LiquidApps

Jan 03, 2023

Contents

1 Developers **1**

1.1 Getting Started . . . 1
1.2 Overview . . . 2
1.3 Zeus Getting Started . . . 3
1.4 Dapp Client Library . . . 13
1.5 Kylin Testnet Account . . . 22
1.6 Zeus IDE . . . 23
1.7 vRAM Getting Started . . . 23
1.8 LiquidAccounts Getting Started . . . 33
1.9 LiquidHarmony Oracles Getting Started . . . 38
1.10 LiquidScheduler Getting Started . . . 43
1.11 LiquidStorage Getting Started . . . 47
1.12 Price feed example . . . 52
1.13 Token bridge example . . . 53
1.14 Contract Logs . . . 54
1.15 DAPP Network Macros . . . 54
1.16 Unit Testing . . . 63
1.17 Packages and Staking . . . 68
1.18 Zeus Boxes . . . 71
1.19 Zeus Create Service . . . 72
1.20 Create service boilerplate . . . 72

2 DSPs **75**

2.1 Getting started . . . 75
2.2 Overview . . . 76
2.3 Architecture . . . 77
2.4 Demux Backend . . . 77
2.5 Account . . . 77
2.6 EOSIO Node . . . 78
2.7 IPFS . . . 82
2.8 PostgreSQL Database Backend . . . 86
2.9 DSP Node . . . 87
2.10 Packages . . . 90
2.11 Testing . . . 94
2.12 Claim Rewards . . . 96
2.13 Replay Contract . . . 96

2.14 Cleanup IPFS and Oracle Entries . . . 97
2.15 Consumer Permissions . . . 98
2.16 Upgrade DSP Node . . . 100

3 Liquidx **101**
3.1 LiquidX Getting Started . . . 101
3.2 Use DAPP Network Services . . . 101
3.3 Become a DSP on another chain . . . 104
3.4 Example Chains to Add . . . 106
3.5 Add a Chain to LiquidX . . . 109

4 Covax **113**
4.1 CoVax Chain Getting Started . . . 113
4.2 Become a DAPP Service Provider . . . 113
4.3 Become a Block Producer . . . 115

5 Services **121**
5.1 LiquidAuthenticator Service . . . 121
5.2 LiquidBilling Service . . . 122
5.3 LiquidScheduler Service . . . 122
5.4 LiquidDNS Service . . . 123
5.5 LiquidArchive Service . . . 124
5.6 LiquidVRAM Service . . . 125
5.7 LiquidKMS Service . . . 126
5.8 LiquidLog Service . . . 127
5.9 LiquidHarmony Service . . . 127
5.10 LiquidLens Service . . . 128
5.11 LiquidLink Service . . . 129
5.12 LiquidStorage Service . . . 130
5.13 LiquidAccounts Service . . . 130
5.14 VCPU Service . . . 131

6 DAPP Tokens **133**
6.1 DAPP Token Overview . . . 133
6.2 DAPP Tokens Tracks . . . 133
6.3 Claiming DAPP Tokens . . . 134
6.4 DAPP Tokens Distribution . . . 134
6.5 Air-HODL . . . 135

7 FAQs **137**
7.1 Frequently Asked Questions The DAPP Token . . . 137
7.2 Frequently Asked Questions DAPP Service Providers (DSPs) . . . 139
7.3 Frequently Asked Questions vRAM . . . 139

8 Patch Notes **141**
8.1 latest . . . 141
8.2 2.0.4719 . . . 143
8.3 2.0.4002 . . . 146
8.4 2.0.3107 . . . 150
8.5 2.0.2812 . . . 152
8.6 2.0.2527 . . . 153

CHAPTER 1

Developers

1.1 Getting Started

1.1.1 These docs are deprecated, please see new docs here: https://liquidapps.gitbook.io/

1.1.2 Overview Resources

1.1.3 Zeus SDK

- Getting Started
- Unit Testing
- Packages and Staking
- Zeus boxes

1.1.4 Dapp Client Library

- Getting Started

1.1.5 vRAM

- With Zeus

1.1.6 LiquidAccounts

- LiquidAccounts Getting Started

1.1.7 LiquidHarmony

- LiquidHarmony Getting Started

1.1.8 LiquidScheduler

- LiquidScheduler Getting Started

1.2 Overview

1.2.1 Articles

- Zeus IDE: Ready? Set. Code!
- LiquidApps DAPP Network Walkthrough #1: Zeus and vRAM
- LiquidApps Walkthrough #2: Staking to DAPP Service Providers and Deploying a vRAM dApp
- LiquidX Brings DSP Services To All EOSIO Chains and dApps
- Horizontally Scaling Blockchain Apps with vCPU
- EOS dApps and Their RAM Expenses
- vRAM guide for experts

1.2.2 Videos

- Multi-Chain dApp Scaling: Intro to LiquidApps & the DAPP Network (Blockchain Tools by Peter Keay)
- Setting up LiquidApps' Zeus SDK, including NVM + NPM (Blockchain Dev Tools by Peter Keay)
- Intro to Scalable, Decentralized Storage with DAPP Network vRAM (Blockchain Tools by Peter Keay)
- Developer Explains - Decentralized Dapp Scaling w/ IPFS! How LiquidApps Dapp Service Providers Work
- EOS Weekly - The LiquidApps Game-Changer
- EOS Weekly - Unlimited DSP Possibilities

1.2.3 Have questions?

- Join our Dev Telegram channel
- Join our Telegram channel
- Email us: support@liquidapps.io

1.2.4 Want more information?

- Read our whitepaper and subscribe to our Medium posts.

1.3 Zeus Getting Started

1.3.1 Overview

Zeus-cmd is an extensible command line tool. SDK extensions come packaged in "boxes" and are served through IPFS. Zeus is currently in alpha. *As a note, all Zeus commands must be run within the root directory of the package that was unboxed.*

- zeus-sdk
- overview of boxes

1.3.2 Features:

- Smart contract templating with a single command
- Install nodeos, keosd, cleos, and eosio.cdt with a single command
- Simulate a blockchain node with a single command
- Test, compile, and deploy smart contracts
- Easily migrate a contract to a different EOSIO chain such as the Kylin and Jungle testnets or the mainnet
- Design fluid dApp frontends
- Cross-platform (Windows, OS X, Linux)
- Easily install necessary libraries with a package manager
- Truffle-like interface
- Manage development lifecycle with version control
- Open source (BSD License)
- And more...

1.3.3 Gitpod Zeus-IDE

If you want to be up and running with Zeus quickly, you can use our cloud based Zeus-IDE, all you need is a Github account! Try it here!

1.3.4 dapp-client library

The dapp-client library makes it easier to interact with the DAPP Network's core smart contracts and services, read more here.

1.3.5 Hardware Requirements

- 16GB RAM
- 2 CPU Cores

1.3.6 Prerequisites

- *node version 10.16.3* is recommended (nvm recommended, install at bottom of doc)
- curl
- cmake
- make
- git

Use node version manager to install node

```
curl -o- https://raw.githubusercontent.com/creationix/nvm/v0.34.0/install.sh | bash
# use install instructions provided to set PATH
nvm install 10.16.3
nvm use 10.16.3
```

1.3.7 Recommended eosio.cdt and eosio versions

Automatically installed with `zeus unbox helloworld`

- eosio.cdt v1.6.3
- eosio v2.0.5

note our contracts are not yet compatible with eosio.cdt 1.7.0

1.3.8 Install Zeus

```
npm install -g @liquidapps/zeus-cmd
```

1.3.9 Create Zeus box

Before unboxing an existing box or creating a new box, the command `zeus box create` must be run. This is intended to act like `npm init`. The command creates a boilerplate `zeus-box.json` file as well as a `package.json` file. Once this command is run, a box may be unboxed.

```
zeus box create
```

1.3.10 Unbox

The unbox command allows a user to unbox one or multiple boxes, similar to `npm install <MODULE> [MODULE2 ...]`. A version may also be specified.

```
zeus box create
zeus unbox helloworld
zeus unbox helloworld@1.0.1
zeus unbox helloworld ipfs-dapp-service
```

1.3.11 Update

```
npm update -g @liquidapps/zeus-cmd
```

1.3.12 Test

```
mkdir helloworld; cd helloworld
zeus box create
zeus unbox helloworld
zeus test -c
```

1.3.13 Create your own contract

This box supports all DAPP Services and unit tests and is built to integrate your own DAPP Network logic. When you run the command a sample unit test and smart contract will be created.

```
mkdir mydapp; cd mydapp
zeus box create
zeus unbox all-dapp-services
zeus create contract mycontract
```

contract is located in /zeus_boxes/contracts, test is located in /zeus_boxes/test

1.3.14 Try out LiquidApps's take on Elemental Battles:

http://elemental.liquidapps.io/ | code

The game incorporates:

- vRAM - light-weight caching solution for EOSIO based RAM
- LiquidAccounts - EOSIO accounts that live in vRAM instead of RAM
- LiquidDNS - DNS service on the blockchain | contract table
- Frontend stored on IPFS
- user data is stored in the vRAM `dapp::multi_index` table (vRAM) | code
- keys stored in `dapp::multi_index` table | code
- keys created using the account name and password as seed phrases | code
- eosjs-ecc's `seedPrivate` method is used to create the keypair | code
- logic to create LiquidAccount transactions | code

To launch locally:

```
mkdir cardgame; cd cardgame
zeus box create
zeus unbox cardgame
zeus migrate
zeus run frontend main
```

1.3.15 Try out vCPU with our LiquidChess game:

https://chess.liquidapps.io/ | code

The game incorporates:

- vRAM - light-weight caching solution for EOSIO based RAM
- LiquidAccounts - EOSIO accounts that live in vRAM instead of RAM
- LiquidDNS - DNS service on the blockchain
- vCPU - a solution to scale blockchain processing power horizontally

To launch locally:

```
mkdir chess; cd chess
zeus box create
zeus unbox chess
zeus migrate
zeus run frontend main
```

1.3.16 Try out LiquidPortfolio

http://portfolio.liquidapps.io/ | code

LiquidPortfolio is a portfolio tracking tool for BTC, ETH (and tokens), and EOS (and tokens). The tool displays the total current value of the portfolio while also encrypting all user account info with the LiquidAccount's private key.

The game incorporates:

- vRAM - light-weight caching solution for EOSIO based RAM
- LiquidAccounts - EOSIO accounts that live in vRAM instead of RAM
- LiquidHarmony - oracle service for fetching prices
- LiquidDNS - DNS service on the blockchain
- Encryption/Decryption locally of account data using LiquidAccount private key

To launch locally:

```
mkdir portfolio; cd portfolio
zeus box create
zeus unbox portfolio
zeus migrate
zeus run frontend main
```

note if you compile and run this contract yourself, you will need to update all instances of `uint8[][]` *within the abi to* `bytes[]`

1.3.17 Samples Boxes

```
zeus box create
zeus unbox <INSERT_BOX>
```

vRAM Boxes

- coldtoken - vRAM based eosio.token
- deepfreeze - vRAM based cold storage contract
- vgrab - vRAM based airgrab for eosio.token
- registry - vRAM based item registration

Zeus Extension Boxes

- contract-migrations-extensions - contract create/deployment command template, deploy contract and allocate DAPP tokens
- test-extensions - provides logic to test smart contract with unit tests
- eos-extensions - install eos/eosio.cdt, launch local nodeos, launch system contracts
- demux - install EOSIO's demux backend to capture events for contracts using the state-history plugin

DAPP Services Boxes

The DAPP Service boxes allow you to isolate the service that you wish to work with. If you instead would like to use all of the DAPP Services, you may unbox the `all-dapp-services` box.

- ipfs-dapp-service - utilize the dapp::multi_index table to store data in IPFS (vRAM) instead of RAM
- cron-dapp-service - schedule CRON tasks on-chain
- oracle-dapp-service - provide oracle services
- readfn-dapp-service - read a contract function without the need to submit a trx to the chain
- vaccounts-dapp-service - EOSIO accounts that live in vRAM instead of RAM
- vcpu-dapp-service - scale blockchain processing power horizontally

Miscellaneous Boxes

- microauctions - twin reverse dutch auctions used in DAPP's generation event
- eos-detective-reports - EOS Detective Reports - by EOSNation - https://eosdetective.io/
- helloworld - Hello World
- token - Standard eosio.token
- airhodl - First ever Air-HODL

1.3.18 Zeus Options

please note: zeus commands are directory sensitive, all commands should be performed in root of box

Zeus compile

Compile a smart contract. You can either compile all of the contracts within the contracts directory with `zeus compile` or a specific contract by name, such as `zeus compile dappservices`

```
zeus compile <CONTRACT_NAME>

# optional flags:

--all # compile all contracts
# default: true
--chain # chain to work on
# default: eos
```

Zeus migrate

Compile and migrate a smart contract to another network such as the Kylin Testnet, Jungle Testnet, or Mainnet.

Be sure to run the following commands from inside the directory you unboxed, e.g., if you unboxed coldtoken, be in `/coldtoken`. Also be sure to set the network in the import and migrate commands so Zeus knows what chain the keys / contract is operating on (mainnet, kylin, or jungle).

```
# keys are stored in ~/.zeus/networks/<NETWORK>/accounts/
zeus key import <CONTRACT_ACCOUNT_NAME> --owner-private-key <KEY> --active-private-
↪key <KEY> --network=kylin
# contract deployment files are stored in ~/<BOX>/models/contract-deployments
zeus create contract-deployment <CONTRACT_FILE_NAME> <CONTRACT_ACCOUNT_NAME>
zeus migrate --network=kylin --creator=<CONTRACT_ACCOUNT_NAME> --creator-key=<ACTIVE_
↪PRIVATE_KEY>

# optional flags:

--compile-all # compile all contracts
# default: true
--wallet # keosd wallet to use
# default: zeus
--creator-key # contract creator private key
# default: (eosio test key) 5KQwrPbwdL6PhXujxW37FSSQZ1JiwsST4cqQzDeyXtP79zkvFD3
--creator # account to set contract to
# default: eosio
--reset # reset testing environment
# default: true
--chain # chain to work on
# default: eos
--network # network to work on (other options, kylin, jungle, mainnet)
# default: development (local)
--verbose-rpc # verbose logs for blockchain communication
# default: false
--storage-path # path for persistent storage',
# default: path.join(require('os').homedir(), '.zeus')
--stake # account EOSIO staking amount
# default: '30.0000'
--no-compile # do not compile contracts
--no-reset # do not reset local testing environment
```

Zeus test

Unit test a smart contract. To run the unit tests for all smart contracts within the unboxed directory, use `zeus test`. The compile all smart contracts before testing, use `zeus test -c`, `-c` being the alias to compile. To test and or compile for a specific contract name, add the `<CONTRACT_NAME>` to the command.

```
zeus test # run all unit tests
zeus test <CONTRACT_NAME> # run unit tests for contract name
zeus test -c <CONTRACT_NAME> # compile and run unit tests for contract name

# optional flags:

--compile # compile contracts
# default: false
# alias: c
--wallet # keosd wallet to use
# default: zeus
# alias: w
--creator-key # contract creator key
# default: (eosio test key) 5KQwrPbwdL6PhXujxW37FSSQZ1JiwsST4cqQzDeyXtP79zkvFD3
--creator # account to set contract to
# default: eosio
# alias: a
--reset # reset testing environment
# default: true
--chain # chain to work on
# default: eos
--network # network to work on (other options, kylin, jungle, mainnet)
# default: development (local)
--verbose-rpc # verbose logs for blockchain communication
# default: false
--storage-path # path for persistent storage',
# default: path.join(require('os').homedir(), '.zeus')
--stake # account EOSIO staking amount
# default: '30.0000'
--no-reset # do not reset local testing environment
```

Zeus Import/Export Keys

Import and export keys to your Zeus wallet. **Please note by default keys are imported without encryption.**

```
zeus key import <ACCOUNT_NAME> --owner-private-key <KEY> --active-private-key <KEY>

# optional flags:

--encrypted # encrypt the account keys with a password
# default: false
--storage # path to the wallet which will store the key
# default: ${home}/.zeus/networks
--network # network to work on (other options, kylin, jungle, mainnet)
# development (local)
--password # password to encrypt the keys with
--vaccount # bool whether account is a LiquidAccount
# default: false

zeus key export <ACCOUNT_NAME>
```

(continues on next page)

(continued from previous page)

```
# optional flags:

--encrypted # exports encrypted key
# default: false
--storage # path to where the key is stored
# default: ${home}/.zeus/networks
--network # network to work on (other options, kylin, jungle, mainnet)
# default: development (local)
--password # password to decrypt the keypair
--vaccount # bool whether account is a LiquidAccount
# default: false
```

Add or remove a box from the local mapping.json file

Zeus uses 2 mapping files to unbox boxes. The `builtin-mapping.json` file is for boxes that are a part of the official zeus-sdk repo (located: `.../node_modules/@liquidapps/zeus-cmd/lib/resources/builtin-mapping.json`). This file only changes when Zeus is updated. There is also a local zeus box for modifying existing boxes from the `builtin-mapping.json` and adding new boxes. If a box exists in both the builtin and the local mapping files, the local mapping file will be used. To use the builtin box instead, you must remove the local version first.

```
zeus box add <BOX_NAME> <VERSION> <URI>
# zeus box add liquidx-jungle 1.0.1 https://s3.us-east-2.amazonaws.com/liquidapps.
↪artifacts/boxes/0a98835c75debf2f1d875be8be39591501b15352f7c017799d0ebf3342668d2c.zip

# to deploy helloworld box locally then add
# zeus box deploy
# zeus box add helloworld 1.0.1 file:///home/ubuntu/.zeus/boxes/helloworld/box.zip

# to remove
# zeus list-boxes # will see new box under 'Local Boxes:'
zeus box remove <BOX_NAME> <VERSION>
# zeus box remove liquidx-jungle 1.0.1
# zeus list-boxes, will be gone
```

Zeus Deploy

Deploy a custom Zeus box to your local working directory. Once deployed, if the `--update-mapping` flag is used, you may unbox this box like other packages. The `--type` method can be used to determine what medium to deploy the box to. The default `local` deploys with the syntax `file://${packagePath}/box.zip`. The option `ipfs` deploys to the IPFS network with the syntax `ipfs://${hash}`.

```
zeus deploy box

# optional flags:

--update-mapping # updates local mapping.json file with an IPFS URI where the package␣
↪may be accessed at
# default: true
--type # deploy destination (local, ipfs)
# default: local
```

Zeus RC File

An RC file allows command flags specified in a json file to be used automatically without needing to add them to a command each time it is used. To use an RC file, on can be created in the directory: `~/.zeus/zeusrc.json` to persist between deleting boxes and updating Zeus, or in another directory using the `--rc-file` flag to specify the relative path.

