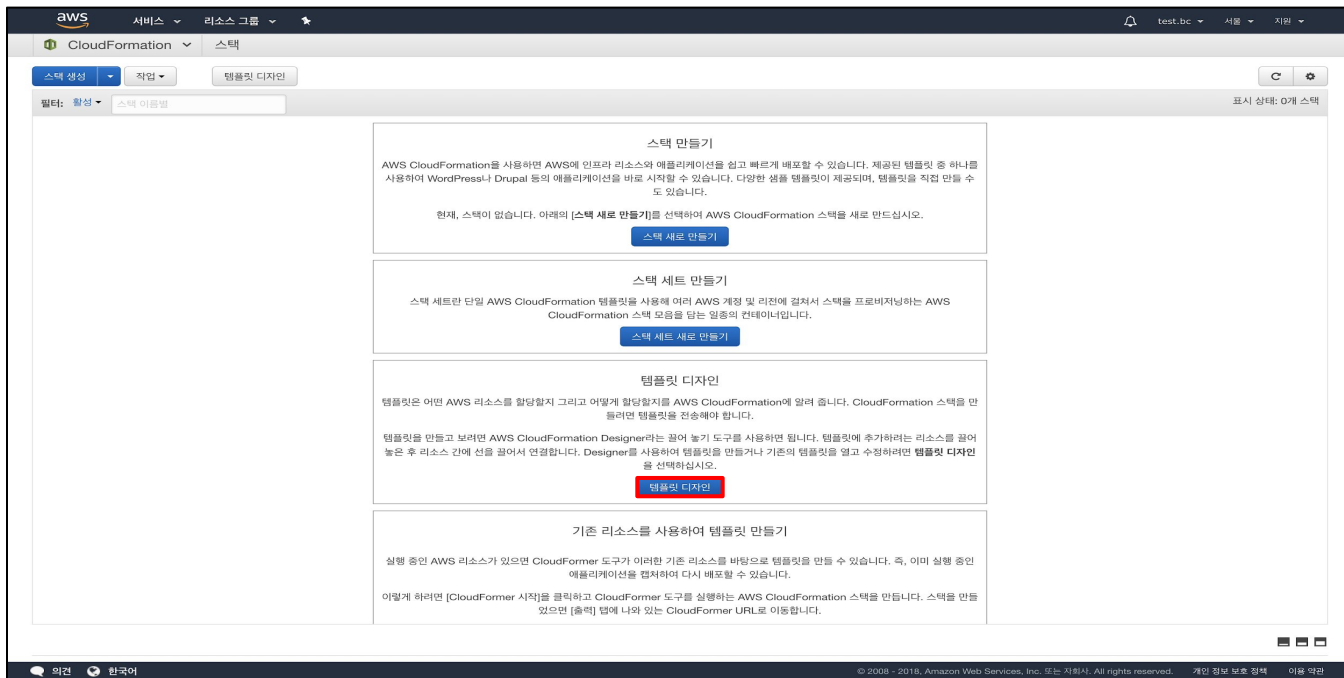
# AWS CloudFormation

## 1. AWS Console ⇒ Service ⇒ CloudFormation



# AWS CloudFormation

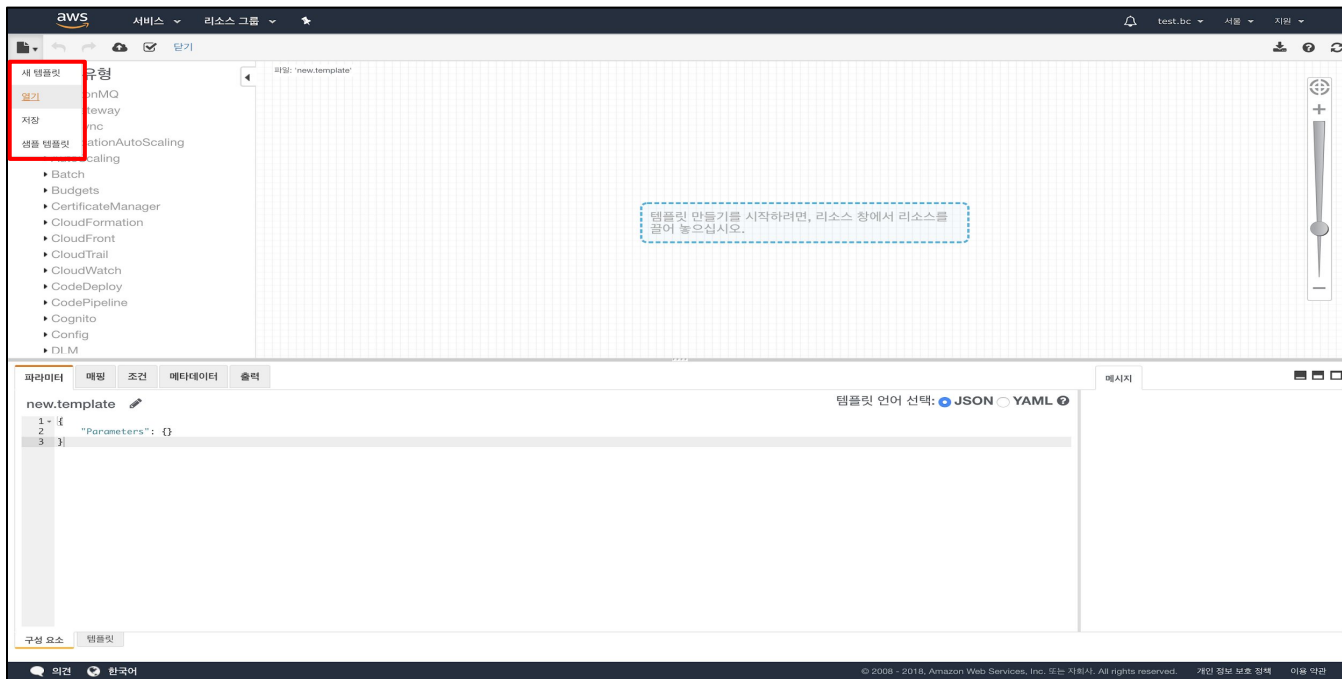
## 2. Click Template Design





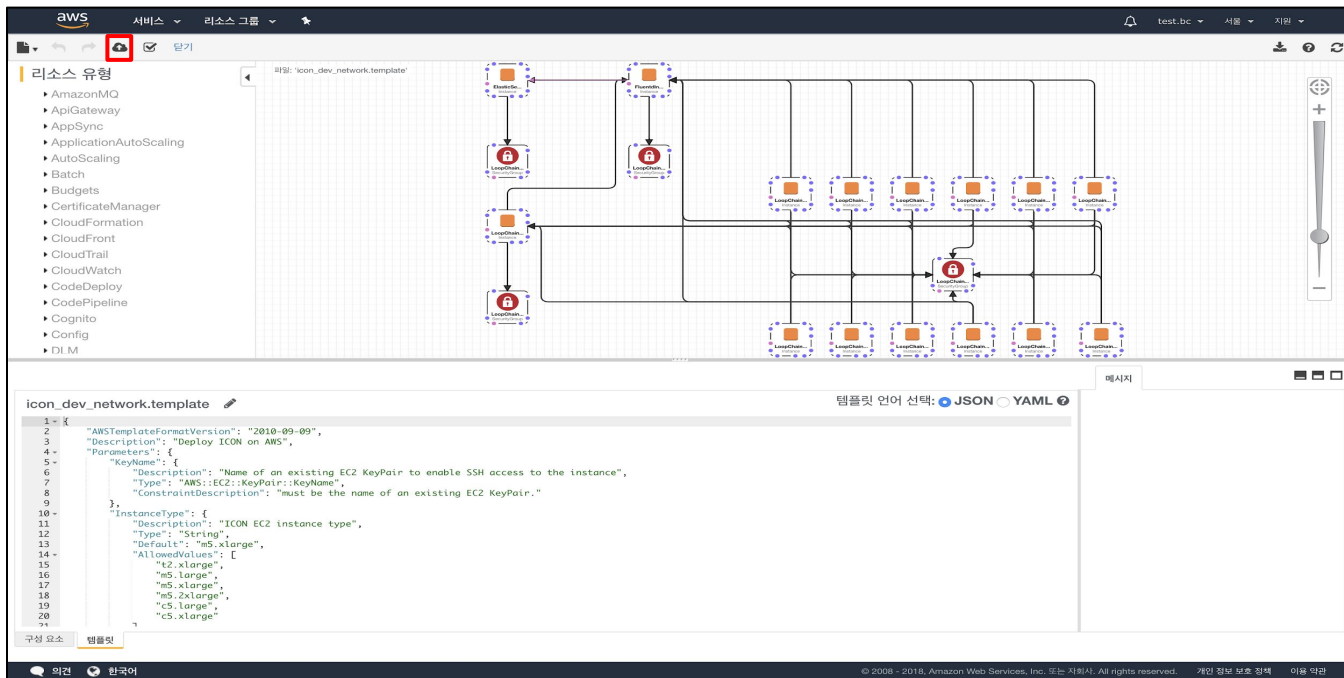
# AWS CloudFormation

## 3. Open “icon\_dev\_network.template” on local storage



# AWS CloudFormation

## 4. Create AWS Stack



The screenshot shows the AWS CloudFormation console interface. The top navigation bar includes the AWS logo, service dropdowns, and user information. The left sidebar lists various AWS services. The main area displays the stack 'icon\_dev\_network.template' in the 'Pending' state. Below the stack name, the template body is shown in JSON format:

```
1 {
2   "AWSTemplateFormatVersion": "2010-09-09",
3   "Description": "Deploy ICON on AWS",
4   "Parameters": {
5     "KeyName": {
6       "Description": "Name of an existing EC2 KeyPair to enable SSH access to the instance",
7       "Type": "AWS::EC2::KeyPair::KeyName",
8       "ConstraintDescription": "must be the name of an existing EC2 KeyPair."
9     },
10    "InstanceType": {
11      "Description": "ICON EC2 instance type",
