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A Developer's View of EOSIO

Presented by Phil Mesnier

OVERVIEW



- Contextualizing “developer”
- Overview of EOS and EOSIO
- Tools provided with EOSIO
- Smart contracts and decentralized apps

WHAT DOES “A DEVELOPER’S VIEW” MEAN?



- Looking at the EOSIO services from a developer’s perspective
- Core developer?
- Web/front-end developer?
- DApp/contract developer?
- Decentralized app projects can engage all three

CORE DEVELOPER



- Works on C++ code most commonly found in the libraries and plugins directories of eosio/eos
- Most developers will not have to work at this level
- May be necessary if adding new capabilities to the blockchain

WEB/FRONT-END DEVELOPER



- Works on application code “above” the API
- Uses tools such as those found in eosio/eosjs
- May also create non UI system services that also live above the API
- Unfortunately, not an area I can say much about

CONTRACT DEVELOPER



- Works on code “below” the API
- Uses C++ and adapters such as those found in eos/contracts/eoscpp
- Defines actions that interact with the blockchain



Overview of EOSIO

EOS and EOSIO



- EOS is a token.
- EOSIO is the software platform for deploying decentralized applications.

Delegated Proof of Stake (DPoS)



- Block creation responsibility shared amongst 21 well-known, voted-in block producers
- Standby block producer pool has over 100 candidates.
- Voting is continuous.

PERFORMANCE



Current block info

15 074 602

2018-09-06 15:31:17

Irreversible Block: **15 074 266** [-336]

Produced by: **eosbixinboot**

Next: **eoscanadacom**

General info

Staked total: **548 266 771.46 EOS**

TPS Live/All time high: **4 / 3996**

APS Live/All time high: **4 / 3996**

RAM in chain: **77 878 170 624**

Unpaid blocks: **75 422**

Core liquid balance: **1 878 050.88 EOS**

Saving total balance: **9 065 398.59 EOS**

Connected Users: **78**

Transactions ||

Total: **307672613** transactions

in **6634408** blocks

Block #: **15074266**

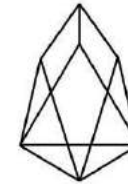
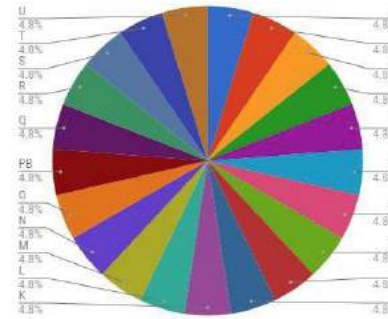
15074259

resolvebet eosbetdice11
{"bet_id": "6030822806423225409", "sig": "SIG_K1_Khpxg
EGY4ASIJ8hv71TF2DaccEWxC2L6bDrspcVqRNUVZHYP
YelJka2Qe18cDukVcE51tuzWuK2QY2bc5MD15v