Example RC file:

```
{
    "verbose": true,
    "type": "local",
    "update-mapping": true,
    "test": true,
    "compile": true
}
```

Example usage:

```
# use rc file in local directory
zeus test --rc-file ./zeusrc.json
# ignore rc file
zeus test -c --rc-ignore
```

Help

```
zeus --help
```

List Boxes

Lists all available zeus boxes that can be unboxed.

```
zeus list-boxes
```

1.3.19 Project structure

Directory structure

```
    extensions/
    contracts/
    frontends/
    models/
    test/
    migrations/
    utils/
    services/
    zeus-box.json
    zeus-config.js
```

zeus-box.json

Add commands, NPM intalls, ignores, and command hooks

```
{
  "ignore": [
    "README.md"
  ],
  "commands": {
    "Compile contracts": "zeus compile",
    "Migrate contracts": "zeus migrate",
    "Test contracts": "zeus test"
  },
  "install":{
      "npm": {

      }
  },
  "hooks": {
    "post-unpack": "echo hello",
    "post-install": "git clone ..."
  }
}
```

zeus-config.js

Configure zeus environments available to interact with. The `zeus-config.js` file is located in the root of an unboxed directory.

```
module.exports = {
    defaultArgs:{
      chain:"eos",
      network:"development"
    },
    chains:{
        eos:{
            networks: {
                development: {
                    host: "localhost",
                    port: 7545,
                    network_id: "*", // Match any network id
                    secured: false
                },
                jungle: {
                    host: "jungle2.cryptolions.io",
                    port: 80,
                    network_id: "*", // Match any network id
                    secured: false
                },
                kylin: {
                    host: "api.kylin.eosbeijing.one",
                    port: 80,
                    network_id: "*",
                    secured: false
                },
                mainnet:{
```

(continues on next page)

(continued from previous page)

```
                        host: "bp.cryptolions.io",
                        port: 8888,
                        network_id: "*", // Match any network id
                        secured: false
                    }
                }
            }
        }
    };
```

1.4 Dapp Client Library

The dapp-client library makes using DAPP Network services much easier. It also allows you to easily tap into the `dappservices` (core DAPP Network Smart contract) and `dappairhodl1` (Air-HODL smart contract) RAM tables with precision utilizing secondary and tertiary indices without the hassle.

To setup the library, first install it:

```
npm i -g @liquidapps/dapp-client
```

From there include the library's client creator script:

```
const { createClient } = require('@liquidapps/dapp-client');
```

Then pass your desired arguments to the creator function

```
/*
    * network: specify your network of choice: mainnet, kylin, jungle
    * httpEndpoint: you may also specify an endpoint to use instead of our defaults
    * fetch: pass a fetch reference as needed
    // if using dfuse
    * dfuse_key: Dfuse API key
    * dfuse_guarantee: Dfuse Push Guarantee(in-block, handoff:1, handoffs:2,␣
↪handoffs:3, irreversible)
    * dfuse_network: Dfuse Network ( mainnet, testnet (eosio testnet), kylin, worbli,␣
↪wax)
*/

export const getClient = async() => {
  return await createClient({ network: "kylin", httpEndpoint: endpoint, fetch: window.
↪fetch.bind(window) });
};
```

Finally, setup the service you would like to interact along with your smart contract name:

```
(async () => {
    const service = await (await createClient()).service('ipfs','cardgame1112');
    const response = await service.get_vram_row( "cardgame1112", "cardgame1112",
↪"users", "nattests" );
    console.log(response);
    // { username: 'nattests',
    //     win_count: 0,
    //     lost_count: 0,
    //     game_data:
```

(continues on next page)

(continued from previous page)

```
    // { life_player: 5,
    //     life_ai: 5,
    //     deck_player:
    //     [ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17 ],
    //     deck_ai:
    //     [ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17 ],
    //     hand_player: [ 0, 0, 0, 0 ],
    //     hand_ai: [ 0, 0, 0, 0 ],
    //     selected_card_player: 0,
    //     selected_card_ai: 0,
    //     life_lost_player: 0,
    //     life_lost_ai: 0,
    //     status: 0 } }
})().catch((e) => { console.log(e); });
```

Here is a full list of service options. The library comes with a push_guarantee function, similar to dfuse's push guarantee, it accepts `in-block`, `handoffs:1-3`, or `irreversible`. There are DAPP Network service extensions and `dappservices` / `dappairhodl1` RAM row calls.

1.4.1 DAPP Network service extensions

Push Guarantee

Retry time between push guarantee verification can be set with the `DAPP_CLIENT_PUSH_TRANSACTION_SLEEP` environment variable, defaults to 10ms.

```
const { PushGuarantee } = require("eosio-push-guarantee");
const { Api, JsonRpc, RpcError } = require('eosjs');
const { JsSignatureProvider } = require('eosjs/dist/eosjs-jssig');      //␣
↪development only
const fetch = require('node-fetch');                                    // node only;␣
↪not needed in browsers
const { TextEncoder, TextDecoder } = require('util');                   // node only;␣
↪native TextEncoder/Decoder
const defaultPrivateKey = "5JMUyaQ4qw6Zt816B1kWJjgRA5cdEE6PhCb2BW45rU8GBEDa1RC"; //␣
↪bob
const signatureProvider = new JsSignatureProvider([defaultPrivateKey]);
const rpc = new JsonRpc('https://kylin-dsp-1.liquidapps.io', { fetch });
const api = new Api({ rpc, signatureProvider, textDecoder: new TextDecoder(),␣
↪textEncoder: new TextEncoder() });

(async () => {
    const config = {
        // pushGuarantee: 'none', // push guarantee level for trx
        // readRetries: 0, // amount of times to try and verify trx before retrying␣
↪trx
        // pushRetries: 3, // amount of times to retry trx before failing
        // backoff: 500, // time in ms between readRetries
        // backoffExponent: 1.1 // multiplier backoff time for backoff (if 500ms and␣
↪1.1 multiplier then 550ms backoff next time, etc)

        pushGuarantee: 'in-block',
        readRetries: 3,

        // pushGuarantee: 'handoffs:1',
```

(continues on next page)

(continued from previous page)

```
        // readRetries: 10,

        // pushGuarantee: 'handoffs:2',
        // readRetries: 20,

        // pushGuarantee: 'handoffs:3',
        // readRetries: 30,

        pushGuarantee: 'irreversible',
        readRetries: 100,
    }
    const push_guarantee_rpc = new PushGuarantee(rpc, config);
    const account = 'dappservices';
    const actor = 'vacctstst123';
    const action = 'transfer';
    const serializedTrx = await api.transact({
        actions: [{
            account,
            name: action,
            authorization: [{
                actor,
                permission: 'active',
            }],
            data: {
                from: 'vacctstst123',
                to: 'natdeveloper',
                quantity: '1.0000 DAPP',
                memo: ''
            },
        }]
    },  {
        blocksBehind: 3, // in-block
        expireSeconds: 30, // in-block

        // blocksBehind: 3, // handoffs
        // expireSeconds: 90, // handoffs

        // expireSeconds: 300, // irreversible
        // useLastIrreversible: true, // irreversible,

        broadcast: false
    });
    const response = await (await getClient()).dappNetwork.push_action(rpc,␣
↪serializedTrx, config);
    console.dir(result);
})().catch((e) => { console.log(e); });
```

vRAM - IPFS

get_vram_row - get vRAM row from DSP's endpoint

```
/*
    getClient()
    * service name: ipfs
```

(continues on next page)

(continued from previous page)

```
    * contract name

    service.get_vram_row - read vRAM table row from DSP's endpoint
    * code - smart contract account
    * scope - scope of table
    * table - name of table
    * primary key

*/

const service = await (await getClient()).service('ipfs','cardgame1112');
const response = await service.get_vram_row( "cardgame1112", "cardgame1112", "users",
↪"nattests" );
```

LiquidAccounts

push_liquid_account_transaction - register new account

```
/*
    getClient()
    * service name: vaccounts
    * contract name

    service.push_liquid_account_transaction
    * account name of contract with LiquidAcount code deployed
    * private key of LiquidAccount
    * action name: regaccount to register new account
    * payload
        * vaccount - name of LiquidAccount

*/

const service = await (await getClient()).service('vaccounts', "vacctstst123");
const response = await service.push_liquid_account_transaction(
    "vacctstst123",
    "5JMUyaQ4qw6Zt816B1kWJjgRA5cdEE6PhCb2BW45rU8GBEDa1RC",
    "regaccount",
    {
        vaccount: 'testing126'
    }
);
```

push_liquid_account_transaction - push transaction after creating account

```
/*
    getClient()
    * service name: vaccounts
    * contract name

    service.push_liquid_account_transaction
    * account name of contract with LiquidAcount code deployed
    * private key of LiquidAccount
```

(continues on next page)

(continued from previous page)

```
    * action name: hello
    * payload
        * any - payload must match struct outline in the smart contract

*/

const service = await (await getClient()).service('vaccounts', "vacctstst123");
const response = await service.push_liquid_account_transaction(
    "vacctstst123",
    "5JMUyaQ4qw6Zt816B1kWJjgRA5cdEE6PhCb2BW45rU8GBEDa1RC",
    "hello",
    {
        vaccount: 'testing126'
    }
);
```

1.4.2 dappservices

get_package_info - returns package info

```
/*

    dappNetwork.get_package_info
    * account name
    * service name - service names are listed under the services section of the docs␣
↪as the Contract name

*/

const response = await (await getClient()).dappNetwork.get_package_info( "cardgame1112
↪", "accountless1" );
console.log(response);
// {
//     api: 'https://kylin-dsp-1.liquidapps.io',
//     package_json_uri: 'https://kylin-dsp-1.liquidapps.io/liquidaccts2.dsp-package.
↪json',
//     package_id: 'liquidaccts2',
//     service: 'accountless1',
//     provider: 'heliosselene',
//     quota: '10.0000 QUOTA',
//     package_period: 60,
//     min_stake_quantity: '10.0000 DAPP',
//     min_unstake_period: 3600,
//     enabled: 0
// }
```

get_table_accountext - returns entire accountext table

```
/*

    dappNetwork.get_table_accountext
```

(continues on next page)

(continued from previous page)

```
*/

const response = await (await getClient()).dappNetwork.get_table_accountext();
for (const row of response.rows) {
    console.log(row);
    // {
    //     id: 144,
    //     account: 'mailcontract',
    //     service: 'ipfsservice1',
    //     provider: 'heliosselene',
    //     quota: '9.9907 QUOTA',
    //     balance: '10.0000 DAPP',
    //     last_usage: '1564112241500',
    //     last_reward: '1564112241500',
    //     package: 'ipfs1',
    //     pending_package: 'ipfs1',
    //     package_started: '1564112241500',
    //     package_end: '1564112301500'
    // }
}
```

get_table_accountext_by_account_service - returns entire accountext by account and service specified

```
/*

    dappNetwork.get_table_accountext_by_account_service
    * account name
    * service name - service names are listed under the services section of the docs␣
↪as the Contract name

*/

const response = await (await getClient()).dappNetwork.get_table_accountext_by_
↪account_service('cardgame1112', 'ipfsservice1');
for (const row of response.rows) {
    console.log(row);
    // {
    //     id: 144,
    //     account: 'mailcontract',
    //     service: 'ipfsservice1',
    //     provider: 'heliosselene',
    //     quota: '9.9907 QUOTA',
    //     balance: '10.0000 DAPP',
    //     last_usage: '1564112241500',
    //     last_reward: '1564112241500',
    //     package: 'ipfs1',
    //     pending_package: 'ipfs1',
    //     package_started: '1564112241500',
    //     package_end: '1564112301500'
    // }
}
```

get_table_accountext_by_account_service_provider - returns entire accountext by account, service, and provider specified

```
/*

    dappNetwork.get_table_accountext_by_account_service_provider
    * account name
    * service name - service names are listed under the services section of the docs as the Contract name
    * provider name - DSP name

*/

const response = await (await getClient()).dappNetwork.get_table_accountext_by_account_service_provider('cardgame1112', 'ipfsservice1','heliosselene');
for (const row of response.rows) {
    console.log(row);
    // {
    //     id: 144,
    //     account: 'mailcontract',
    //     service: 'ipfsservice1',
    //     provider: 'heliosselene',
    //     quota: '9.9907 QUOTA',
    //     balance: '10.0000 DAPP',
    //     last_usage: '1564112241500',
    //     last_reward: '1564112241500',
    //     package: 'ipfs1',
    //     pending_package: 'ipfs1',
    //     package_started: '1564112241500',
    //     package_end: '1564112301500'
    // }
}
```

get_table_package - returns entire package table

```
/*

    dappNetwork.get_table_package
    * [limit] - optional limit for how many packages to return

*/

const response = await (await getClient()).dappNetwork.get_table_package({ limit: 500});
for (const row of response.rows) {
    console.log(row);
    // {
    //     id: 9,
    //     api_endpoint: 'https://kylin-dsp-1.liquidapps.io',
    //     package_json_uri: 'https://kylin-dsp-1.liquidapps.io/package1.dsp-package.json',
    //     package_id: 'package1',
    //     service: 'ipfsservice1',
    //     provider: 'heliosselene',
    //     quota: '1.0000 QUOTA',
    //     package_period: 86400,
```

(continues on next page)

(continued from previous page)

```
    //     min_stake_quantity: '10.0000 DAPP',
    //     min_unstake_period: 3600,
    //     enabled: 1
    // }
}
```

get_table_package_by_package_service_provider - returns packages by package, service, and DSP name

```
/*

    dappNetwork.get_table_package_by_package_service_provider
    * package name
    * service name - service names are listed under the services section of the docs as the Contract name
    * DSP name
    * [limit] - optional limit for how many packages to return

*/

const response = await (await getClient()).dappNetwork.get_table_package_by_package_service_provider('package1', 'ipfsservice1', 'heliosselene', { limit: 500 });
for (const row of response.rows) {
    console.log(row);
    // {
    //     id: 9,
    //     api_endpoint: 'https://kylin-dsp-1.liquidapps.io',
    //     package_json_uri: 'https://kylin-dsp-1.liquidapps.io/package1.dsp-package.json',
    //     package_id: 'package1',
    //     service: 'ipfsservice1',
    //     provider: 'heliosselene',
    //     quota: '1.0000 QUOTA',
    //     package_period: 86400,
    //     min_stake_quantity: '10.0000 DAPP',
    //     min_unstake_period: 3600,
    //     enabled: 1
    // }
}
```

get_table_packageext - returns a packages selected inflation rate and quota cost for actions

```
/*

    dappNetwork.get_table_packageext
    * [limit] - optional limit for how many packages to return

*/

const response = await (await getClient()).dappNetwork.get_table_packageext({ limit: 500 });
for (const row of response.rows) {
```

(continues on next page)

(continued from previous page)

```
    console.log(row);
}
```

get_table_packagext_by_package_service_provider - returns DSP packagext entries that match the package and dsp service provided

```
/*

    dappNetwork.get_table_packagext_by_package_service_provider
    * package name
    * service name - service names are listed under the services section of the docs␣
↪as the Contract name
    * DSP name
    * [limit] - optional limit for how many packages to return

*/

const response = await (await getClient()).dappNetwork.get_table_packagext_by_package_
↪service_provider('package1', 'ipfsservice1', 'heliosselene', { limit: 500 });
for (const row of response.rows) {
    console.log(row);
}
```

get_table_refunds - returns refund table details for account name specified

```
/*

    dappNetwork.get_table_refunds
    * account name

*/

const response = await (await getClient()).dappNetwork.get_table_refunds('heliosselene
↪');
for (const row of response.rows) {
    console.log(row);
    // {
    //     id: 0,
    //     account: 'heliosselene',
    //     amount: '10.0000 DAPP',
    //     unstake_time: 12345678
    //     provider: 'heliosselene',
    //     service: 'ipfsservice1'
    // }
}
```

get_table_staking - returns staking table details for account name specified

```
/*

    dappNetwork.get_table_staking
```

(continues on next page)

(continued from previous page)

```
    * account name

*/

const response = await (await getClient()).dappNetwork.get_table_staking('cardgame1112
↪');
for (const row of response.rows) {
    console.log(row);
    // {
    //     id: 0,
    //     account: 'cardgame1112',
    //     balance: '10.0000 DAPP',
    //     provider: 'uuddlrlrbass',
    //     service: 'accountless1'
    // }
}
```

1.4.3 dappairhodl1

get_dapphdl_accounts - get an account's DAPPHDL stats

```
/*

    airhodl.get_dapphdl_accounts
    * account name

*/

const response = await (await getClient()).airhodl.get_dapphdl_accounts('natdeveloper
↪');
for (const row of response.rows) {
    console.log(row);
    // {
    //     balance: '0.0033 DAPPHDL',
    //     allocation: '0.0199 DAPPHDL',
    //     staked: '0.0000 DAPPHDL',
    //     claimed: 1
    // }
}
```

1.5 Kylin Testnet Account

The CryptoKylin testnet is one of the EOS Testnets. Feel free to join their Telegram, or checkout their Github repo.