12      "Type": "String",
13      "Default": "m5.xlarge",
14      "AllowedValues": [
15        "t2.xlarge",
16        "m5.large",
17        "m5.xlarge",
18        "m5.2xlarge",
19        "c5.large",
20        "c5.xlarge"
21      ]
22    }
23  }
```

# AWS CloudFormation

## 5. Select CloudFormation Template ⇒ Next

The screenshot shows the AWS CloudFormation console interface. At the top, the navigation bar includes the AWS logo, '서비스' (Services), '리소스 그룹' (Resource Groups), and a user profile 'test.bc'. The main header shows 'CloudFormation' with a dropdown and '스택' (Stacks) with a dropdown, followed by '스택 생성' (Create Stack).

The left sidebar is titled '스택 생성' (Create Stack) and contains links for '템플릿 선택' (Select Template), '세부 정보 지정' (Specify Detailed Information), '출산' (Launch), and '검토' (Review).

The main content area is titled '템플릿 선택' (Select Template). It includes a sub-header '만들려는 스택을 나타내는 템플릿을 선택하십시오. 스택이란 하나의 단위로 관리하는 여러 관련 리소스의 그룹입니다.' (Select a template that represents the stack you want to create. A stack is a group of related resources that you manage as a single unit).

There are two main sections: '템플릿 디자인' (Template Design) and '템플릿 선택' (Template Selection).

The '템플릿 디자인' section has a description: 'AWS CloudFormation Designer를 사용하여 템플릿을 만들거나 기존 템플릿을 수정할 수 있습니다. 자세히 알아보기' (Use AWS CloudFormation Designer to create or modify existing templates. Learn more). Below this is a button labeled '템플릿 디자인'.

The '템플릿 선택' section has a description: '템플릿은 스택 리소스와 해당 속성을 나타내는 JSON/YAML 형식의 텍스트 파일입니다. 자세히 알아보기' (A template is a text file in JSON/YAML format that represents the stack resources and their properties. Learn more). Below this are three radio button options:

- ☐ 샘플 템플릿 선택 (Select sample template) - This option is selected, and a dropdown menu is visible below it.
- ☐ Amazon S3에 템플릿 업로드 (Upload template to Amazon S3) - This option has a sub-link '파일 선택' (Select file) and the text '선택된 파일 없음' (No file selected).
- ☒ Amazon S3 템플릿 URL 지정 (Specify Amazon S3 template URL) - This option is selected, and a text input field contains the URL 'https://s3.ap-northeast-2.amazonaws.com/cf-templates-8ba17968mlik-ap-northeast-2'. To the right of the input field is a link 'Designer에서 템플릿 보기/편집' (View/Edit template in Designer).