	Name	Answered	Blk seen	Version	Votes
<input type="checkbox"/>	1 zbeosbp11111	20sec	15074594	3409331630	97 802 581.82 2.56%
<input type="checkbox"/>	2 eoslaomaocom	20sec	15074593	3900515421	95 868 954.97 2.51%
<input type="checkbox"/>	3 starteosiobp	19sec	15074596	718541431	93 855 527.65 2.46%
<input type="checkbox"/>	4 eoshuobipool	19sec	15074597	3409331630	91 970 854.33 2.41%
<input checked="" type="checkbox"/>	5 bitfinexeos1	19sec	15074597	3099701954	90 903 578.81 2.39%
<input type="checkbox"/>	6 eosfishrocks	19sec	15074598	3099701954	88 658 045.48 2.32%
<input type="checkbox"/>	7 eos42freedom	19sec	15074597	3409331630	82 981 583.6 2.17%
<input type="checkbox"/>	8 eosnewyorkio	18sec	15074598	3900515421	82 119 196.62 2.15%
<input type="checkbox"/>	9 jedaaaaaaa	18sec	15074600	3099701954	81 819 652.73 2.14%
<input type="checkbox"/>	10 libertyblock	18sec	15074600	3099701954	77 077 698.92 2.02%
<input type="checkbox"/>	11 eoscannonchn	18sec	15074600	3099701954	73 753 147.22 1.93%
<input type="checkbox"/>	12 eosflytomars	17sec	15074602	3409331630	72 970 014.68 1.91%
<input type="checkbox"/>	13 eoscanadacom	17sec	15074601	2720575964	72 937 594.47 1.91%
<input type="checkbox"/>	14 eosauthority	17sec	15074601	3409331630	71 936 308.14 1.89%
<input type="checkbox"/>	15 eosswedenorg	17sec	15074602	3150511990	70 866 827.84 1.86%
<input checked="" type="checkbox"/>	16 eosbixinboot	19sec	15074594	3900515421	68 760 840.42 1.8%
<input type="checkbox"/>	17 cypherglass	22sec	15074591	3099701954	68 718 851.17 1.8%
<input type="checkbox"/>	18 teamgreymass	22sec	15074588	4267626568	66 983 852.39 1.76%
<input type="checkbox"/>	19 argentinaeos	22sec	15074591	3900515421	64 169 196.36 1.68%
<input type="checkbox"/>	20 eosyskoreabp	20sec	15074594	3099701954	63 766 338.04 1.67%
<input type="checkbox"/>	21 eosasia11111	21sec	15074593	2720575964	63 696 597.83 1.67%

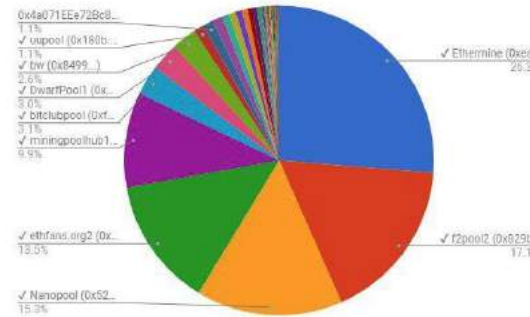
DECENTRALIZATION

This shows that DPoS in fact increases the overall block producer decentralization, whereas with bitcoin and Ethereum, mining pools have become effective central authorities with the top 5 producer pools controlling over 70% of the block production.



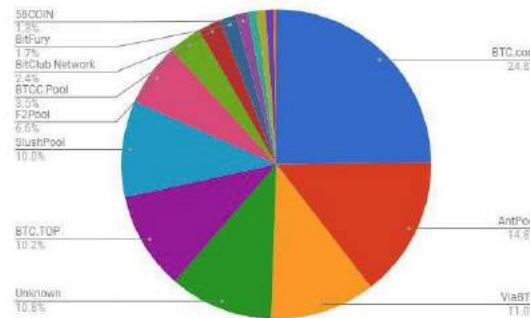
EOS

Source: EOS.IO WhitePaper
21 Block Producers



ETHEREUM

Source: etherchain.org
Top Miners over last 24 hrs



BITCOIN

Source: Blockchain.info
Hashrate Distribution - 4 Days

THE SOFTWARE BUNDLE



- Download available from GitHub. Package is eosio/eos
- git clone <https://github.com/EOSIO/eos> — recursive
- A lot of external dependencies, particularly on LLVM and Boost
- Supports Linux and MacOS
- Does not support Windows out of the box

THE BRANCHES IN git



- Branch "master" contains the latest patch release
- Branch "release" contains the latest major release
- Branch "develop" contains the upcoming patch release

IMPORTANT TOP-LEVEL DIRECTORIES



Docs and contacts top list

- ▶ .git
- ▶ build
- ▶ build_0904
 - ▶ CMakeModules
- ▶ contracts
- ▶ debian
- ▶ Docker
- ▶ docs
- ▶ emscripten
- ▶ externals
- ▶ images
- ▶ libraries
- ▶ plugins
- ▶ programs
- ▶ scripts
- ▶ spec
- ▶ tests
- ▶ tools
- ▶ tutorials
- ▶ unittests
- ▶ waterfall