1.5.1 Account

```
# Create a new available account name (replace 'yourtestaccount' with your account␣
↪name):
export ACCOUNT=yourtestaccount
```

(continues on next page)

(continued from previous page)

```
# Configure endpoint
export DSP_ENDPOINT=https://kylin-dsp-1.liquidapps.io

# Create wallet
cleos wallet create --file wallet_password.pwd

# Create account and import key
curl http://faucet-kylin.blockzone.net/create/$ACCOUNT > keys.json
export ACTIVE_PRIVATE_KEY=`cat keys.json | jq -e '.data.account.active.privateKey'`
export ACTIVE_PUBLIC_KEY=`cat keys.json | jq -e '.data.account.active.publicKey'`
cleos wallet import --private-key $ACTIVE_PRIVATE_KEY
# if this does not work, import key directly

# Get some tokens, stake CPU/NET, buy RAM for contract
curl http://faucet-kylin.blockzone.net/get_token/$ACCOUNT
curl http://faucet-kylin.blockzone.net/get_token/$ACCOUNT
cleos -u $DSP_ENDPOINT system buyram $ACCOUNT $ACCOUNT "100.0000 EOS" -p
↪$ACCOUNT@active
cleos -u $DSP_ENDPOINT system delegatebw $ACCOUNT $ACCOUNT "20.0000 EOS" "80.0000 EOS
↪" -p $ACCOUNT@active
```

Save wallet_password.pwd and keys.json somewhere safe!

1.5.2 Kylin DAPP Tokens

DAPP Faucet

1.6 Zeus IDE

The Zeus IDE allows new developers to get up and running in mere minutes! It is based on Gitpod, a cloud-based tool for creating IDEs from git repos backed by Docker containers. All a you need to do is log in to Gitpod with your GitHub account and establish a new workspace based on the LiquidApps Zeus IDE GitHub repo.

Behind the scenes, Gitpod executes the following:

- Automatically installs the Docker image, which already contains EOSIO, Zeus and many other tools
- Starts an EOSIO development node
- Generates a basic starting point for a project (using the Zeus SDK)
- Starts a LiquidApps development DSP

Click here to try it!

1.7 vRAM Getting Started

```
        _____              __  __
       |  __ \      /\    |  \/  |
__   _| |__) |    /  \   | \  / |
\ \ / /  _  /    / /\ \  | |\/| |
 \ V /| | \ \   / ____ \| |  | |
```

(continues on next page)

(continued from previous page)

```
  \_/ |_|  \_\/_/    \_\_|  |_|

```

vRAM is a caching solution that enables DAPP Service providers (specialized EOS nodes) to load data to and from RAM <> vRAM on demand. Data is evicted from RAM and stored in vRAM after the transaction has been run. This works similar to the way data is passed to and from regular computer RAM and a hard drive. As with EOS, RAM is used in a computer sometimes because it is a faster storage mechanism, but it is scarce in supply as well. For more information on the technical details of the transaction lifecycle, please read the vRAM Guide For Experts article and/or the whitepaper.

vRAM requires a certain amount of data to be stored in RAM permanently in order for the vRAM system to be trustless. This data is stored in a regular `eosio::multi_index` table with the same name as the `dapp::multi_index` vRam table defined by the smart contract. Each row in the regular `eosio::multi_index` table represents the merkle root of a partition of the sharded data with the root hash being `vector<char> shard_uri` and the partition id being `uint64_t shard`. Note that this is equivalent to having a single merkle root with the second layer of the tree being written to RAM for faster access. The default amount of shards (which is proportional to the maximum amount of permanent RAM required) is 1024 meaning that, the total amount of RAM that a `dapp::multi_index` table will need to permanently use is `1024 * (sizeof(vector<char> shard_uri) + sizeof(uint64_t id))`.

In order to access/modify vRam entries certain data may need to be loaded into RAM in order to prove (via the merkle root) that an entry exists in the table. This temporary data (the "cache") is stored in the `ipfsentry` table. The DAPP Services Provider is responsible for removing this data after the transaction's lifecycle. If the DSP does not perform this action, the `ipfsentry` table will continue to grow until the account's RAM supply has been exhausted or the DSP resumes its services.

1.7.1 Prerequisites

- Zeus - Zeus installs eos and the eosio.cdt if not already installed
- Kylin Account

1.7.2 Unbox sample template

This box supports all DAPP Services and unit tests and is built to integrate your own vRAM logic.

```
mkdir mydapp; cd mydapp
zeus box create
zeus unbox dapp
zeus create contract mycontract
```

contract is located in /zeus_boxes/contracts, test is located in /zeus_boxes/test

1.7.3 Or use one of our template contracts

```
mkdir coldtoken; cd coldtoken
zeus box create
# unbox coldtoken contract and all dependencies
zeus unbox coldtoken
# unit test coldtoken contract locally
zeus test -c
```

1.7.4 Advanced features

To use advanced multi index features include `#define USE_ADVANCED_IPFS` at the top of the contract file while following the steps below. If you have already deployed a contract that does not use advanced features, do not add this line, as it is not backwards compatible. With this addition, the primary key may be `uint32`, `uint64`, `uint128`, and `checksum256`.

Example implementation:

```
TABLE bigentry {
  checksum256 id;
  uint64_t sometestnumber;
  checksum256 primary_key()const {return id;}
};

typedef dapp::advanced_multi_index<"test2"_n, bigentry, checksum256> testindex_big_t;
```

Another feature of the advanced multi index is `warmuprow` and `cleanuprow` actions. The `warmuprow` action allows for faster warmups for IPFS actions. The warmup process is where data is fetched and loaded into RAM to be used. Previously each RAM entry touched would require 3 separate warmup actions, now this can be done within 1 action. The `cleanuprow` action removes all the data entries created by the `warmuprow` in the case that a rollback is required.

Additionally, vram tables from other contracts can now be read with the addition of the `warmupcode` action. This is done the same way as a regular multi_index table by specifying a `code` other than `_self`. For example, by replacing:

```
my_table_struct mytable(_self,_self.value);
```

with

```
my_table_struct mytable(othercntr,othercntr.value);
```

This does require that the table struct and table name of the remote contract to be known, just as in regular multi_index. Remote tables can only be read, they cannot be modified. Remote table owners do not have to be staked to the same DSP as your contract.

These same conditions apply for reading vram tables from contracts on other chains. This is achieved with the `warmupchain` and `cleanchain` actions. Similar to reading from other contracts, this may be done using some additional parameters:

```
my_table_struct mytable(othercntr,othercntr.value, 1024, 64, false, false, 0, chain);
```

Where `chain` is the name of the side chain as specified in the LiquidX chain model file. In the case of reading from the EOSIO mainnet, specify `chain` as 'mainnet'.

1.7.5 Add your contract logic

in `zeus_boxes/contracts/eos/mycontract/mycontract.cpp`

```
#pragma once

#include "../dappservices/ipfs.hpp"
#include "../dappservices/multi_index.hpp"

#define DAPPSERVICES_ACTIONS() \
  XSIGNAL_DAPPSERVICE_ACTION \
```

(continues on next page)

(continued from previous page)

```
  IPFS_DAPPSERVICE_ACTIONS

/*** IPFS: (xcommit)(xcleanup)(xwarmup) ***/
#define DAPPSERVICE_ACTIONS_COMMANDS() \
  IPFS_SVC_COMMANDS()

/*** UPDATE CONTRACT NAME ***/
#define CONTRACT_NAME() mycontract

using std::string;

CONTRACT_START()
  public:

  /*** YOUR LOGIC ***/

  private:
    struct [[eosio::table]] vramaccounts {
      asset    balance;
      uint64_t primary_key()const { return balance.symbol.code().raw(); }
    };

    /*** VRAM MULTI_INDEX TABLE ***/
    typedef dapp::multi_index<"vaccounts"_n, vramaccounts> cold_accounts_t;

    /*** FOR CLIENT SIDE QUERY SUPPORT ***/
    typedef eosio::multi_index<".vaccounts"_n, vramaccounts> cold_accounts_t_v_abi;
    TABLE shardbucket {
      std::vector<char> shard_uri;
      uint64_t shard;
      uint64_t primary_key() const { return shard; }
    };
    typedef eosio::multi_index<"vaccounts"_n, shardbucket> cold_accounts_t_abi;

/*** ADD ACTIONS ***/
CONTRACT_END((your)(actions)(here))
```

1.7.6 Compile

See the unit testing section for details on adding unit tests.

```
zeus compile
# compile and test with
zeus test -c
```

1.7.7 Deploy Contract

```
export DSP_ENDPOINT=https://kylin-dsp-1.liquidapps.io
export KYLIN_TEST_ACCOUNT=<ACCOUNT_NAME>
export KYLIN_TEST_PUBLIC_KEY=<ACTIVE_PUBLIC_KEY>
# Buy RAM:
cleos -u $DSP_ENDPOINT system buyram $KYLIN_TEST_ACCOUNT $KYLIN_TEST_ACCOUNT "200.
↪0000 EOS" -p $KYLIN_TEST_ACCOUNT@active
```

(continues on next page)

(continued from previous page)

```
# Set contract code and abi
cleos -u $DSP_ENDPOINT set contract $KYLIN_TEST_ACCOUNT ../contract -p $KYLIN_TEST_
↪ACCOUNT@active

# Set contract permissions, add eosio.code
cleos -u $DSP_ENDPOINT set account permission $KYLIN_TEST_ACCOUNT active "{\
↪"threshold\":1,\"keys\":[{\"weight\":1,\"key\":\"$KYLIN_TEST_PUBLIC_KEY\"}],\
↪"accounts\":[{\"permission\":{\"actor\":\"$KYLIN_TEST_ACCOUNT\",\"permission\":\
↪"eosio.code\"},\"weight\":1}]}" owner -p $KYLIN_TEST_ACCOUNT@active
```

1.7.8 Select and stake DAPP for DSP package

- Use the faucet to get some DAPP tokens on Kylin
- Information on: DSP Packages and staking DAPP/DAPPHDL (AirHODL token)

```
export PROVIDER=uuddlrlrbass
export PACKAGE_ID=package1

# select your package:
export SERVICE=ipfsservice1
cleos -u $DSP_ENDPOINT push action dappservices selectpkg "[\"$KYLIN_TEST_ACCOUNT\",\"
↪$PROVIDER\",\"$SERVICE\",\"$PACKAGE_ID\"]" -p $KYLIN_TEST_ACCOUNT@active

# Stake your DAPP to the DSP that you selected the service package for:
cleos -u $DSP_ENDPOINT push action dappservices stake "[\"$KYLIN_TEST_ACCOUNT\",\"
↪$PROVIDER\",\"$SERVICE\",\"10.0000 DAPP\"]" -p $KYLIN_TEST_ACCOUNT@active
```

1.7.9 Test

Finally you can now test your vRAM implementation by sending an action through your DSP's API endpoint

```
cleos -u $DSP_ENDPOINT push action $KYLIN_TEST_ACCOUNT youraction1 "[\"param1\",\
↪"param2\"]" -p $KYLIN_TEST_ACCOUNT@active

# coldtoken (issue / transfer use vRAM):
cleos -u $DSP_ENDPOINT push action $KYLIN_TEST_ACCOUNT create "[\"$KYLIN_TEST_ACCOUNT\
↪",\"1000000000 TEST\"]" -p $KYLIN_TEST_ACCOUNT
cleos -u $DSP_ENDPOINT push action $KYLIN_TEST_ACCOUNT issue "[\"$KYLIN_TEST_ACCOUNT\
↪",\"1000 TEST\",\"yay vRAM\"]" -p $KYLIN_TEST_ACCOUNT
cleos -u $DSP_ENDPOINT push action $KYLIN_TEST_ACCOUNT transfer "[\"$KYLIN_TEST_
↪ACCOUNT\",\"natdeveloper\",\"1000 TEST\",\"yay vRAM\"]" -p $KYLIN_TEST_ACCOUNT
```

The result should look like:

```
executed transaction:␣
↪865a3779b3623eab94aa2e2672b36dfec9627c2983c379717f5225e43ac2b74a  104 bytes  67049␣
↪us
#  yourcontract <= yourcontract::youraction1         {"param1":"param1","param2":
↪"param2"}
>> {"version":"1.0","etype":"service_request","payer":"yourcontract","service":
↪"ipfsservice1","action":"commit","provider":"","data":"DH......"}
```

1.7.10 Get table row

```
# zeus:
zeus get-table-row "CONTRACT_ACCOUNT" "TABLE_NAME" "SCOPE" "TABLE_PRIMARY_KEY"
↪"KEYTYPE" "KEYSIZE" --endpoint $DSP_ENDPOINT | python -m json.tool

# contract - account name
# table_name - name of dapp::multi_index table
# scope - table scope to search under
# table_primary_key - primary key of row requesting | options: "string", "number"
# key type (optional) - the type of key being passed in the request ("name", "number",
↪ "hex"). If table_primary_key is a js number, key type defaults to "number",␣
↪otherwise "name". In case of large keys, table_primary_key should be encoded as a␣
↪hex string, and key type should be "hex".
# key size (optional) - size of key in bits: 64 (uint64_t), 128 (uint128_t), 256␣
↪(uint256_t, eosio::checksum256)

# curl:
curl http://$DSP_ENDPOINT/v1/dsp/ipfsservice1/get_table_row -d '{"contract":"CONTRACT_
↪ACCOUNT","scope":"SCOPE","table":"TABLE_NAME","key":"TABLE_PRIMARY_KEY"}' | python -
↪m json.tool

# coldtoken:
zeus get-table-row $KYLIN_TEST_ACCOUNT "accounts" $KYLIN_TEST_ACCOUNT "TEST" --
↪endpoint $DSP_ENDPOINT | python -m json.tool
curl http://$DSP_ENDPOINT/v1/dsp/ipfsservice1/get_table_row -d '{"contract":"CONTRACT_
↪ACCOUNT","scope":"CONTRACT_ACCOUNT","table":"accounts","key":"TEST"}' | python -m␣
↪json.tool
```

1.7.11 Get table - `get-table.js`

Reads all vRAM tables of a smart contract and stores them with the naming syntax: `${contract_name}-${table_name}-table.json`. The script is located in the `utils/ipfs-service/get-table.js` of an unboxed zeus box.

Mandatory env variables:

```
# account name vRAM table exists on
export CONTRACT_NAME=
# run script
node zeus_boxes/ipfs-dapp-service/utils/ipfs-service/get-table
```

Optional env variables (if using non-local nodeos / IPFS instance):

```
# defaults to all vRam tables in the abi, can be used to target a specific table
export TABLE_NAME=
# defaults to localhost:8888, can be used to specify external nodeos instance
export NODEOS_ENDPOINT=
# defaults to localhost, can be used to specify external IPFS instance
export IPFS_HOST=
# defaults to 5001
export IPFS_PORT=
# defaults to http
export IPFS_PROTOCOL=
# defaults to 1024
export SHARD_LIMIT=
```

(continues on next page)

(continued from previous page)

```
# defaults to false
# produces a ${contractName}-${tableName}-roots.json file which is the table's␣
↪current entries
# also produces an ipfs-data.json which can be used to recreate the current state of␣
↪the IPFS table
export VERBOSE=
```

Steps to produce `/ipfs-dapp-service/test1-test-table.json` file below:

```
npm i -g @liquidapps/zeus-cmd
mkdir ipfs-dapp-service; cd ipfs-dapp-service
zeus box create
zeus unbox ipfs-dapp-service
zeus test -c
export CONTRACT_NAME=test1
node zeus_boxes/ipfs-dapp-service/utils/ipfs-service/get-table
```

Expected output `/ipfs-dapp-service/test1-test-table.json`:

```
[
  {
    "scope": "test1",
    "key": "2b02000000000000",
    "data": {
      "id": "555",
      "sometestnumber": "0"
    }
  },
  {
    "scope": "test1",
    "key": "0200000000000000",
    "data": {
      "id": "2",
      "sometestnumber": "0"
    }
  }
  ...
]
```

If `VERBOSE=true`, you will also get `test1-test-roots.json` and `ipfs-data.json`:

`test1-test-roots.json` - equivalent of `cleos get table test1 test1 test`

```
[
  {
    "shard_uri":
↪"01551220d0c889cbd658f2683c78a09a8161ad406dd828dadab383fdcc0659aa6dfed8dc",
    "shard": 3
  },
  {
    "shard_uri":
↪"01551220435f234b3af595737af50ac0b4e44053f0b31d31d94e1ffe917fd3dfbc6a9d88",
    "shard": 156
  },
  ...
]
```

`ipfs-data.json` - produces all data necessary to recreate current state of the table, can be used for populating a

DSP's IPFS cluster

```
{
  "015512204cbbd8ca5215b8d161aec181a74b694f4e24b001d5b081dc0030ed797a8973e0":
↪"0100000000000000000000000000000000",
  "01551220b422e3b9180b32ba0ec0d538c7af1cf7ccf764bfb89f4cd5bc282175391e02bb":
↪"77cc0000000000007f00000000000000",
  ...
}
```

1.7.12 Get ordered keys - `get-ordered-keys.js`

Prints ordered vRAM table keys in ascending order account/table/scope. This can be used to iterate over the entire table client side. The script is located in the `utils/ipfs-service/get-ordered-keys.js` of an unboxed zeus box.