At the bottom right of the main content area, there are two buttons: '취소' (Cancel) and '다음' (Next).

The footer of the console shows '의견' (Feedback) and '한국어' (Korean) links on the left, and copyright information '© 2008 - 2018, Amazon Web Services, Inc. 또는 지회사. All rights reserved. 개인 정보 보호 정책' (Privacy Policy) and '이름 약관' (Terms of Use) on the right.

# AWS CloudFormation

## 6. Edit Configuration

템플릿 선택

세부 정보 지정

공식

검토

세부 정보 지정

스택 이름과 파라미터 값을 지정하십시오. AWS CloudFormation 템플릿에 정의된 기본 파라미터 값을 사용하거나 변경할 수 있습니다. 자세히 알아보기

스택 이름

파라미터

AWS Instance and Network Settings

InstanceType  ICON EC2 instance type

NodeCount  ICON Node Cluster size; must be between 4 and 12

InstanceName  EC2 Instance Name Prefix

VpcId  VpcId of your existing Virtual Private Cloud (VPC)

SubnetId  Subnet should be a public subnet.

Fee, Audit Parameters

Fee  Pay commission to execute the transaction by ICX or not

Audit  Prevent to deploy SCORE by anybody or not

EC2 Parameters

KeyName  Name of an existing EC2 KeyPair to enable SSH access to the instance

SSHLocation  The IP address range that can be used to SSH to the EC2 instances

취소

이전

다음

# AWS CloudFormation

## 7. Finalize Options

템플릿 선택

세부 정보 지정

**옵션**

검토

### 옵션

태그

사용자 스택의 리소스에 대한 태그(키-값 페어)를 지정할 수 있습니다. 각 스택에 대해 최대 50개의 고유한 키-값 페어를 추가할 수 있습니다. [자세히 알아보기](#)

키 (최대 127자)	값 (최대 255자)
1	

[+](#)

### 권한

CloudFormation에서 스택에 리소스를 생성, 수정 또는 삭제하는 데 사용할 IAM 역할을 선택할 수 있습니다. 역할을 선택하지 않으면 해당 계정에 정의된 권한을 CloudFormation에서 사용합니다. [자세히 알아보기](#)

**IAM 역할** 역할 선택(선택 사항)

역할 ARN 입력

### 볼백 트리거

볼백 트리거를 사용하면 스택 생성 및 업데이트 중 AWS CloudFormation이 애플리케이션의 상태를 모니터링할 수 있으며, 애플리케이션이 지정한 경로의 임계값을 위반한 경우 해당 작업을 볼백할 수 있습니다. [자세히 알아보기](#)

모니터링 시간 0-180 분

최소값은 0입니다. 최대값은 180입니다.

유형	ARN(Amazon 리소스 이름)
1	AWS::CloudWatch::Alarm

[+](#)

### 고급

스택에 대해 알림 옵션 및 스택 정책 등과 같은 추가 옵션을 설정할 수 있습니다. [자세히 알아보기](#)

취소

이전

다음

# AWS CloudFormation

## 8. Check Loaded Instances

The screenshot shows the AWS Management Console interface for EC2 instances. The left sidebar contains navigation links for various AWS services. The main content area displays a table of instances. The table has columns for Name, Instance ID, Instance Type, Availability Zone, Instance State, State Checks, Health Status, Public DNS (IPv4), IPv4 Public IP, and IPv6 IP. The instances listed are:

Name	Instance ID	Instance Type	가용 영역	인스턴스 상태	상태 검사	경보 상태	퍼블릭 DNS(IPv4)	IPv4 퍼블릭 IP	IPv6 IP
loopchain_*.monitoringserver	i-011728970ec386edf	m5.xlarge	ap-northeast-2a	running	2/2 검사 통과	없음	ec2-13-209-18-38.ap-n...	13.209.18.38	-
loopchain_*.peer#2	i-02628995aedceca88	m5.xlarge	ap-northeast-2a	running	2/2 검사 통과	없음	ec2-13-125-79-254.ap-...	13.125.79.254	-
loopchain_*.peer#4	i-02d5c2a66fb52017f	m5.xlarge	ap-northeast-2a	running	2/2 검사 통과	없음	ec2-13-124-230-127.ap-...	13.124.230.127	-
loopchain_*.radiostation	i-03122488638e54d...	m5.xlarge	ap-northeast-2a	running	2/2 검사 통과	없음	ec2-13-209-16-24.ap-n...	13.209.16.24	-
loopchain_*.logserver	i-03fa30e9521ce2aed	m5.xlarge	ap-northeast-2a	running	2/2 검사 통과	없음	ec2-52-79-170-120.ap-...	52.79.170.120	-
loopchain_*.peer#3	i-0438d8487aa67d...	m5.xlarge	ap-northeast-2a	running	2/2 검사 통과	없음	ec2-54-180-135-65.ap-...	54.180.135.65	-
loopchain_*.peer#1	i-0464ebc4c18c06e2d	m5.xlarge	ap-northeast-2a	running	2/2 검사 통과	없음	ec2-13-125-122-192.ap-...	13.125.122.192	-