BUILDING THE BUNDLE



- good: use `./eosio_build.sh` script
- It will guide you through resolving your dependencies.
- better: use an IDE, for example XCode or CLion

A SUCCESSFUL BUILD!



```
(S)(I)(O)(S)(I)(O)
```

```
EOSIO has been successfully built. 00:13:06
```

```
To verify your installation run the following commands:
```

```
/usr/local/bin/mongod -f /usr/local/etc/mongod.conf &  
cd /tao_builds/phil/projects/eos/at1/eos/build; make test
```

```
For more information:
```

```
EOSIO website: https://eos.io
```

```
EOSIO Telegram channel @ https://t.me/EOSProject
```

```
EOSIO resources: https://eos.io/resources/
```

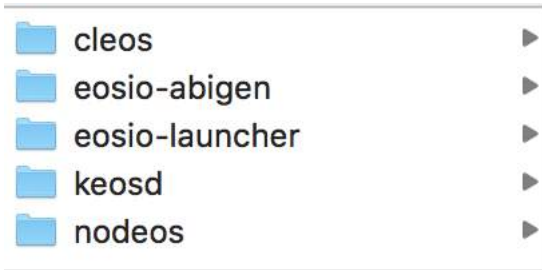
```
EOSIO Stack Exchange: https://eosio.stackexchange.com
```

```
EOSIO wiki: https://github.com/EOSIO/eos/wiki
```



EOSIO Tools

EOSIO PROGRAMS



- Found in eos/build/programs
- Could be installed to usr/local/bin

nodeos



- The heart of any eosio-derived network
- Single threaded (mostly)
- Modular construction using plugins

AVAILABLE PLUGINS

- In directory eos/plugins
- Several plugins separate function from API

- bnet_plugin
- chain_api_plugin
- chain_interface
- chain_plugin
- db_size_api_plugin
- faucet_testnet_plugin
- history_api_plugin
- history_plugin
- http_client_plugin
- http_plugin
- login_plugin
- mongo_db_plugin
- net_api_plugin
- net_plugin
- producer_api_plugin
- producer_plugin
- template_plugin
- txn_test_gen_plugin
- wallet_api_plugin
- wallet_plugin



RUNNING NODES



- A single node may be run as a "network" to perform most testing necessary during application development
- Start nodes from the command line
- Runs forever, builds a block archive
- Can be configured to join a running network, must synchronize its block database with the rest of the network.

Application Command Line Options:

```
-h [ --help ]           Print this help message and exit.
-v [ --version ]       Print version information.
--print-default-config  Print default configuration template
-d [ --data-dir ] arg  Directory containing program runtime
                        data
--config-dir arg       Directory containing configuration
                        files such as config.ini
-c [ --config ] arg (=config.ini) Configuration file name relative to
                        config-dir
-l [ --logconf ] arg (=logging.json) Logging configuration file name/path
                        for library users
```

eosio-launcher



- nodeos configuration for multiple nodes requires many similar values and some different ones
 - Each node has a listen socket or two that is unique
 - Each node also connects to some peers based on desired network topology
- The launcher simplifies creation of the config files using simple network definition lists
- Deploys files and launches nodes using ssh and scp commands

cleos



- Command line interface to the blockchain
- Performs actions, from checking the status of a single node to creating accounts, loading contract, and invoking actions
- Will automatically load an instance of keosd if needed

cleos AND COMMAND STRUCTURE



- Parameter list varies based on what command is being issued
- Most common use case is invoking contract actions
- Most common arguments are nodeos host/port
- Example: `cleos create account eosio eosio.token EOS7ijWCB`

keosd



- A keystore manager
- Should only listen to localhost connections
- Can be run separately or started on demand by cleos

eosio-abigen



- Generates ABI files for contracts based on C++ definitions



EOSIO Contracts

CONTRACT ESSENTIALS



- Written in C++
- Compiled by WASM
- Associated with accounts on the blockchain
- Run duration is limited
- Every invocation reloads/validates/initializes the contract