Mandatory env variables:

```
export CONTRACT_NAME=
export SCOPE=
export TABLE_NAME=
node zeus_boxes/ipfs-dapp-service/utils/ipfs-service/get-ordered-keys
```

Optional env variables (if using non-local nodeos / IPFS instance):

```
# defaults to localhost:8888, can be used to specify external nodeos instance
export NODEOS_ENDPOINT=
# defaults to localhost, can be used to specify external IPFS instance
export IPFS_HOST=
# defaults to 5001
export IPFS_PORT=
# defaults to http
export IPFS_PROTOCOL=
# defaults to 1024
export SHARD_LIMIT=
# defaults to 10000
export IPFS_TIMEOUT=
```

Steps to produce console logged output below:

```
npm i -g @liquidapps/zeus-cmd
mkdir ipfs-dapp-service; cd ipfs-dapp-service
zeus box create
zeus unbox ipfs-dapp-service
zeus test -c
export CONTRACT_NAME=test1
export SCOPE=test1
export TABLE_NAME=test
node zeus_boxes/ipfs-dapp-service/utils/ipfs-service/get-ordered-keys
```

Expected output:

```
[ '0', '1', '2', '20', '555', '12345', '52343' ]
```

Querying table rows with Zeus or the `dapp-client`'s `get_vram_row` call:

```
# zeus get-table-row <contract> <table> <scope> <key> <keytype> <keysize>
zeus get-table-row test1 test test1 52343 number 64
# output:
{"row":{"id":"0","sometestnumber":"0"}}
```

1.7.13 Save load and reset dapp::multi_index data

To enable these features, you must include the advanced multi index with: `#define USE_ADVANCED_IPFS` at the top of the contract file. If you have already deployed a contract that does not use advanced features, do not add this line, as it is not backwards compatible.

With that, you now have the ability to save the list of shards currently being used to represent the table's current state. With the saved snapshot, a developer can upload it to another contract, or version the snapshot and save it to be loaded to the contract later. This adds much needed flexibility to maintaining database state in a vRAM table.

Save dapp::multi_index data

Using zeus, a backup file can be created with the following command:

```
zeus backup-table <CONTRACT> <TABLE>

# optional flags:

--endpoint # endpoint of node
# default: localhost:13115
--output # output file name
# default: vram-backup-${CONTRACT}-${TABLE}-0-1578405972.json

# example
zeus backup-table lqdportfolio users --endpoint=http://kylin-dsp-2.liquidapps.io/
```

Example: vram-backup-lqdportfolio-users-0-1578405972.json

```
{
  "contract": "lqdportfolio",
  "table": "users",
  "timestamp": "2020-01-07T14:06:12.339Z",
  "revision": 0,
  "manifest": {
    "next_available_key": 0,
    "shards": 1024,
    "buckets_per_shard": 64,
    "shardbuckets": [
      {
        "key": 2,
        "value":
↪"015512202a1de9ce245a8d14b23512badc076aee71aad3aba30900e9c938243ce25b467d"
      },
      {
        "key": 44,
        "value":
↪"015512205b43f739a9786fbe2c384c504af15d06fe1b5a61b72710f51932c6b62592d800"
      },
      ...
```

(continues on next page)

(continued from previous page)

```
    ]
  }
}
```

Load manifest

Once a manifest is saved, it can be loaded with the following smart contract action.

```
[[eosio::action]] void testman(dapp::manifest man) {
  testindex_t testset(_self,_self.value);
  // void load_manifest(manifest manifest, string description)
  // description is description item in the backup table
  testset.load_manifest(man,"Test");
}
```

With a unit test:

```
let manifest = {
  next_available_key: 556,
  shards: 1024,
  buckets_per_shard: 64,
  shardbuckets
}
await testcontract.testman({
  man: manifest
}, {
  authorization: `${code}@active`,
  broadcast: true,
  sign: true
});
```

1.7.14 Clear table

By calling the clear command, a table's version is incremented via the `revision` param and the `next_available_key` is reset

```
TABLE vconfig {
    checksum256 next_available_key = empty256;
    uint32_t shards = 0;
    uint32_t buckets_per_shard = 0;
    uint32_t revision = 0;
};
void clear() {
  vconfig_sgt vconfigsgt(_code,name(TableName).value);
  auto config = vconfigsgt.get_or_default();
  config.revision++;
  config.next_available_key = empty256; //reset the next available key
  vconfigsgt.set(config,_code);
}
[[eosio::action]] void testclear() {
  testindex_t testset(_self,_self.value);
  testset.clear();
}
```

1.8 LiquidAccounts Getting Started

```
  _        _                    _        _       _                                                ␣
↪     _
 | |      (_)    __ _    _    _   (_)    __| |     / \       ___     ___     ___     _    _    _ __
↪    | |_    ___
 | |      | |   / _` | | | | | | |   / _` |    / _ \     / __|   / __|   / _ \   | | | | | '_␣
↪\   | __| / __|
 | |___   | | | (_| | | |_| | | | | (_| |   / ___ \   | (__   | (__   | (_) | | |_| | | |␣
↪| | | |_   \__ \
 |_____| |_|   \__, |   \__,_| |_|   \__,_| /_/    \_\   \___|   \___|   \___/    \__,_| |_|␣
↪|_|   \__| |___/
                  |_|
```

LiquidAccounts are EOS accounts that are stored in vRAM instead of RAM. This drastically reduces the cost of creating accounts on EOS. Another great place to understand the service is in the unit tests.

1.8.1 Prerequisites

- Zeus - Zeus installs eos and the eosio.cdt if not already installed
- Kylin Account

1.8.2 Unbox LiquidAccounts DAPP Service box

This box contains the LiquidAccounts smart contract libraries, DSP node logic, unit tests, and everything else needed to get started integrating / testing the DAPP Network LiquidAccounts in your smart contract.

```
mkdir vaccounts-dapp-service; cd vaccounts-dapp-service
# npm install -g @liquidapps/zeus-cmd
zeus box create
zeus unbox vaccounts-dapp-service
zeus test -c
```

1.8.3 LiquidAccount Consumer Example Contract used in unit tests

in `zeus_boxes/contracts/eos/vaccountsconsumer/vaccountsconsumer.cpp` The consumer contract is a great starting point for playing around with the LiquidAccount syntax.

```
/* DELAY REMOVAL OF USER DATA INTO VRAM */
/* ALLOWS FOR QUICKER ACCESS TO USER DATA WITHOUT THE NEED TO WARM DATA UP */
#define VACCOUNTS_DELAYED_CLEANUP 120

/* ADD NECESSARY LIQUIDACCOUNT / VRAM INCLUDES */
#include "../dappservices/vaccounts.hpp"
#include "../dappservices/ipfs.hpp"
#include "../dappservices/multi_index.hpp"

/* ADD LIQUIDACCOUNT / VRAM RELATED ACTIONS */
#define DAPPSERVICES_ACTIONS() \
  XSIGNAL_DAPPSERVICE_ACTION \
  IPFS_DAPPSERVICE_ACTIONS \
  VACCOUNTS_DAPPSERVICE_ACTIONS
```

(continues on next page)

(continued from previous page)

```
#define DAPPSERVICE_ACTIONS_COMMANDS() \
  IPFS_SVC_COMMANDS()VACCOUNTS_SVC_COMMANDS()

#define CONTRACT_NAME() vaccountsconsumer


CONTRACT_START()

  /* THE FOLLOWING STRUCT DEFINES THE PARAMS THAT MUST BE PASSED */
  struct dummy_action_hello {
      name vaccount;
      uint64_t b;
      uint64_t c;

      EOSLIB_SERIALIZE( dummy_action_hello, (vaccount)(b)(c) )
  };

  /* DATA IS PASSED AS PAYLOADS INSTEAD OF INDIVIDUAL PARAMS */
  [[eosio::action]] void hello(dummy_action_hello payload) {
    /* require_vaccount is the equivalent of require_auth for EOS */
    require_vaccount(payload.vaccount);

    print("hello from ");
    print(payload.vaccount);
    print(" ");
    print(payload.b + payload.c);
    print("\n");
  }

  [[eosio::action]] void hello2(dummy_action_hello payload) {
    print("hello2(default action) from ");
    print(payload.vaccount);
    print(" ");
    print(payload.b + payload.c);
    print("\n");
  }

  [[eosio::action]] void init(dummy_action_hello payload) {
  }

  /* EACH ACTION MUST HAVE A STRUCT THAT DEFINES THE PAYLOAD SYNTAX TO BE PASSED */
  VACCOUNTS_APPLY(((dummy_action_hello)(hello))((dummy_action_hello)(hello2)))

CONTRACT_END((init)(hello)(hello2)(regaccount)(xdcommit)(xvinit)(xvauth))
```

1.8.4 Use LiquidAccounts between contracts

To enable the usage of LiquidAccounts between contracts, the subscriber contract (contract that wishes to use LiquidAccounts of another host contract) must add the `#define VACCOUNTS_SUBSCRIBER` definition to the smart contract. The subscriber contract must also be staked to a DSP offering the LiquidAccounts service, but this DSP does not need to be the same DSP as the DSP providing services to the host contract. In place of setting the `CHAIN_ID` with the `xvinit` action (detailed below), the account name of the host account providing the LiquidAccounts (not the DSP account) must be used in its place. The subscriber contract may also subscribe to a "cross-chain host" in the same manner.

1.8.5 Use LiquidAccounts across chains

To enable the usage of LiquidAccounts across chains, a "cross-chain host" must be deployed on each supported EOSIO chain. This "cross-chain host" will be configured to use the LiquidAccounts that have been registered on the "host chain" contract. To convert a LiquidAccount contract to a "cross-chain host" add the following defines to the contract:

```
#define LIQUIDX
#define USE_ADVANCED_IPFS
#define VACCOUNTS_CROSSCHAIN
```

and remove `(regaccount)` from the CONTRACT_END

Optional:

```
#define VACCOUNTS_CROSSCHAIN_NONCE_VARIANCE 5 // defaults to 5 if not defined
```

The `VACCOUNTS_CROSSCHAIN_NONCE_VARIANCE` is the difference of allowed variance from the calculated nonce at run time. For example, if the calculated nonce is 10 and the variance is 5, then if a transactions is attempted with a nonce of 4 or less, the transaction will be rejected. The variance's purpose is to allow leeway in the event that multiple accounts are using the sidechain's contract at the same time. This allows the nonce to be outdated between the time the client pulls the nonce and pushes the transaction, potentially a few blocks in the future.

No changes are required to the LiquidAccount contract on the "host chain". All registration of new accounts must occur on the "host chain". The final step is to use the xvinit action with the parameters `chainid`, `hostchain`, and `hostcode`. When the host chain is the EOSIO mainnet, `hostchain` will be `mainnet`. If another chain is used as the host chain, use the chain name as specified in the LiquidX chain mapping. The `hostcode` is the account name of the LiquidAccounts contract.

1.8.6 Compile

See the unit testing section for details on adding unit tests.

```
zeus compile
# test without compiling
zeus test
# compile and test with
zeus test -c
```

1.8.7 Deploy Contract

```
export DSP_ENDPOINT=https://kylin-dsp-1.liquidapps.io
export KYLIN_TEST_ACCOUNT=<ACCOUNT_NAME>
export KYLIN_TEST_PUBLIC_KEY=<ACTIVE_PUBLIC_KEY>
# Buy RAM:
cleos -u $DSP_ENDPOINT system buyram $KYLIN_TEST_ACCOUNT $KYLIN_TEST_ACCOUNT "200.
↪0000 EOS" -p $KYLIN_TEST_ACCOUNT@active
# Set contract code and abi
cleos -u $DSP_ENDPOINT set contract $KYLIN_TEST_ACCOUNT vaccountsconsumer -p $KYLIN_
↪TEST_ACCOUNT@active

# Set contract permissions, add eosio.code
cleos -u $DSP_ENDPOINT set account permission $KYLIN_TEST_ACCOUNT active "{\
↪"threshold\":1,\"keys\":[{\"weight\":1,\"key\":\"$KYLIN_TEST_PUBLIC_KEY\"}],\
↪"accounts\":[{\"permission\":{\"actor\":\"$KYLIN_TEST_ACCOUNT\",\"permission\":\
↪"eosio.code\"},\"weight\":1}]}" owner -p $KYLIN_TEST_ACCOUNT@active
```

1.8.8 Select and stake DAPP for DSP package | DSP Portal Link

- Use the faucet to get some DAPP tokens on Kylin
- Information on: DSP Packages and staking DAPP/DAPPHDL (AirHODL token)

```
export PROVIDER=heliosselene
export PACKAGE_ID=accountless1

# select your package:
export SERVICE=accountless1
cleos -u $DSP_ENDPOINT push action dappservices selectpkg "[\"$KYLIN_TEST_ACCOUNT\",\"
↪$PROVIDER\",\"$SERVICE\",\"$PACKAGE_ID\"]" -p $KYLIN_TEST_ACCOUNT@active

# Stake your DAPP to the DSP that you selected the service package for:
cleos -u $DSP_ENDPOINT push action dappservices stake "[\"$KYLIN_TEST_ACCOUNT\",\"
↪$PROVIDER\",\"$SERVICE\",\"10.0000 DAPP\"]" -p $KYLIN_TEST_ACCOUNT@active
```

1.8.9 Test

First you'll need to initialize the LiquidAccounts implementation with the `chain_id` of the platform you're operating on. If you are using the `#define VACCOUNTS_SUBSCRIBER` definition to use LiquidAccounts from another host account, that host account must be used in place of the `chain_id`.

```
# kylin
export CHAIN_ID=5fff1dae8dc8e2fc4d5b23b2c7665c97f9e9d8edf2b6485a86ba311c25639191
cleos -u $DSP_ENDPOINT push action $KYLIN_TEST_ACCOUNT xvinit "[\"$CHAIN_ID\"]" -p
↪$KYLIN_TEST_ACCOUNT
# if using VACCOUNTS_CROSSCHAIN
export CHAIN_ID=5fff1dae8dc8e2fc4d5b23b2c7665c97f9e9d8edf2b6485a86ba311c25639191
export HOST_CHAIN=chainname
export HOST_CODE=vaccnthost
cleos -u $DSP_ENDPOINT push action $KYLIN_TEST_ACCOUNT xvinit "[\"$CHAIN_ID\",\"$HOST_
↪CHAIN\",\"$HOST_CODE\"]" -p $KYLIN_TEST_ACCOUNT
# if using VACCOUNTS_SUBSCRIBER
export HOST_ACCOUNT_NAME=kylinhost
cleos -u $DSP_ENDPOINT push action $KYLIN_TEST_ACCOUNT xvinit "[\"$HOST_ACCOUNT_NAME\
↪"]" -p $KYLIN_TEST_ACCOUNT
```

Then you can begin registering accounts. You will need to do this either in a nodejs environment using the `dapp-client-lib`, or you can use the `zeus vaccounts push-action`. Here is an example of using the lib to register an account..

All payloads must include a key value pair with `"vaccount":"vaccountname"` or the transaction will fail. This is so the `dapp-client` can fetch the nonce associated with the LiquidAccount.

dapp-client

```
npm install -g @liquidapps/dapp-client
```

This example takes:

- the contract name the LiquidAccount project is deployed to
- the active private key of that account
- the `regaccount` as the action name

- the payload with the `vaccount` name

After registering an account, you may also use the library to push LiquidAccount transactions. In the linked example, you can see that the action name has changed to `hello` and the payload has changed to include the required parameters.

Zeus vaccounts push-action

Push LiquidAccount actions easily with zeus's wrapper of the `dapp-client` library. You can pass a `--dsp-url` for your DAPP Service Provider's API endpoint. Then pass the name of the contract that the LiquidAccount code is deployed to, the action name (`regaccount` for example), and the payload.