Below the table, there is a prompt: "위에서 인스턴스를 선택하십시오" (Select an instance from above).

---

# ICON Developers Meetup

Step 1. ICON Basics

Step 2. Interacting with ICON nodes

Step 3. Smart Contract Development

Appendix A. T-Bears Quickstart

Appendix B. AWS Development Network

- B.1 AWS Marketplace : ICON Development Network
- B.2 AWS CloudFormation
- **B.3 Interacting with Development Network**

Appendix C. Development Resources

---

# Interacting with Development Network

## How to use ICON Development Network

- Usage Instructions :
  - Access the application via a browser at `http://<radiostation_dns>:9002/api/v1/peer/list`.
  - To connect to the operating system, use SSH and the username `ec2-user`.
- JSON-RPC API v3 Document :  
<https://github.com/icon-project/icon-rpc-server/blob/master/docs/icon-json-rpc-v3.md>
- DApp Developer Guide : <https://www.icondev.io>



# Interacting with Development Network

## Send Query to Each Nodes - vi sendQuery.sh

```
#!/usr/bin/env zsh

echo "-----peer#1-----"
echo "Total Supply"
tbears totalsupply -u http://{peer#1 URL}:9000/api/v3
echo "-----"
echo "Last Block"
tbears lastblock -u http://{peer#1 URL}:9000/api/v3

echo "-----peer#2-----"
echo "Total Supply"
tbears totalsupply -u http://{peer#2 URL}:9000/api/v3
echo "-----"
echo "Last Block"
tbears lastblock -u http://{peer#2 URL}:9000/api/v3

...
```

# Interacting with Development Network

## Send Query to Each Nodes - vi sendQuery.sh

...

```
echo "-----peer#3-----"
echo "Total Supply"
tbears totalsupply -u http://{peer#3 URL}:9000/api/v3
echo "-----"
echo "Last Block"
tbears lastblock -u http://{peer#3 URL}:9000/api/v3
```

```
echo "-----peer#4-----"
echo "Total Supply"
tbears totalsupply -u http://{peer#4 URL}:9000/api/v3
echo "-----"
echo "Last Block"
tbears lastblock -u http://{peer#4 URL}:9000/api/v3
```

# Interacting with Development Network

## Query Results - **peer#1**

```
-----peer#1-----
Total Supply
Total supply of ICX in hex: 0x52c3ff441ba8feb88e00000
Total supply of ICX in decimal: 16009198000000000000000000000000
-----
Last Block
block info : {
  "jsonrpc": "2.0",
  "result": {
    ...
    "merkle_tree_root_hash": "72722dad5bdb0adff8f5fbb061de07a2404b522d463b708d1a62071262616fb3",
    ...
    "block_hash": "b3c99e161f8013b7dabc2ff8be56bacb3209853d139bb54f0a37384388a36505",
    ...
  },
  "id": 1
}
```

# Interacting with Development Network

## Query Results - **peer#2**

```
-----peer#2-----
Total Supply
Total supply of ICX in hex: 0x52c3ff441ba8feb88e00000
Total supply of ICX in decimal: 16009198000000000000000000000000
-----
Last Block
block info : {
  "jsonrpc": "2.0",
  "result": {
    ...
    "merkle_tree_root_hash": "72722dad5bdb0adff8f5fbb061de07a2404b522d463b708d1a62071262616fb3",
    ...
    "block_hash": "b3c99e161f8013b7dabc2ff8be56bacb3209853d139bb54f0a37384388a36505",
    ...
  },
  "id": 1
}
```