ACTIONS AND TABLES

- Actions are functions that may be triggered by an invocation
- Tables are used to persist data on the blockchain
- Consider the Tic-Tac-Toe contract

```
],
  "actions": [{
    "name": "create",
    "type": "create",
    "ricardian_contract": ""
  }, {
    "name": "restart",
    "type": "restart",
    "ricardian_contract": ""
  }, {
    "name": "close",
    "type": "close",
    "ricardian_contract": ""
  }, {
    "name": "move",
    "type": "move",
    "ricardian_contract": ""
  }
],
  "tables": [{
    "name": "games",
    "index_type": "i64",
    "key_names": [
      "challenger"
    ],
    "key_types": [
      "name"
    ],
    "type": "game"
  }
],
```



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CREATE OR GENERATE AN ABI



- “Application Binary Interface” is a JSON definition of all the types and values that are passed in invocations or stored in tables
- Types are primitives or structs. Type definitions may include base types defined external to the ABI
- EOSIO contains a common library of type definitions
- ABI files can be generated from the C++ header files

TIC-TAC-TOE FULL ABI



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```
{
  "comment": "This file was generated by the OCI tool.",
  "version": "eosio::abi/1.0",
  "types": [],
  "structs": [{
    "name": "game",
    "base": "",
    "fields": [{
      "name": "challenger",
      "type": "name"
    }, {
      "name": "host",
      "type": "name"
    }, {
      "name": "turn",
      "type": "name"
    }, {
      "name": "winner",
      "type": "name"
    }, {
      "name": "board",
      "type": "uint8[]"
    }
  ]
}, {
  "name": "create",
  "base": "",
  "fields": [{
    "name": "challenger",
    "type": "name"
  }, {
    "name": "host",
    "type": "name"
  }
}
```

```
, {
  "name": "restart",
  "base": "",
  "fields": [{
    "name": "challenger",
    "type": "name"
  }, {
    "name": "host",
    "type": "name"
  }, {
    "name": "by",
    "type": "name"
  }
]
}, {
  "name": "close",
  "base": "",
  "fields": [{
    "name": "challenger",
    "type": "name"
  }, {
    "name": "host",
    "type": "name"
  }
}
```

```
, {
  "name": "move",
  "base": "",
  "fields": [{
    "name": "challenger",
    "type": "name"
  }, {
    "name": "host",
    "type": "name"
  }, {
    "name": "by",
    "type": "name"
  }, {
    "name": "row",
    "type": "uint16"
  }, {
    "name": "column",
    "type": "uint16"
  }
]
```

```
"actions": [{
  "name": "create",
  "type": "create",
  "ricardian_contract": ""
}, {
  "name": "restart",
  "type": "restart",
  "ricardian_contract": ""
}, {
  "name": "close",
  "type": "close",
  "ricardian_contract": ""
}, {
  "name": "move",
  "type": "move",
  "ricardian_contract": ""
}
],
"tables": [{
  "name": "games",
  "index_type": "i64",
  "key_names": [
    "challenger"
  ],
  "key_types": [
    "name"
  ],
  "type": "game"
}
],
"ricardian_clauses": [],
"error_messages": [],
"abi_extensions": []
}
```

RICHARDIAN CONTRACTS



- A response to the notion that "code is law"
- Provided for every action, written in English
- Structured to be both human and machine readable
- Enable arbitration by codifying "intent"
- Enforce the notion that "intent is law"

ACCOUNT NAMES




- Why the weird restrictions? only 'a' - 'z', '1' - '5', '.'
- That is 32, or 2^5 , characters
- So a name is composed of 12 and 1/2 characters making a 64 bit value.



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