You also have the ability to store your private keys with or without encryption. If you choose to encrypt, you can pass the `--encrypted` flag when creating a new account to store the keys. You can provide a password by command line, or with the flag `--password`. If you use the account again, zeus will look for the key based on what network you are operating on. If it finds it, it will use that key to sign and prompt for a password if needed.

```
zeus vaccounts push-action <CONTRACT> <ACTION> <PAYLOAD> --dsp-url https://kylin-dsp-
↪1.liquidapps.io

# optional flags:

--dsp-url # url to DAPP Service Provider's API endpoint
# default: https://kylin-dsp-1.liquidapps.io
--private-key # LiquidAccount private key, can be provided or auto generated
# will be auto generated and stored in the storage path if not provided
--encrypted # Encrypt the LiquidAccount keys with a password
# default: false
--password # password to encrypt the keys with
--network # network LiquidAccount contract deployed on (other options: kylin, jungle,␣
↪mainnet)
# development (local)
--storage-path # path to the wallet which will store the LiquidAccount key
# default: path.join(require('os').homedir(), '.zeus')

# Example:
zeus vaccounts push-action test1v regaccount '{"vaccount":"vaccount1"}'
zeus vaccounts push-action vacctstst123 regaccount '{"vaccount":"vaccount2"}' --
↪private-key 5KJL... -u https://kylin-dsp-1.liquidapps.io
zeus vaccounts push-action vacctstst123 regaccount '{"vaccount":"vaccount3"}' -u␣
↪http://kylin-dsp-2.liquidapps.io/ --encrypted --network=kylin --password=password
```

1.8.10 Deserialize Payload | `des-payload.js`

This file is under the utility/tool and it is for deserializing `xvexec` data (vaccount action data).

Example:

```
deserializeVactionPayload('dappaccoun.t', '6136465e000000002a00000000000000aca376f206b8fc25
'https://mainnet.eos.dfuse.io')
```

returns

```
{
   "payload":{
      "expiry":"1581659745",
```

(continues on next page)

(continued from previous page)


```
      "nonce":"42",
      "chainid":"ACA376F206B8FC25A6ED44DBDC66547C36C6C33E3A119FFBEAEF943642F0E906",
      "action":{
         "account":"",
         "action_name":"transfervacc",
         "authorization":[

         ],
         "action_data":
↪"70AE375C19FEAA49E0D336557DF8AA49010000000000000004454F5300000000026869"
      }
   },
   "deserializedAction":{
      "payload":{
         "vaccount":"dapjwaewayrb",
         "to":"dapjkzepavdy",
         "quantity":"0.0001 EOS",
         "memo":"hi"
      }
   }
}
```


1.9 LiquidHarmony Oracles Getting Started

```
  _      _              _     _ _    _                                                  ____ ␣
↪                _
 | |     (_)            (_)    | | |   | |                                              / __ \␣
↪                | |
 | |      _  __ _ _   _ _  __| | |__| | __ _ _ __ _ __ ___   ___  _ __  _   _  | |  |␣
↪|_ __ __ _  ___| | ___  ___
 | |     | |/ _` | | | | |/ _` |  __  |/ _` | '__| '_ ` _ \ / _ \| '_ \| | | | | |  |␣
↪| '__/ _` |/ __| |/ _ \/ __|
 | |____| | (_| | |_| | | (_| | |  | | (_| | |  | | | | | | (_) | | | | |_| | | |__|␣
↪| | | (_| | (__| |  __/\__ \
 |______|_|\__, |\__,_|_|\__,_|_|  |_|\__,_|_|  |_| |_| |_|\___/|_| |_|\__, |  \____/
↪|_|  \__,_|\___|_|\___||___/
              | |                                                        __/ |
              |_|                                                       |___/
```

LiquidHarmony includes all oracle related logic from the DAPP Network. This includes things like http fetches, IBC and XIBC fetches, vCPU and more. The full list of options can be explored in the oracles directory of the repo: https://github.com/liquidapps-io/zeus-sdk/tree/master/boxes/groups/oracles

The DAPP Network offers the ability to fetch information using DAPP Service Providers (DSPs). A developer may choose as many or as few oracles to use in fetching data points from the internet. If a developer wishes to prevent a scenario where all oracles have an incentive to return false information, the developer may run a DSP themselves and set the threshold of acceptance for the information to all parties. Another great place to understand the service is in the unit tests within each sub directory.

The price feed example uses LiquidHarmony web oracles and the LiquidScheduler to periodically update a price on chain only when the new price is more or less than 1% of the last updated price, conserving CPU by only running actions when necessary. See here

1.9.1 Prerequisites

- Zeus - Zeus installs eos and the eosio.cdt if not already installed
- Kylin Account

The DAPP Network currently supports the following oracle requests:

- HTTP(S) Get
- HTTP(S) Post
- HTTP(S)+JSON Get
- HTTP(S)+JSON Post
- Nodeos History Get
- IBC Block Fetch - (Mainnet, BOS, Telos, Kylin, Worbli, Jungle, Meetone)
- Oracle XIBC - read for foreign chain (Ethereum, Tron, Cardano, Ripple, Bitcoin, Litecoin, Bitcoin Cash)
- Wolfram Alpha
- Random Number
- Stockfish - chess engine AI
- SQL

1.9.2 Unbox Oracle DAPP Service box

This box contains the oracle smart contract libraries, DSP node logic, unit tests, and everything else needed to get started integrating / testing the DAPP Network oracles in your smart contract.

```
mkdir oracle-dapp-service; cd oracle-dapp-service
# npm install -g @liquidapps/zeus-cmd
zeus box create
zeus unbox oracle-dapp-service
zeus test -c
```

1.9.3 Creating an Oracle Request URI

Each of the following oracle request types comes equipped with its own syntax that gets encoded with `Buffer.from("<URI HERE>", 'utf8')`. The following guide will explain the syntax to generate your URI. Each URI should be passed through the buffer as plaintext is not accepted.

- HTTP(S) Get & Post: `https://ipfs.io/ipfs/Qmaisz6NMhDB51cCvNWa1GMS7LU1pAxdF4Ld6Ft9kZEP2a` - simply add the full URL path
- HTTP(S)+JSON Get: `https+json://name/api.github.com/users/tmuskal` - prepend your uri with `https+json`, then specify the key mapping path of your desired data point, in the example, the `name` key is used as the requested data point. To request nested values beneath the first layer of keys, simple separate the desired data point with a `.`, e.g., `name.value`. Then add the path to your desired data point: `api.github.com/users/tmuskal`. Note you may use `http+json` or `https+json`.
- HTTP(S)+JSON Post: `https+post+json://timestamp/${body}/nodes.get-scatter.com:443/v1/chain/get_block` - where body is `const body = Buffer.from('{"block_num_or_id":"36568000"}').toString('base64').` In this example you specify the type of request: `https+post+json` then the key mapping `timestamp` then the body of

the POST request, encoded in base64, then the URL path `nodes.get-scatter.com:443/v1/chain/get_block`.

- ECHO Get: `echo://${returnvalue}` - where return value is a `base64` string. `const returnvalue = Buffer.from("My return value").toString('base64')`
- ECHO+JSON Get: `echo+json://name/${returnvalue}, const returnvalue = Buffer.from('{"name":"Tal Muskal"}').toString('base64')`
- ECHO+JSON Post: `echo+post+json://timestamp/${body}/${content}` - where body is `const body = Buffer.from('{"block_num_or_id":"36568000"}').toString('base64')`. In this example you specify the type of request: `echo+post+json` then the key mapping `timestamp` then the body of the POST request, encoded in base64, then the URL path `const content = Buffer.from('{"timestamp":"2019-01-09T18:20:23.000"}').toString('base64');`.
- Nodeos History Get: `self_history://${code}/0/0/0/action_trace.act.data.account` - where code is `const code = 'test1';`
- Sister Chain Fetch: `sister_chain_block://bos/10000000/transaction_mroot` - the `sister_chain_block` specifies the type of oracle request, followed by the chain of choice `bos` then the requested data point.
- Foreign Chain Fetch: `foreign_chain://ethereum/history/0x100/result.transactionsRoot` - here the `foreign_chain` oracle type is used followed by the foreign chain of choice: `ethereum`, the type of data point (`block_number`, `history`, `balance`, `storage`). To see other blockchain data point options, see this file. Then the required data parameter is passed `0x100` followed by the object key mapping `result.transactionsRoot`.
  - You may also see more examples in the unit test
- Wolfram Alpha: `wolfram_alpha://What is the average air speed velocity of a laden swallow?` - here the `wolfram_alpha` oracle type is used followed by the question: `What is the average air speed velocity of a laden swallow?`.
- Random Number: `random://1024` - this will fetch a random number from 0-1024
- Stockfish: chess engine AI: `stockfish://${fen}` by adding the fen (`Forsyth-Edwards Notation`), an AI chess move will be returned
- SQL: see unit test

1.9.4 LiquidHarmony Consumer Example Contract used in unit tests

in `zeus_boxes/contracts/eos/oracleconsumer/oracleconsumer.cpp` The consumer contract is a great starting point for playing around with the LiquidHarmony syntax.

```
/* INCLUDE ORACLE LOGIC */
#include "../dappservices/oracle.hpp"

/* ADD DAPP NETWORK RELATED ORACLE ACTIONS */
#define DAPPSERVICES_ACTIONS() \
  XSIGNAL_DAPPSERVICE_ACTION \
  ORACLE_DAPPSERVICE_ACTIONS

#define DAPPSERVICE_ACTIONS_COMMANDS() \
  ORACLE_SVC_COMMANDS()

#define CONTRACT_NAME() oracleconsumer
```

(continues on next page)

(continued from previous page)

```
CONTRACT_START()

  /*

    testget - provide a URI using the DAPP Network Oracle syntax and an expected result,
    if the result does not match the expected field, the transaction fails

    testrnd - fetch oracle request based on URI without expected field assertion

  */

 [[eosio::action]] void testget(std::vector<char>  uri, std::vector<char> expectedfield) {
    /* USE EOSIO'S ASSERTION TO CHECK FOR REQUIRED THREHSHOLD OF ORACLES IS MET */
    eosio::check(getURI(uri, [&]( auto& results ) {
      eosio::check(results.size() > 0, "require multiple results for consensus");
      auto itr = results.begin();
      auto first = itr->result;
      ++itr;
      /* SET CONSENSUS LOGIC FOR RESULTS */
      while(itr != results.end()) {
        eosio::check(itr->result == first, "consensus failed");
        ++itr;
      }
      return first;
    }) == expectedfield, "wrong data");
  }

  [[eosio::action]] void testrnd(std::vector<char> uri) {
    getURI(uri, [&]( auto& results ) {
      return results[0].result;
    });
  }
CONTRACT_END((testget)(testrnd))
```

1.9.5 Compile

See the unit testing section for details on adding unit tests.

```
zeus compile
# test without compiling
zeus test
# compile and test with
zeus test -c
```

1.9.6 Deploy Contract

```
export DSP_ENDPOINT=https://kylin-dsp-1.liquidapps.io
export KYLIN_TEST_ACCOUNT=<ACCOUNT_NAME>
export KYLIN_TEST_PUBLIC_KEY=<ACTIVE_PUBLIC_KEY>
# Buy RAM:
```

(continues on next page)

(continued from previous page)

```
cleos -u $DSP_ENDPOINT system buyram $KYLIN_TEST_ACCOUNT $KYLIN_TEST_ACCOUNT "200.
↪0000 EOS" -p $KYLIN_TEST_ACCOUNT@active
# Set contract code and abi
cleos -u $DSP_ENDPOINT set contract $KYLIN_TEST_ACCOUNT oracleconsumer -p $KYLIN_TEST_
↪ACCOUNT@active

# Set contract permissions, add eosio.code
cleos -u $DSP_ENDPOINT set account permission $KYLIN_TEST_ACCOUNT active "{\
↪"threshold\":1,\"keys\":[{\"weight\":1,\"key\":\"$KYLIN_TEST_PUBLIC_KEY\"}],\
↪"accounts\":[{\"permission\":{\"actor\":\"$KYLIN_TEST_ACCOUNT\",\"permission\":\
↪"eosio.code\"},\"weight\":1}]}" owner -p $KYLIN_TEST_ACCOUNT@active
```

1.9.7 Select and stake DAPP for DSP package | DSP Portal Link

- Use the faucet to get some DAPP tokens on Kylin
- Information on: DSP Packages and staking DAPP/DAPPHDL (AirHODL token)

```
export PROVIDER=heliosselene
export PACKAGE_ID=oracleservic

# select your package:
export SERVICE=oracleservic
cleos -u $DSP_ENDPOINT push action dappservices selectpkg "[\"$KYLIN_TEST_ACCOUNT\",\"
↪$PROVIDER\",\"$SERVICE\",\"$PACKAGE_ID\"]" -p $KYLIN_TEST_ACCOUNT@active

# Stake your DAPP to the DSP that you selected the service package for:
cleos -u $DSP_ENDPOINT push action dappservices stake "[\"$KYLIN_TEST_ACCOUNT\",\"
↪$PROVIDER\",\"$SERVICE\",\"10.0000 DAPP\"]" -p $KYLIN_TEST_ACCOUNT@active
```

1.9.8 Test

Finally you can now test your LiquidHarmony implementation by sending an action through your DSP's API endpoint

```
# oracleconsumer contract (testrnd / testget):
# uri: Buffer.from("https://ipfs.io/ipfs/
↪Qmaisz6NMhDB51cCvNWa1GMS7LU1pAxdF4Ld6Ft9kZEP2a", 'utf8')
export␣
↪URI=68747470733a2f2f697066732e696f2f697066732f516d6169737a364e4d68444235316343764e576131474d53374c5
export EXPECTED_FIELD=48656c6c6f2066726f6d204950465320476174657761792043686565636b65720a
cleos -u $DSP_ENDPOINT push action $KYLIN_TEST_ACCOUNT testrnd "[\"$URI\"]" -p $KYLIN_
↪TEST_ACCOUNT
cleos -u $DSP_ENDPOINT push action $KYLIN_TEST_ACCOUNT testget "[\"$URI\",\"$EXPECTED_
↪FIELD\"]" -p $KYLIN_TEST_ACCOUNT
```

Custom eosio assertion message

If `shouldAbort` is included in an `eosio::check` assertion, the DSP will cease to process the request instead of retrying. Retrying is done automatically in the event a transaction fails for any reason.

Pre geturi hook

Traditionally, an oracle request will be run on each DSP a consumer is staked to with each DSP returning the result of that request before the final array of oracle responses is returned to the smart contract. In order to access the response each DSP is returning before it is returned, a hook has been added which can be accessed with the following syntax. This hook can be used to throw an assertion preventing the DSP from using CPU to process a transaction under certain circumstances:

```
// define custom filter
#undef ORACLE_HOOK_FILTER
#define ORACLE_HOOK_FILTER(uri, data) filter_result(uri, data);

void filter_result(std::vector<char> uri, std::vector<char> data){
  // if assertion thrown here, DSP will not respond nor use CPU to process the geturi␣
↪action
  // shouldAbort is included here to prevent the DSP from retrying the oracle request
  eosio::check(data.size() > 3, "shouldAbort, result too small");
}
```

1.10 LiquidScheduler Getting Started

```
  _       _                    _       _   ____           _                  _        ␣
↪  _
 | |      (_)   __ _   _   _  (_)   __| | / ___|    ___  | |__     ___    __| |  _   _␣
↪ | |   ___   _ __
 | |      | |  / _` | | | | | | |  / _` | \___ \   / __| | '_ \   / _ \  / _` | | | |␣
↪| | |  / _ \ | '__|
 | |___  | | | (_| | | |_| | | | | (_| |  ___) | | (__  | | | | |  __/ | (_| | | |_|␣
↪| | | |  __/ | |
 |_____| |_|  \__, |  \__,_| |_|  \__,_| |____/   \___| |_| |_|  \___|  \__,_|  \__,_
↪| |_|  \___| |_|
                |_|
```

LiquidScheduler is an on chain scheduling solution for EOS based actions. LiquidScheduler takes a `name timer`, a `std::vector<char> payload` object, and an `uint32_t seconds` interval as its parameters. Multiple timers may be used within the same contract. For example, if a contract deals with multiple accounts, a timer can be set up for each account. The `payload` parameter can be used to pass data to the `timer_callback` function which is used to run the scheduled task. At the end of the `timer_callback` is a return response. If the return is truthy, the task will reschedule again based on the interval passed, if it is false, the task will not be rescheduled.

One use case would be setting up LiquidHarmony (oracle) fetches on a continual basis. An example of this can be seen in the portfolio example which fetches 3 prices on an infinite loop.

Another great place to understand the service is in the unit tests.