# Interacting with Development Network

## Query Results - **peer#3**

```
-----peer#3-----  
Total Supply  
Total supply of ICX in hex: 0x52c3ff441ba8feb88e00000  
Total supply of ICX in decimal: 16009198000000000000000000000000  
-----  
Last Block  
block info : {  
  "jsonrpc": "2.0",  
  "result": {  
    ...  
    "merkle_tree_root_hash": "72722dad5bdb0adff8f5fbb061de07a2404b522d463b708d1a62071262616fb3",  
    ...  
    "block_hash": "b3c99e161f8013b7dabc2ff8be56bacb3209853d139bb54f0a37384388a36505",  
    ...  
  },  
  "id": 1  
}
```

# Interacting with Development Network

## Query Results - **peer#4**

```
-----peer#4-----
Total Supply
Total supply of ICX in hex: 0x52c3ff441ba8feb88e00000
Total supply of ICX in decimal: 16009198000000000000000000000000
-----
Last Block
block info : {
  "jsonrpc": "2.0",
  "result": {
    ...
    "merkle_tree_root_hash": "72722dad5bdb0adff8f5fbb061de07a2404b522d463b708d1a62071262616fb3",
    ...
    "block_hash": "b3c99e161f8013b7dabc2ff8be56bacb3209853d139bb54f0a37384388a36505",
    ...
  },
  "id": 1
}
```

---

# Summary

- AWS Marketplace

[https://aws.amazon.com/marketplace/pp/B07KBTZHZD?qid=1544602499452&sr=0-1&ref\\_=srh\\_res\\_product\\_title](https://aws.amazon.com/marketplace/pp/B07KBTZHZD?qid=1544602499452&sr=0-1&ref_=srh_res_product_title)

- AWS CloudFormation
  - Create AWS Stack & Load Instances
  - Resource : CloudFormation Template

# Appendix C. Development Resources



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# ICON Developers Meetup

Step 1. ICON Basics

Step 2. Interacting with ICON nodes

Step 3. Smart Contract Development

Appendix A. T-Bears Quickstart

Appendix B. AWS Development Network

Appendix C. Development Resources

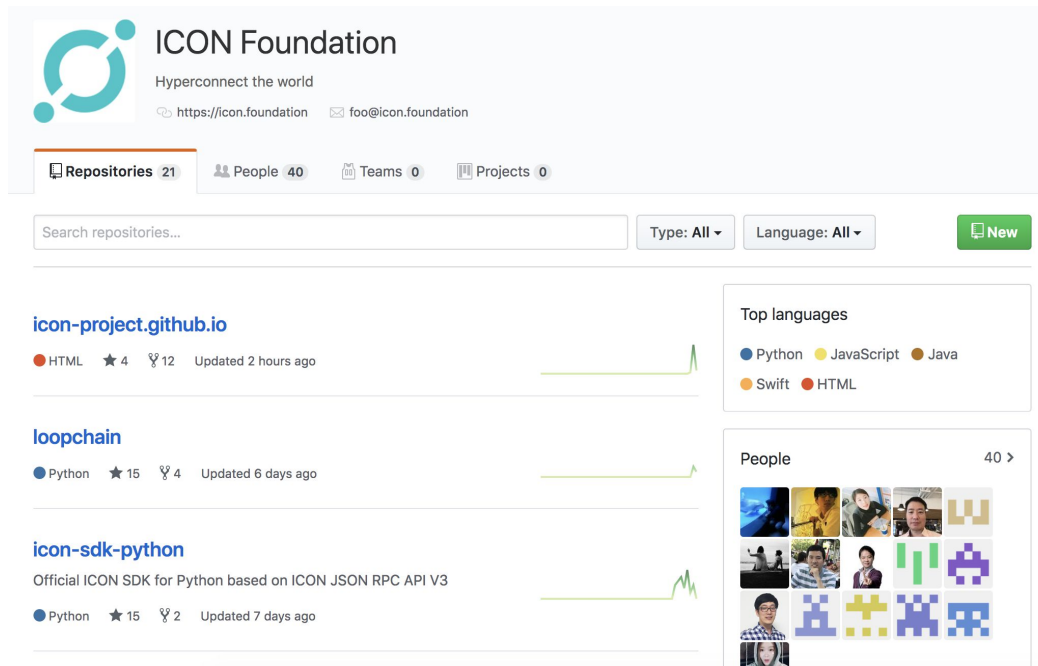
---

## Development Resources

- GitHub
- Developer Portal
- ICON official Documentation Project
- ICON Improvement Proposal