The price feed example uses LiquidHarmony web oracles and the LiquidScheduler to periodically update a price on chain only when the new price is more or less than 1% of the last updated price, conserving CPU by only running actions when necessary. See here

1.10.1 Prerequisites

- Zeus - Zeus installs eos and the eosio.cdt if not already installed
- Kylin Account

1.10.2 Unbox LiquidScheduler DAPP Service box

This box contains the LiquidScheduler smart contract libraries, DSP node logic, unit tests, and everything else needed to get started integrating / testing the DAPP Network LiquidScheduler in your smart contract.

```
mkdir cron-dapp-service; cd cron-dapp-service
# npm install -g @liquidapps/zeus-cmd
zeus box create
zeus unbox cron-dapp-service
zeus test -c
```

1.10.3 LiquidScheduler Consumer Example Contract used in unit tests

in `zeus_boxes/contracts/eos/cronconsumer/cronconsumer.cpp` The consumer contract is a great starting point for playing around with the LiquidScheduler syntax.

```
/* IMPORT DAPP NETWORK SERVICE */
#include "../dappservices/cron.hpp"

/* ADD LIQUIDSCHEDULER ACTIONS */
#define DAPPSERVICES_ACTIONS() \
  XSIGNAL_DAPPSERVICE_ACTION \
  CRON_DAPPSERVICE_ACTIONS \

#define DAPPSERVICE_ACTIONS_COMMANDS() \
  CRON_SVC_COMMANDS()

#define CONTRACT_NAME() cronconsumer

CONTRACT_START()

  TABLE stat {
      uint64_t   counter = 0;
  };
  typedef eosio::singleton<"stat"_n, stat> stats_def;

  TABLE payloadtbl {
      string   payload = "";
  };
  typedef eosio::singleton<"payloadtbl"_n, payloadtbl> payload_def;

  bool timer_callback(name timer, std::vector<char> payload, uint32_t seconds){
    stats_def statstable(_self, timer.value);
    stat newstats;
    if(!statstable.exists()){
      statstable.set(newstats, _self);
    }
    else{
      newstats = statstable.get();
    }
    if(payload.size() > 0) {
      payload_def payloadtable(_self, timer.value);
      payloadtbl newpayload;
      string payload_string(payload.begin(), payload.end());
      newpayload.payload = payload_string;
      payloadtable.set(newpayload, _self);
```

(continues on next page)

(continued from previous page)

```
      return false;
    }
    newstats.counter++;
    statstable.set(newstats, _self);
    // reschedule
    return (newstats.counter < 45);
    // for infinite loop, return true
  }

  // test scheduling timer scoped to _self with 2s interval
  [[eosio::action]] void testschedule() {
      // optional payload for data to be passed to timer_callback
      std::vector<char> payload;
      schedule_timer(_self, payload, 2);
  }

  // test multiple timers by scoping each timer by account with 2s interval
  [[eosio::action]] void multitimer(name account) {
      // optional payload for data to be passed to timer_callback
      std::vector<char> payload;
      schedule_timer(account, payload, 2);
  }

  // remove timer by scope
  [[eosio::action]] void removetimer(name account) {
      remove_timer(account);
  }

  // test passing payload to timer_callback
  [[eosio::action]] void testpayload(name account, std::vector<char> payload, uint32_
↪t seconds) {
      schedule_timer(account, payload, seconds);
  }
CONTRACT_END((testschedule)(multitimer)(removetimer)(testpayload))
```

1.10.4 Compile

See the unit testing section for details on adding unit tests.

```
zeus compile
# test without compiling
zeus test
# compile and test with
zeus test -c
```

1.10.5 Deploy Contract

```
export DSP_ENDPOINT=https://kylin-dsp-1.liquidapps.io
export KYLIN_TEST_ACCOUNT=<ACCOUNT_NAME>
export KYLIN_TEST_PUBLIC_KEY=<ACTIVE_PUBLIC_KEY>
# Buy RAM:
cleos -u $DSP_ENDPOINT system buyram $KYLIN_TEST_ACCOUNT $KYLIN_TEST_ACCOUNT "200.
↪0000 EOS" -p $KYLIN_TEST_ACCOUNT@active
```

(continues on next page)

(continued from previous page)

```
# Set contract code and abi
cleos -u $DSP_ENDPOINT set contract $KYLIN_TEST_ACCOUNT vaccountsconsumer -p $KYLIN_
↪TEST_ACCOUNT@active

# Set contract permissions, add eosio.code
cleos -u $DSP_ENDPOINT set account permission $KYLIN_TEST_ACCOUNT active "{\
↪"threshold\":1,\"keys\":[{\"weight\":1,\"key\":\"$KYLIN_TEST_PUBLIC_KEY\"}],\
↪"accounts\":[{\"permission\":{\"actor\":\"$KYLIN_TEST_ACCOUNT\",\"permission\":\
↪"eosio.code\"},\"weight\":1}]}" owner -p $KYLIN_TEST_ACCOUNT@active
```

1.10.6 Select and stake DAPP for DSP package | DSP Portal Link

- Use the faucet to get some DAPP tokens on Kylin
- Information on: DSP Packages and staking DAPP/DAPPHDL (AirHODL token)

```
export PROVIDER=heliosselene
export PACKAGE_ID=cronservices

# select your package:
export SERVICE=cronservices
cleos -u $DSP_ENDPOINT push action dappservices selectpkg "[\"$KYLIN_TEST_ACCOUNT\",\"
↪$PROVIDER\",\"$SERVICE\",\"$PACKAGE_ID\"]" -p $KYLIN_TEST_ACCOUNT@active

# Stake your DAPP to the DSP that you selected the service package for:
cleos -u $DSP_ENDPOINT push action dappservices stake "[\"$KYLIN_TEST_ACCOUNT\",\"
↪$PROVIDER\",\"$SERVICE\",\"10.0000 DAPP\"]" -p $KYLIN_TEST_ACCOUNT@active
```

1.10.7 Test

To test the sample contract, first check the stat table for the current counter value which should increase after the cron. Then simply send a `testschedule` action to your smart contract's account name.

Check RAM Table Row for Counter

Add your `account_namez` to the following curl to see if the counter increases.

```
curl --request POST \
  --url $DSP_ENDPOINT/v1/chain/get_table_rows \
  --header 'accept: application/json' \
  --header 'content-type: application/json' \
  --data '{"code":"account_name","table":"stat","scope":"account_name"}'
```

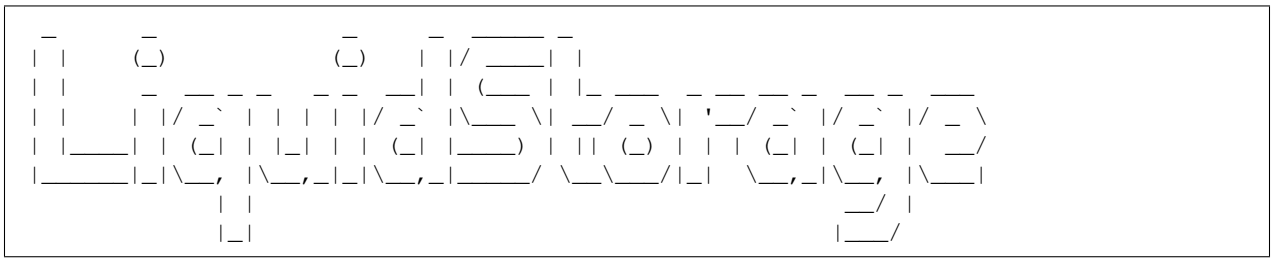
Test actions

```
# setup scheduling task to run 45 times for multiple timers/accounts
cleos -u $DSP_ENDPOINT push action $KYLIN_TEST_ACCOUNT testschedule '[INTERVAL]' -p
↪$KYLIN_TEST_ACCOUNT
```

Custom eosio assertion message

If `shouldAbort` is included in an `eosio::check` assertion, the DSP will cease to process the request and will reschedule it. This prevents the DSP from using CPU to schedule the next cron.

1.11 LiquidStorage Getting Started



LiquidStorage allows the read/write of data to a DAPP Service Provider's IPFS node.

1.11.1 Prerequisites

- Zeus - Zeus installs eos and the eosio.cdt if not already installed
- Kylin Account

1.11.2 Unbox LiquidStorage DAPP Service box

This box contains the LiquidStorage example smart contract, DAPP Service Provider node logic, unit tests, dapp-client source code and examples.

```
mkdir storage-dapp-service; cd storage-dapp-service
# npm install -g @liquidapps/zeus-cmd
zeus box create
zeus unbox storage-dapp-service
zeus test -c
```

1.11.3 LiquidStorage Consumer Example Contract used in unit tests

`./zeus_boxes/contracts/eos/storageconsumer/storageconsumer.cpp`

The consumer contract is a great starting point for playing around with the LiquidStorage service. This sample contract uses LiquidAccounts as an option, but the service may also be used with regular EOS accounts.

```
/* DELAY REMOVAL OF USER DATA INTO VRAM */
/* ALLOWS FOR QUICKER ACCESS TO USER DATA WITHOUT THE NEED TO WARM DATA UP */
#define VACCOUNTS_DELAYED_CLEANUP 120

/* ADD NECESSARY LIQUIDACCOUNT / VRAM INCLUDES */
#include "../dappservices/ipfs.hpp"
#include "../dappservices/multi_index.hpp"
#include "../dappservices/vaccounts.hpp"
#include <eosio/singleton.hpp>
```

(continues on next page)

(continued from previous page)

```
/* ADD LIQUIDACCOUNT / VRAM RELATED ACTIONS */
#define DAPPSERVICES_ACTIONS()                                                  \
  XSIGNAL_DAPPSERVICE_ACTION                                                    \
  IPFS_DAPPSERVICE_ACTIONS                                                      \
  VACCOUNTS_DAPPSERVICE_ACTIONS
#define DAPPSERVICE_ACTIONS_COMMANDS()                                          \
  IPFS_SVC_COMMANDS() VACCOUNTS_SVC_COMMANDS()

#define CONTRACT_NAME() storageconsumer

CONTRACT_START()

/* THE storagecfg TABLE STORES STORAGE PARAMS */
TABLE storagecfg {
  // all measurements in bytes
  uint64_t max_file_size_in_bytes = UINT64_MAX; // max file size in bytes that can be␣
↪uploaded at a time, default 10mb
  uint64_t global_upload_limit_per_day = UINT64_MAX; // max upload limit in bytes per␣
↪day for EOS account, default 1 GB
  uint64_t vaccount_upload_limit_per_day = UINT64_MAX; // max upload limit in bytes␣
↪per day for LiquidAccounts, default 10 MB
};
typedef eosio::singleton<"storagecfg"_n, storagecfg> storagecfg_t;

/* SET PARAMS FOR storagecfg TABLE */
ACTION setstoragecfg(const uint64_t &max_file_size_in_bytes,
                     const uint64_t &global_upload_limit_per_day,
                     const uint64_t &vaccount_upload_limit_per_day) {
  require_auth(get_self());
  storagecfg_t storagecfg_table(get_self(), get_self().value);
  auto storagecfg = storagecfg_table.get_or_default();

  storagecfg.max_file_size_in_bytes = max_file_size_in_bytes;
  storagecfg.global_upload_limit_per_day = global_upload_limit_per_day;
  storagecfg.vaccount_upload_limit_per_day = vaccount_upload_limit_per_day;

  storagecfg_table.set(storagecfg, get_self());
}

/* THE FOLLOWING STRUCT DEFINES THE PARAMS THAT MUST BE PASSED FOR A LIQUIDACCOUNT␣
↪TRX */
struct dummy_action_hello {
  name vaccount;
  uint64_t b;
  uint64_t c;

  EOSLIB_SERIALIZE(dummy_action_hello, (vaccount)(b)(c))
};

/* DATA IS PASSED AS PAYLOADS INSTEAD OF INDIVIDUAL PARAMS */
[[eosio::action]] void hello(dummy_action_hello payload) {
  /* require_vaccount is the equivalent of require_auth for EOS */
  require_vaccount(payload.vaccount);

  print("hello from ");
  print(payload.vaccount);
```

(continues on next page)

(continued from previous page)

```
  print(" ");
  print(payload.b + payload.c);
  print("\n");
}

/* EACH ACTION MUST HAVE A STRUCT THAT DEFINES THE PAYLOAD SYNTAX TO BE PASSED */
VACCOUNTS_APPLY(((dummy_action_hello)(hello)))

CONTRACT_END((hello)(regaccount)(setstoragecfg)(xdcommit)(xvinit))
```

1.11.4 Compile

See the unit testing section for details on adding unit tests.

```
zeus compile
# test without compiling
zeus test
# compile and test with
zeus test -c
```

1.11.5 Deploy Contract

```
export DSP_ENDPOINT=https://kylin-dsp-1.liquidapps.io
export KYLIN_TEST_ACCOUNT=<ACCOUNT_NAME>
export KYLIN_TEST_PUBLIC_KEY=<ACTIVE_PUBLIC_KEY>
# Buy RAM:
cleos -u $DSP_ENDPOINT system buyram $KYLIN_TEST_ACCOUNT $KYLIN_TEST_ACCOUNT "200.
↪0000 EOS" -p $KYLIN_TEST_ACCOUNT@active
# Set contract code and abi
cleos -u $DSP_ENDPOINT set contract $KYLIN_TEST_ACCOUNT storageconsumer -p $KYLIN_
↪TEST_ACCOUNT@active

# Set contract permissions, add eosio.code
cleos -u $DSP_ENDPOINT set account permission $KYLIN_TEST_ACCOUNT active "{\
↪"threshold\":1,\"keys\":[{\"weight\":1,\"key\":\"$KYLIN_TEST_PUBLIC_KEY\"}],\
↪"accounts\":[{\"permission\":{\"actor\":\"$KYLIN_TEST_ACCOUNT\",\"permission\":\
↪"eosio.code\"},\"weight\":1}]}" owner -p $KYLIN_TEST_ACCOUNT@active
```

1.11.6 Select and stake DAPP for DSP package | DSP Portal Link

- Use the faucet to get some DAPP tokens on Kylin
- Information on: DSP Packages and staking DAPP/DAPPHDL (AirHODL token)

```
export PROVIDER=heliosselene
export PACKAGE_ID=storagelarge

# select your package:
export SERVICE=liquidstorag
cleos -u $DSP_ENDPOINT push action dappservices selectpkg "[\"$KYLIN_TEST_ACCOUNT\",\"
↪$PROVIDER\",\"$SERVICE\",\"$PACKAGE_ID\"]" -p $KYLIN_TEST_ACCOUNT@active
```

(continues on next page)

(continued from previous page)

```
# Stake your DAPP to the DSP that you selected the service package for:
cleos -u $DSP_ENDPOINT push action dappservices stake "[\"$KYLIN_TEST_ACCOUNT\",\"
↪$PROVIDER\",\"$SERVICE\",\"10.0000 DAPP\"]" -p $KYLIN_TEST_ACCOUNT@active
```

1.11.7 Set LiquidStorage Configuration

The `setstoragecfg` table allows setting limits to the LiquidStorage service for users. This is an optional step.

```
TABLE storagecfg {
  // all measurements in bytes
  uint64_t max_file_size_in_bytes = UINT64_MAX; // max file size in bytes that can be␣
↪uploaded at a time, default 10mb
  uint64_t global_upload_limit_per_day = UINT64_MAX; // max upload limit in bytes per␣
↪day for EOS account, default 1 GB
  uint64_t vaccount_upload_limit_per_day = UINT64_MAX; // max upload limit in bytes␣
↪per day for LiquidAccounts, default 10 MB
};
```

Here we will set the maximum file size to 1MB and the global upload limits to 10MB each. You can update the `YOUR_ACCOUNT_HERE` to your consumer account.

```
cleos -u https://kylin.eos.dfuse.io push transaction '{"delay_sec":0,"max_cpu_usage_ms
↪":0,"actions":[{"account":"YOUR_ACCOUNT_HERE","name":"setstoragecfg","data":{"max_
↪file_size_in_bytes":1000000,"global_upload_limit_per_day":100000000,"vaccount_
↪upload_limit_per_day":100000000},"authorization":[{"actor":"YOUR_ACCOUNT_HERE",
↪"permission":"active"}]}]}'
```

1.11.8 Test

This test will use a regular EOS account instead of a LiquidAccount, to use a LiquidAccount, visit the LiquidAccount section for how to send a transaction.

First install the `dapp-client`

```
npm install -g @liquidapps/dapp-client
```

Create the following file:

```
touch test.js
# add contents below
vim test.js
# run file
node test.js
```

```
const { createClient } = require('@liquidapps/dapp-client');
const fetch = require('isomorphic-fetch');
const endpoint = "https://kylin-dsp-1.liquidapps.io";
const getClient = () => createClient( { network:"kylin", httpEndpoint: endpoint,␣
↪fetch });

(async () => {
    const service = await (await getClient()).service('storage', "YOUR_ACCOUNT_HERE");
    const data = Buffer.from("a great success", "utf8");
```

(continues on next page)

(continued from previous page)

```
    const key = "YOUR_ACTIVE_PRIVATE_KEY_HERE";
    const permission = "active";
    const options = {
      // if true, DAG leaves will contain raw file data and not be wrapped in a␣
↪protobuf
      rawLeaves: true
    };
    const response = await service.upload_public_file(
        data,
        key,
        permission,
        null,
        options
    );
    console.log(`response uri: ${response.uri}`);
})().catch((e) => { console.log(e); });
```

```
# node test.js
response uri: ipfs://IPFS_URI_HERE
```

This will return the IPFS URI where the content can be fetched.

Add the URI to the end of the IPFS gateway: `https://ipfs.io/ipfs/IPFS_URI_HERE`, and you will see "a great success".

To fetch data, the following example can be used:

```
const fetch = require("node-fetch");

(async () => {
    let res = await fetch('https://kylin-dsp-1.liquidapps.io/v1/dsp/liquidstorag/get_
↪uri', {
      method: 'POST',
      mode: 'cors',
      body: JSON.stringify({ uri: "ipfs://
↪zb2rhX28fttoDTUhpmHBgQa2PzjL1N3XUDaL9rZvx8dLZseji" })
    });
    res = await res.json();
    res = Buffer.from(res.data, 'base64').toString(),
    console.log(`result: ${res}`);
})().catch((e) => { console.log(e); });
// result: a great success
```

To see additional examples of the other `dapp-client` services, see the examples folder here.

1.11.9 Zeus commands

There are 2 Zeus commands available, upload, and unpin. These can be used in the root of the storage box. Upload will upload an archive (.tar), a directory, or a file. The unpin command unpins data from the IPFS node.

```
zeus storage upload <ACCOUNT_NAME> package.json <ACCOUNT_PRIVATE_KEY>
zeus storage unpin <ACCOUNT_NAME> <IPFS_URI_RETURNED_ABOVE> <ACCOUNT_PRIVATE_KEY>
```

1.12 Price feed example

The price feed example uses either `LiquidScheduler` and `LiquidHarmony` or just `LiquidHarmony` oracles to fetch a price every X seconds. If the price does not deviate by more or less than 1% (default) then an assertion will be thrown preventing the DSP from using CPU on the oracle request or the cron rescheduling action.