# GitHub <https://github.com/icon-project>

- loopchain
  - icon-service
  - icon-rpc-server
  - t-bears
  - icon-sdk-python
  - icon-sdk-java
  - icon-sdk-js
  - iconex\_android
  - iconex\_ios
  - iconex\_chrome\_extension
- Node
- Dev tools



**ICON Foundation**  
Hyperconnect the world  
<https://icon.foundation> [foo@icon.foundation](mailto:foo@icon.foundation)

Repositories 21 People 40 Teams 0 Projects 0

Search repositories... Type: All Language: All New

**icon-project.github.io**  
HTML ★ 4 🍴 12 Updated 2 hours ago

**loopchain**  
Python ★ 15 🍴 4 Updated 6 days ago

**icon-sdk-python**  
Official ICON SDK for Python based on ICON JSON RPC API V3  
Python ★ 15 🍴 2 Updated 7 days ago

**Top languages**  
Python JavaScript Java Swift HTML

**People** 40 >

# Developer Portal <https://www.icondev.io>

- Community portal for ICON DApp ecosystem

## Getting Started

Tutorials for developers to get started

## SCORE

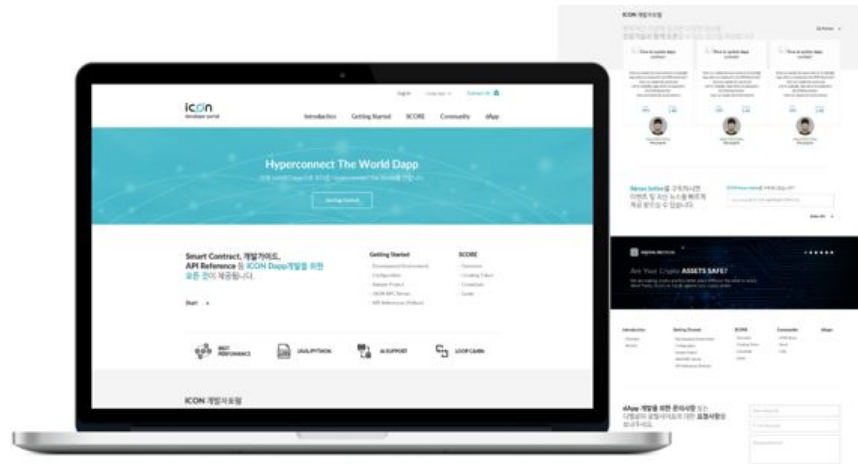
Details on ICON's Smart Contract, SCORE

## Community

Forum for Korean/English developers to discuss and communicate

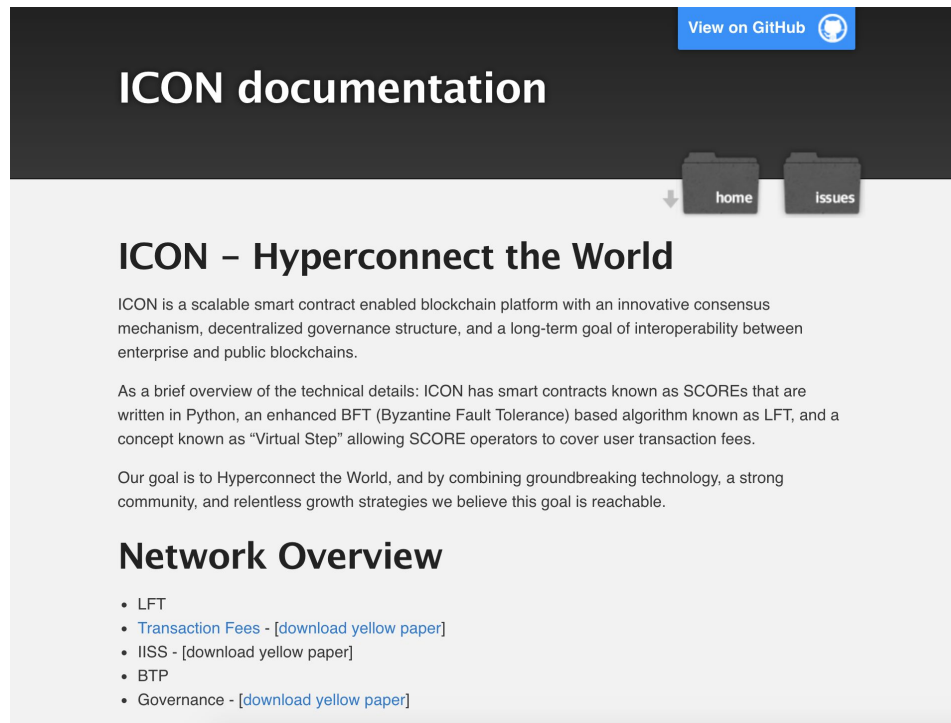
## DApp

Overview of ICON DApp Partners



# Documentation Project <https://icon-project.github.io>

- GitHub Pages
  - ICON overview
  - Network info
  - Account management
  - Client SDKs
  - SCORE development
  - Mainnet SCORE audit guideline
  - Tutorials with sample codes
- We welcome contributors !
  - Read CONTRIBUTING.md
  - French / Chinese translation provided by volunteer contributors.



The screenshot shows the homepage of the ICON documentation website. At the top right, there is a blue button labeled "View on GitHub" with the GitHub logo. The main header is dark grey with the text "ICON documentation" in white. Below the header, there are two dark grey buttons labeled "home" and "issues". The main content area has a light grey background. The first section is titled "ICON – Hyperconnect the World" in bold. Below the title, there is a paragraph describing ICON as a scalable smart contract enabled blockchain platform. The next section is titled "Network Overview" in bold. Below this title, there is a list of bullet points: "LFT", "Transaction Fees - [download yellow paper]", "LISS - [download yellow paper]", "BTP", and "Governance - [download yellow paper]".

View on GitHub

## ICON documentation

home issues