Code located here

1.12.1 Download and test with zeus

To download and run the unit test the price feed with zeus simply run:

```
mkdir price-feed; cd price-feed
# npm install -g @liquidapps/zeus-cmd
zeus box create
zeus unbox price-feed
zeus test -c
```

The unit test will run several requests, none of which will increment the CPU used past the first action unless the price deviates by 1% from the first price logged during the test.

1.12.2 Price feed settings

The following are the settings that can be customized with the `settings` action.

- `uint32_t threshold = 1;` - this represents the minimum amount of DSPs that must respond to deem a price fetch valid, defaults to 1
- `float lower_bound_filter = 1;` // lower bound check to see if a price has dropped by more than x%, if so, update the price and spend CPU to do so, if not assert reschedule the cron and spend no CPU, defaults 1%
- `float upper_bound_filter = 1;` // upper bound check to see if a price has increased by more than x%, if so, update the price and spend CPU to do so, if not assert reschedule the cron and spend no CPU, defaults 1%
- `float lower_bound_dsp = 1;` // lower bound check to compare all DSP results against, if any DSP result is less than the first reported price by x%, assert, defaults to 1%
- `float upper_bound_dsp = 1;` // upper bound check to compare all DSP results against, if any DSP result is more than the first reported price by x%, assert, defaults to 1%

The example also allows an average or median consensus mechanism for calculating the most recent price.

1.12.3 Price feed actions

- `testfeed (std::vector<char> uri, uint32_t interval)` - takes a LiquidHarmony URI and an interval to reschedule the price feed request
- `settings (uint32_t new_threshold_val, float lower_bound_filter, float upper_bound_filter, float lower_bound_dsp, float upper_bound_dsp)` - update settings for price feed
- `stopstart (bool stopstart_bool)` - toggles price feed cron on or off
- `testfetch (std::vector<char> uri)` - fetches price feed oracle request without cron

cleos examples:

```
# set settings
cleos -u $EOS_ENDPOINT push action $KYLIN_TEST_ACCOUNT settings '[1,1,1,1,1]' -p
↪$KYLIN_TEST_ACCOUNT
# start feed for EOS price fetch every 15 seconds
cleos -u $EOS_ENDPOINT push action $KYLIN_TEST_ACCOUNT testfeed '[
↪"68747470732b6a736f6e3a2f2f5553442f6d696e2d6170692e63727970746f636f6d706172652e636f6d2f646174612f70
↪",15]' -p $KYLIN_TEST_ACCOUNT
# stop feed / enable feed to be restarted
cleos -u $EOS_ENDPOINT push action $KYLIN_TEST_ACCOUNT stopstart '[false]' -p $KYLIN_
↪TEST_ACCOUNT
# test once time fetch only using oracles
cleos -u $EOS_ENDPOINT push action $KYLIN_TEST_ACCOUNT testfetch '[
↪"68747470732b6a736f6e3a2f2f5553442f6d696e2d6170692e63727970746f636f6d706172652e636f6d2f646174612f70
↪"]' -p $KYLIN_TEST_ACCOUNT
```

1.13 Token bridge example

The Token bridge example uses the cron, oracle and ipfs service to enable token pegging between eosio chains.

Code located here

1.13.1 Download and test with zeus

To download and run the unit test for tokenpeg with zeus simply run:

```
mkdir bridge; cd bridge
# npm install -g @liquidapps/zeus-cmd
zeus box create
zeus unbox tokenpeg
zeus test -c
```

The unit test will deploy two "bridge contracts", one on the "mainnet" and one on a sidechain, as well as two corresponding token contracts on each chain. It will then transfer a token from the mainnet to sidechain and back from the sidechain to the mainnet.

1.13.2 Token bridge settings/initialization

The following are required settings for initializing the bridge contracts to allow cross chain transfers. Note that the code for the bridge contracts are identical, the only differences being the settings/initialization values.

- `name sister_code` - name of bridge contract on other chain
- `string sister_chain_name` - identifier of sister chain. The DSP's servicing the bridge contracts need to support these chains and have appropriate endpoints.
- `name token_contract` - the name of the token contract which holds the balances
- `bool processing_enabled` - flag to enable/disable message processing. Essentially disables outgoing tokens.
- `bool transfers_enabled` - flag to enable/disable token transfers to the bridge contract. Essentially disables incoming tokens.
- `uint64_t last_irreversible_block_num` - stores the last irreversible block number

- `bool can_issue` - boolean as to whether or not the contract can issue tokens. False on the chain where the original token was created, true on the other.
- `uint64_t last_irreversible_block_num` stores the last irreversible block number
- `uint64_t last_received_releases_id, uint64_t last_received_receipts_id, uint64_t last_confirmed_block_id,uint64_t last_received_transfer_block_id` - counters for tracking the last received block of releases, receipts, confirmed block, and transfers

The example also allows an average or median consensus mechanism for calculating the most recent price.

1.13.3 Token bridge actions

```
[[eosio::action]] void init( name sister_code, string sister_chain_name,
name token_contract, symbol token_symbol, bool processing_enabled, bool
transfers_enabled, uint64_t last_irreversible_block_num, bool can_issue,
uint64_t last_received_releases_id, uint64_t last_received_receipts_id,
uint64_t last_confirmed_block_id, uint64_t last_received_transfer_block_id
);
```

- initializes settings and broadcasts cron requests

```
[[eosio::action]] void enable(bool processing_enabled, bool
transfers_enabled);
```

- enable/disable processing or transfers

1.14 Contract Logs

The DAPP Network uses custom event logs to communicate between consumer contracts and the DAPP Service Providers (specialized EOSIO nodes running the DAPP Network logic and servicing requests). For this reason any print statements added to a contract which utilizes a DAPP Network service must end with a newline (`\n`) in order to not interfere with the event parsing.

For example:

```
print("{\"type\":\"debug\",\"message\":\"YOUR LOGS HERE\"}\n");
```

```
print("Hello World!");
print("\n");
```

1.15 DAPP Network Macros

The DAPP Network utilizes a series of macros and service actions to perform different logic. Many of the macros use a special syntax to interact with the DAPP Service Providers.

In this portion of the docs we'll have a look at the macros associated with the DAPP Network's core services (beta and above). We'll also explore some of the macros exposed by the `dappservices` contract (core contract to the DAPP Network that handles staking, the DAPP token, and packages). This is intended to be an additional reading piece to the getting started sections.

- *dappservices*
- *vRAM*

- *LiquidAccounts*
- *LiquidHarmony (oracles)*
- *LiquidScheduler (cron)*

1.15.1 dappservices

CONTRACT_START() | code

```
/**
  *  Wraps the eosio::contract class and provides the DAPP service actions needed for each service utilized as well as a specified CONTRACT_NAME. Intended to be used with CONTRACT_END.
  *
  *  @param CONTRACT_NAME - defines smart contract's name
  *  @param DAPPSERVICES_ACTIONS - specifies DAPP Service actions that must be included to perform a service
  *
  *  @return eosio::contract class with DAPP service actions defined under DAPPSERVICES_ACTIONS() and CONTRACT_NAME
  *
  *  Example:
  *
  *  @code
  *  #define DAPPSERVICES_ACTIONS() \
  *  XSIGNAL_DAPPSERVICE_ACTION \
  *  ORACLE_DAPPSERVICE_ACTIONS
  *
  *  #define CONTRACT_NAME() oracleconsumer
  *
  *  CONTRACT_START()
  *  @endcode
  */

#define CONTRACT_START() \
CONTRACT CONTRACT_NAME() : public eosio::contract { \
  using contract::contract; \
public: \
DAPPSERVICES_ACTIONS()
```

CONTRACT_END() | code

```
/**
  *  Generates the EOSIO_DISPATCH_SVC list of actions for a smart contract.  Intended to be used with CONTRACT_START.
  *
  *  @param CONTRACT_NAME - contract name for eosio smart contract
  *  @param methods - list of actions to be included in the smart contract's ABI
  *
  *  @return EOSIO_DISPATCH_SVC list of actions
  *
  *  Example:
  *
  *  @code
```

(continues on next page)

(continued from previous page)

```
  *  #define CONTRACT_NAME() oracleconsumer
  *
  *  CONTRACT_END((testget)(testrnd))
  *  @endcode
  */

#define CONTRACT_END(methods) \
}; \
EOSIO_DISPATCH_SVC(CONTRACT_NAME(),methods)
```

1.15.2 vRAM

dapp::multi_index | code

```
/**
  *  DAPP Network version of the eosio::multi_index container.  Enables storage of␣
↪information in IPFS (vRAM) when not needed in RAM.  When data is warmed up, it is␣
↪checked against the merkle root stored on-chain to ensure integrity and prevent a␣
↪DAPP Service Provider from needing to be a trusted entity.
  *
  *  @param {name} code - account that owns table
  *  @param {uint64_t} scope - scope identifier within the code hierarchy
  *  @param {uint32_t} [shards=1024] - amount of shards to include for each table
  *  @param {buckets_per_shard} [buckets_per_shard=64] - number of buckets to use per␣
↪shard
  *  @param {bool} [pin_shards=false] - persist shards to RAM
  *  @param {bool} [pin_buckets=false] - persist shard buckets to RAM
  *  @param {uint32_t} [cleanup_delay=0] - time in seconds before data loaded in RAM␣
↪is committed to vRAM (IPFS)
  *
  *  @return advanced_multi_index container
  *
  *  Notes
  *  - by utilizing the cleanup_delay param, data persists to RAM and can be used␣
↪until committed.  One use case for this is a session based application where a user␣
↪does not need their data committed to RAM after each transaction.  The cleanup_
↪delay is reset each time a user uses the data.  If a user is inactive for say 120␣
↪seconds, then their data can be committed.  Utilizing the cleanup_delay also␣
↪prevents the latency associated with warming up data into RAM from vRAM (IPFS).
  *  - by selecting pin_shards = true, the shards will not be evicted from the␣
↪ipfsentry table after the transaction that required the data is run
  *
  *
  *  Example:
  *
  *  @code
  *  TABLE testindex {
  *   uint64_t id;
  *   uint64_t sometestnumber;
  *   uint64_t primary_key()const {return id;}
  *  };
  *
  *  typedef dapp::multi_index<"test"_n, testindex> testindex_t;
  *  typedef eosio::multi_index<".test"_n, testindex> testindex_t_v_abi;
```

(continues on next page)

(continued from previous page)

```
 *  typedef eosio::multi_index<"test"_n, testindex_shardbucket> testindex_t_abi;
 *  @endcode
 */

TABLE testindex {
  uint64_t id;
  uint64_t sometestnumber;
  uint64_t primary_key()const {return id;}
};

typedef dapp::multi_index<"test"_n, testindex> testindex_t;
typedef eosio::multi_index<".test"_n, testindex> testindex_t_v_abi;
typedef eosio::multi_index<"test"_n, testindex_shardbucket> testindex_t_abi;

// get some data
[[eosio::action]] void testget(uint64_t id) {
  testindex_t testset(_self,_self.value, 1024, 64, false, false, 0);
  auto const& data = testset.get(id,"data not found");
}

// add new data row with .emplace
[[eosio::action]] void testemplace(uint64_t id) {
  testindex_t testset(_self,_self.value, 1024, 64, false, false, 0);
  testset.emplace(_self, [&]( auto& a ){
    a.id = id;
  });
}

// modify existing data row with .modify
[[eosio::action]] void testmodify(uint64_t id, uint64_t new_id) {
  testindex_t testset(_self,_self.value, 1024, 64, false, false, 0);
  auto existing = testset.find(id);
  testset.modify(existing,_self, [&]( auto& a ){
    a.id = new_id;
  });
}

// test adding a delayed cleanup
[[eosio::action]] void testdelay(uint64_t id, uint64_t value, uint32_t delay_sec) {
  testindex_t testset(_self,_self.value, 1024, 64, false, false, delay_sec);
  auto existing = testset.find(id);
  if(existing == testset.end())
    testset.emplace(_self, [&]( auto& a ){
      a.id = id;
      a.sometestnumber = value;
    });
  else
    testset.modify(existing,_self, [&]( auto& a ){
      a.sometestnumber = value;
    });
}

// test loading a new manifest file
// a manifest file is a snapshot of the current state of the table
// manifests can be used to version the database or to revert back
[[eosio::action]] void testman(dapp::manifest man) {
  testindex_t testset(_self,_self.value);
```

(continues on next page)

(continued from previous page)

```
    testset.load_manifest(man,"Test");
  }

  // increment revision number, reset shards and buckets_per_shard params and next_
↪available_key in vconfig table
  [[eosio::action]] void testclear() {
    testindex_t testset(_self,_self.value, 1024, 64, false, false, 0);
    testset.clear();
  }
```

1.15.3 LiquidAccounts

payload definition | code

```
/**
  *  LiquidAccounts use a payload syntax in order to pass params.  This payload is␣
↪setup as a struct and uses the EOSLIB_SERIALIZE to create the payload type
  *
  *  @param {name} vaccount - vaccount that owns table
  *
  *  Notes
  *  - primary key for the vaccount payload table must be "vaccount" for client side␣
↪library support
  *
  *  Example:
  *
  *  @code
  *  struct dummy_action_hello {
  *   name vaccount;
  *   uint64_t b;
  *   uint64_t c;
  *
  *   EOSLIB_SERIALIZE( dummy_action_hello, (vaccount)(b)(c) )
  *  };
  *
  *  [[eosio::action]] void hello(dummy_action_hello payload) {
  *   ...
  *  }
  *  @endcode
  */
```

VACCOUNTS_APPLY | code

```
/**
  *  LiquidAccounts use the VACCOUNTS_APPLY macro to map which payload structs are␣
↪associated with which actions.  It also defines the LiquidAccount action.
  *
  *  @param ((payload_struct)(action_name))
  *
  *  Example:
  *
  *  @code
```

(continues on next page)

(continued from previous page)

```
  *  VACCOUNTS_APPLY(((dummy_action_hello)(hello))((dummy_action_hello)(hello2)))
  *  @endcode
  */
```

require_vaccount | code

```
/**
  *  LiquidAccounts use the require_vaccount macro in place of the require_auth macro␣
↪for authenticating a LiquidAccount against the key assigned when calling regaccount
  *
  *  @param {name} - vaccount from payload
  *
  *  Example:
  *
  *  @code
  *  require_vaccount(payload.vaccount);
  *  @endcode
  */

void required_key(const eosio::public_key& pubkey){ \
    eosio::check(_pubkey == pubkey, "wrong public key"); \
} \

void require_vaccount(name vaccount){ \
    auto pkey = handleNonce(vaccount); \
    required_key(pkey); \
} \
```

VACCOUNTS_DELAYED_CLEANUP | code

```
/**
  *  LiquidAccounts use the VACCOUNTS_DELAYED_CLEANUP time in seconds to prevent data␣
↪from being committed to IPFS from RAM.
  *
  *  @param {uint32_t} VACCOUNTS_DELAYED_CLEANUP - time delay in seconds before data␣
↪is removed from RAM and committed to vRAM (IPFS)
  *
  *  Notes
  *  - VACCOUNTS_DELAYED_CLEANUP is intended to allow DAPPs to operate in a session␣
↪based way.  Data persists to RAM for the time specified to avoid the warmup process␣
↪associated with vRAM data.  After the user has become inactive, the data is␣
↪committed.
  *
  *  Example:
  *
  *  @code
  *  #define VACCOUNTS_DELAYED_CLEANUP 120
  *  @endcode
  */
```

1.15.4 LiquidHarmony

geturi | code

```
/**
  *  LiquidHarmony uses the geturi action to perform an oracle request
  *
  *  @param {std::vector<char>} uri - hex conversion of URL syntax to perform an oracle request
  *  @param {Lambda&&} combinator - lambda to return the results of an oracle request
  *
  *  Example:
  *
  *  @code
  *  [[eosio::action]] void testrnd(std::vector<char> uri) {
  *    getURI(uri, [&]( auto& results ) {
  *      return results[0].result;
  *    });
  *  }
  *  @endcode
  */

TABLE oracleentry {  \
   uint64_t                      id; \
   std::vector<char>             uri; \
   std::vector<provider_result>     results; \
   checksum256 hash_key() const { return hashData(uri); }  \
   uint64_t primary_key()const { return id; }  \
};  \
typedef eosio::multi_index<"oracleentry"_n, oracleentry, indexed_by<"byhash"_n, const_mem_fun<oracleentry, checksum256, &oracleentry::hash_key>>> oracleentries_t; \

static std::vector<char> getURI(std::vector<char> uri, Lambda&& combinator){  \
    checksum256 trxId = transaction_id(); \
    auto trxIdp = trxId.data(); \
    std::string trxIdStr(trxIdp, trxIdp + trxId.size()); \
    auto pubTime = tapos_block_prefix(); \
    std::string uristr(uri.begin(), uri.end()); \
    auto s = fc::base64_encode(trxIdStr) + "://" + fc::to_string(pubTime) + "://" + uristr;\
    std::vector<char> idUri(s.begin(), s.end()); \
    return _getURI(idUri, combinator); \
}\

static std::vector<char> _getURI(std::vector<char> uri, Lambda&& combinator){  \
    auto _self = name(current_receiver()); \
    oracleentries_t entries(_self, _self.value);  \
    auto cidx = entries.get_index<"byhash"_n>(); \
    auto existing = cidx.find(hashData(uri)); \
    if(existing == cidx.end()){  \
        SEND_SVC_REQUEST(geturi, uri); \
    } \
    else {\
        auto results = _extractResults(*existing, combinator);\
        cidx.erase(existing);\
        return results; \
    } \
    return std::vector<char>();\
}  \
```