### ICON – Hyperconnect the World

ICON is a scalable smart contract enabled blockchain platform with an innovative consensus mechanism, decentralized governance structure, and a long-term goal of interoperability between enterprise and public blockchains.

As a brief overview of the technical details: ICON has smart contracts known as SCOREs that are written in Python, an enhanced BFT (Byzantine Fault Tolerance) based algorithm known as LFT, and a concept known as "Virtual Step" allowing SCORE operators to cover user transaction fees.

Our goal is to Hyperconnect the World, and by combining groundbreaking technology, a strong community, and relentless growth strategies we believe this goal is reachable.

### Network Overview

- LFT
- Transaction Fees - [download yellow paper]
- LISS - [download yellow paper]
- BTP
- Governance - [download yellow paper]

# ICON Improvement Proposal <https://github.com/icon-project/IIPs>

- IIP describes a standard for ICON platform.
- Anyone can prompt suggestions and discussions on new functions or improvement.
- Selected items will be implemented on ICON network.

- **For all other IIPs**, open a PR changing the state of your IIP to 'Final'. An editor will review your draft and ask if anyone objects to its being finalised. If the editor decides there is no rough consensus - for instance, because contributors point out significant issues with the IIP - they may close the PR and request that you fix the issues in the draft before trying again.

## IIP Status Terms

- **Draft** - an IIP that is open for consideration.
- **Last Call** - an IIP that is calling for last review before finalizing. IIPs that has been more than 2 weeks in Last Call without any technical changes or objections enters either Accepted or Final state.
- **Accepted** - an IIP that is planned for immediate adoption, i.e. expected to be included in the next release (for Core/Consensus layer IIPs only).
- **Final** - an IIP that has been adopted. For Core/Consensus layer IIPs, the implementation has been adopted in the mainnet.
- **Deferred** - an IIP that is not being considered for immediate adoption. May be reconsidered in the future.

## IIPs

Number	Title	Author	Type	Status
1	IIP Purpose and Guidelines	Sojin Kim	Meta	Active
2	ICON Token Standard	Jaechang Namgoong	IRC	Final
3	ICON Non-Fungible Token Standard	Jaechang Namgoong	IRC	Draft
6	ICON Name Service Standard	Phyrex Tsai, Portal Network Team	IRC	Draft

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