1.15.5 LiquidScheduler

schedule_timer | code

```
/**
  *  LiquidScheduler uses the schedule_timer macro to schedule a cron action on chain by adding a timer to the timerentry singleton
  *
  *  @param {name} timer - account name to scope the timer within
  *  @param {std::vector<char>} payload - payload to be accessed within the timer_callback function in the consumer contract
  *  @param {uint32_t} seconds - seconds to repeat the cron
  *
  *  Example:
  *
  *  @code
  *  [[eosio::action]] void testschedule() {
  *    std::vector<char> payload;
  *    schedule_timer(_self, payload, 2);
  *  }
  *  @endcode
  */

TABLE timerentry { \
    int64_t   set_timestamp = 0; \
    int64_t   fired_timestamp = 0; \
};\
typedef eosio::singleton<"timer"_n, timerentry> timers_def;\

static void schedule_timer(name timer,std::vector<char> payload, uint32_t seconds){  \
    timers_def timers(current_receiver(), timer.value); \
    timerentry newtimer; \
    if(timers.exists()){ \
        newtimer = timers.get(); \
    } \
    newtimer.fired_timestamp = 0;\
    newtimer.set_timestamp = eosio::current_time_point().time_since_epoch().count();\
    timers.set(newtimer, current_receiver()); \
    SEND_SVC_REQUEST(schedule, timer, payload, seconds); \
}  \

SVC_RESP_CRON(schedule)(name timer,std::vector<char> payload, uint32_t seconds,name current_provider){ \
    timers_def timers(current_receiver() , timer.value); \
    if(!timers.exists()) \
        return; \
    auto current_timer = timers.get(); \
    if(current_timer.fired_timestamp != 0 || (current_timer.set_timestamp + (seconds * 1000000) > eosio::current_time_point().time_since_epoch().count()))\
        return; \
    current_timer.fired_timestamp = eosio::current_time_point().time_since_epoch().count(); \
    timers.set(current_timer, current_receiver()); \
    if(!timer_callback(timer, payload, seconds)) \
        return; \
    schedule_timer(timer, payload, seconds);\
} \
```

remove_timer | code

```
/**
  *  LiquidScheduler uses the remove_timer macro to remove a timer from the␣
↪timerentry singleton
  *
  *  @param {name} timer - account name to scope the timer within
  *  @param {std::vector<char>} payload - payload to be accessed within the timer_
↪callback function in the consumer contract
  *  @param {uint32_t} seconds - seconds to repeat the cron
  *
  *  Example:
  *
  *  @code
  *  [[eosio::action]] void testsremove() {
  *    std::vector<char> payload;
  *    remove_timer(_self, payload, 2);
  *  }
  *  @endcode
  */

static void remove_timer(name timer,std::vector<char> payload, uint32_t seconds){  \
    timers_def timers(current_receiver(), timer.value); \
    if(timers.exists()){ \
        timers.remove(); \
    } \
}  \
```

timer_callback | code

```
/**
  *  LiquidScheduler uses the timer_callback to run the cron logic within the␣
↪consumer contract
  *
  *  @param {name} timer - account name to scope the timer within
  *  @param {std::vector<char>} payload - payload to be accessed within the timer_
↪callback function in the consumer contract
  *  @param {uint32_t} seconds - seconds to repeat the cron
  *
  *  Notes
  *  - can return true to create an infinite loop, false breaks the loop
  *
  *  Example:
  *
  *  @code
  *  bool timer_callback(name timer, std::vector<char> payload, uint32_t seconds){
  *    stats_def statstable(_self, _self.value);
  *    stat newstats;
  *    if(!statstable.exists()){
  *      statstable.set(newstats, _self);
  *    }
  *    else {
  *      newstats = statstable.get();
  *    }
  *    newstats.counter++;
  *    statstable.set(newstats, _self);
```

(continues on next page)

(continued from previous page)

```
  *    return (newstats.counter < 10);
  *  }
  *  @endcode
  */
```

1.16 Unit Testing

Unit testing with Zeus is highly customizable and easy to configure. The following example explains how to use the main helper functions to write your own test.

1.16.1 Customize your own unit tests

in `zeus_boxes/tests/mycontract.spec.js`

```
require('mocha');
const { requireBox } = require('@liquidapps/box-utils');
const { assert } = require('chai'); // Using Assert style
const { requireBox } = require('@liquidapps/box-utils');
const { getCreateKeys } = requireBox('eos-keystore/helpers/key-utils');
const getDefaultArgs = requireBox('seed-zeus-support/getDefaultArgs');
const { getTestContract } = requireBox('seed-eos/tools/eos/utils');
const artifacts =requireBox('seed-eos/tools/eos/artifacts');
const deployer = requireBox('seed-eos/tools/eos/deployer');
const { genAllocateDAPPTokens, readVRAMData } = requireBox('dapp-services/tools/eos/
↪dapp-services');

/*** UPDATE CONTRACT CODE ***/
var contractCode = 'mycontract';
var ctrt = artifacts.require(`./${contractCode}/`);
const { eosio } = requireBox('test-extensions/lib/index');

describe(`${contractCode} Contract`, () => {
  var testcontract;

  /*** SET CONTRACT NAME(S) ***/
  const code = 'airairairair';
  const code2 = 'airairairai2';
  var testUser = "tt11";
  var account = code;

  /*** CREATE TEST ACCOUNT NAME ***/
  const getTestAccountName = (num) => {
    var fivenum = num.toString(5).split('');
    for (var i = 0; i < fivenum.length; i++) {
      fivenum[i] = String.fromCharCode(fivenum[i].charCodeAt(0) + 1);
    }
    fivenum = fivenum.join('');
    var s = '111111111111' + fivenum;
    var prefix = 'test';
    s = prefix + s.substr(s.length - (12 - prefix.length));
    console.log(s);
    return s;
  };
```

(continues on next page)

(continued from previous page)

```
before(done => {
  (async () => {
    try {

      /*** DEPLOY CONTRACT ***/
      var deployedContract = await deployer.deploy(ctrt, code);

      /*** DEPLOY ADDITIONAL CONTRACTS ***/
      var deployedContract2 = await deployer.deploy(ctrt, code2);

      /*** ALLOCATE DAPP TOKENS TO YOUR DEPLOYED CONTRACT ***/
      await genAllocateDAPPTokens(deployedContract, 'ipfs');

      /*** RETURNS EOSJS SMART CONTRACT INSTANCE ***/
      testcontract = await getTestContract(code);

      /*** ENDS UNIT TEST SUCCESSFULLY ***/
      done();
    } catch (e) {
      /*** FAILS UNIT TEST AND PROVIDES ERROR ***/
      done(e);
    }
  })();
});

/*** DISPLAY NAME FOR TEST, REPLACE 'coldissue' WITH ANYTHING ***/
it('coldissue', done => {
  (async () => {
    try {

      /*** SETUP VARIABLES ***/
      var symbol = 'AIR';

      /*** DEFAULT failed = false FOR ASSERTION ERROR ***/
      /*** SET failed = true IN TRY/CATCH BLOCK TO FAIL TEST ***/
      var failed = false;

      /*** SETUP CHAIN OF ACTIONS ***/
      await testcontract.create({
        issuer: code2,
        maximum_supply: `1000000000.0000 ${symbol}`
      }, {
        authorization: `${code}@active`,
        broadcast: true,
        sign: true
      });

      /*** CREATE ADDITIONAL KEYS AS NEEDED ***/
      var key = await getCreateKeys(code2);

      var testtoken = testcontract;
      await testtoken.coldissue({
        to: code2,
        quantity: `1000.0000 ${symbol}`,
        memo: ''
      }, {
```

(continues on next page)

(continued from previous page)

```
          authorization: `${code2}@active`,
          broadcast: true,
          keyProvider: [key.active.privateKey],
          sign: true
        });

        /*** ADD DELAY BETWEEN ACTIONS ***/
        await delay(3000);

        /*** EXAMPLE TRY/CATCH failed = true ***/
        try {
          await testtoken.transfer({
            from: code2,
            to: code,
            quantity: `100.0000 ${symbol}`,
            memo: ''
          }, {
            authorization: `${code2}@active`,
            broadcast: true,
            keyProvider: [key.active.privateKey],
            sign: true
          });
        } catch (e) {
          failed = true;
        }

        /*** ADD CUSTOM FAILURE MESSAGE ***/
        assert(failed, 'should have failed before withdraw');

        /*** ADDITIONAL ACTIONS ... ***/

        done();
      } catch (e) {
        done(e);
      }
    })();
  });

  /*** USE it.skip TO CONTINUE WITH UNIT TEST IF TEST FAILS ***/
  it.skip('it.skip does not assert and continues test if fails' ...
});
```

1.16.2 Helper Functions

getCreateKeys | Code

The `getCreateKeys` function is intended to create a new key pair in `~/.zeus/networks/development/accounts` if a key pair does not already exist for the account provided. The sub directory to `~/.zeus/network` can be any chain that you are developing on as well, e.g., `kylin`, `jungle`, `mainnet`. If an account name has a contract deployed to it with the `deploy` function, then a key pair will automatically be assigned during the deployment.

```
/**
 * @param account - account name to generate or fetch keys for
 */
```

(continues on next page)

(continued from previous page)

```
const { requireBox } = require('@liquidapps/box-utils');
const { getCreateKeys } = requireBox('eos-keystore/helpers/key-utils');
var keys = await getCreateKeys(account);
```

artifacts | Code

The `artifacts` helper pulls the relevant contract files, such as the wasm / ABI, to be used within the unit test.

```
/**
 * @param f - contract name within the /contracts/eos directory
 */

const { requireBox } = require('@liquidapps/box-utils');
const artifacts =requireBox('seed-eos/tools/eos/artifacts');
var contractCode = 'mycontract';
var ctrt = artifacts.require(`./${contractCode}/`);
```

deployer | Code

The `deployer` function deploys a contract to an account based on the contract files and the account name passed. You may also pass your own args, if not specified, the `getDefaultArgs()` function will be passed.

```
/**
 * @param contract - contract file name to deploy
 * @param account - account name to deploy contract to
 * @param [args=getDefaultArgs()] - arguments to be used for configuring the network
↪'s settings
 */

const { requireBox } = require('@liquidapps/box-utils');
const deployer = requireBox('seed-eos/tools/eos/deployer');
var ctrt = artifacts.require(`./${contractCode}/`);
const code = 'airairairair';
var deployedContract = await deployer.deploy(ctrt, code);
```

genAllocateDAPPTokens | Code

The `genAllocateDAPPTokens` function allocates DAPP tokens to the specified contract provided. It also issues, selects a package, stakes, and updates auth to include `eosio.code`.

```
/**
 * @param deployedContract - deployed contract
 * @param serviceName - DAPP Services name as determined in the groups/boxes/groups/
↪services/SELECTED_SERVICE/models/dapp-services/SELECTED_SERVICE.json model file␣
↪under the "name" key
 * @param [provider=''] - DAPP Services Provider name, if non provided, 'pprovider1',
↪'pprovider2' will be used
 * @param [selectedPackage='default'] - package name to select, defaults to "default"
 */

const { requireBox } = require('@liquidapps/box-utils');
```

(continues on next page)

(continued from previous page)

```
const { genAllocateDAPPTokens } = requireBox('dapp-services/tools/eos/dapp-services');
await genAllocateDAPPTokens(deployedContract, 'ipfs');
```

readVRAMData | Code

The `readVRAMData` function makes a vRAM get table row call by providing the `contract`, `key`, `table`, and `scope` arguments.

```
/**
 * @param contract - account name contract was deployed to
 * @param key - primary key of the dapp::multi_index container
 * @param table - table name as specified in the ABI
 * @param scope - scope of dapp::multi_index container to read from
 */

const { requireBox } = require('@liquidapps/box-utils');
const { readVRAMData } = requireBox('dapp-services/tools/eos/dapp-services');
var tableRes = await readVRAMData({
    contract: 'airairairair',
    key: `AIRU`,
    table: "accounts",
    scope: 'tt11'
});
```

getTestContract | Code

The `getTestContract` function creates an EOSJS instance to be used for sending EOS transactions.

```
/**
 * @param code - account name to use in setting up
 */

const { requireBox } = require('@liquidapps/box-utils');
const code = 'airairairair';
const { getTestContract } = requireBox('seed-eos/tools/eos/utils');
testcontract = await getTestContract(code);
await testcontract.create({
    issuer: code,
    maximum_supply: `1000000000.0000 ${symbol}`
}, {
    authorization: `${code}@active`,
    broadcast: true,
    sign: true
});
```

1.16.3 Compile and test

```
zeus test -c
```

1.17 Packages and Staking

1.17.1 List of available Packages

DSPs who have registered their service packages may be found in the package table under the dappservices account on every supported chain.

DSP Portals for viewing/interacting with packages:

- DSP HQ
- Bloks.io
- EOS Nation
- Malta Block
- Mission Control
- Aloha EOS
- MinerGate

1.17.2 DSP Package Explanation

DSP packages have several fields which are important to understand:

- **api_endpoint** - endpoint to direct DSP related trxs/api requests to
- **package_id** - ID of the package that can be selected with the **selectpkg** action
- **service** - the DSP service to be used. Currently LiquidApps supports 6 DSP services; however DSPs are encouraged to create services of their own as well as create bundled DSP services. The use of these resources is measured in QUOTA.

1. ipfsservice1 - providing IPFS services to the dapp::multi_index container of a smart contract
2. cronservices - enable CRON related tasks such as continuous staking
3. oracleservic - provide oracle related services
4. readfndspsvc - return a result from a smart contract function based on current conditions without sending an EOSIO trx
5. accountless1 - virtual accounts that do not require RAM storage for account related data, instead data and accounts are stored in vRAM

- **provider** - DSP account name
- **quota** - QUOTA represents the amount of actions that a DSP supports based on the package_period. You can think of QUOTA like cell phone minutes in a plan. For a cell phone plan you could pay $10 per month and get 1000 minutes. 1 QUOTA always equals 10,000 actions. Said differently .0001 QUOTA equals 1 action. Instead of $10 per month perhaps you would be required to stake 10 DAPP and/or 10 DAPPHDL (Air-HODL) tokens for a day to receive .001 QUOTA or 10 actions.
- **package_period** - period of the package before restaking is required. Upon restaking the QUOTA and package period are reset.
- **min_stake_quantity** - the minimum quantity of DAPP and/or DAPPHDL (Air-HODL) tokens to stake to receive the designated amount of QUOTA for the specified package_period
- **min_unstake_period** - period of time required to pass before **refund** action can be called after **unstake** command is executed

- **enabled** - bool if the package is available or not

1.17.3 Select a DSP Package

Select a service package from the DSP of your choice.

```
export PROVIDER=someprovider
export PACKAGE_ID=providerpackage
export MY_ACCOUNT=myaccount

# select your package:
export SERVICE=ipfsservice1
cleos -u $DSP_ENDPOINT push action dappservices selectpkg "[\"$MY_ACCOUNT\",\"
↪$PROVIDER\",\"$SERVICE\",\"$PACKAGE_ID\"]" -p $MY_ACCOUNT@active
```

1.17.4 Stake DAPP Tokens for DSP Package

```
# Stake your DAPP to the DSP that you selected the service package for:
cleos -u $DSP_ENDPOINT push action dappservices stake "[\"$MY_ACCOUNT\",\"$PROVIDER\",
↪\"$SERVICE\",\"50.0000 DAPP\"]" -p $MY_ACCOUNT@active
```

1.17.5 Stake DAPPHDL (AirHODL) Tokens for DSP Package

If you were a holder of the EOS token on February 26th, 2019 then you should have a balance of DAPPHDL tokens. These tokens possess the ability to 3rd party stake and unstake tokens throughout the duration of the AirHODL, until February 26th 2021.

```
# Stake your DAPPHDL to the DSP that you selected the service package for:
cleos -u $DSP_ENDPOINT push action dappairhodl1 stake "[\"$MY_ACCOUNT\",\"$PROVIDER\",
↪\"$SERVICE\",\"50.0000 DAPPHDL\"]" -p $MY_ACCOUNT@active
```

1.17.6 Unstake DAPP Tokens

The amount of time that must pass before an unstake executes a refund action and returns DAPP or DAPPHDL tokens is either the current time + the minimum unstake time as stated in the package table, or the end of the current package period, whichever is greater.

```
cleos -u $DSP_ENDPOINT push action dappservices unstake "[\"$MY_ACCOUNT\",\"$PROVIDER\
↪\",\"$SERVICE\",\"50.0000 DAPP\"]" -p $MY_ACCOUNT@active
```

1.17.7 Unstake DAPPHDL (AirHODL) Tokens

```
cleos -u $DSP_ENDPOINT push action dappairhodl1 unstake "[\"$MY_ACCOUNT\",\"$PROVIDER\
↪\",\"$SERVICE\",\"50.0000 DAPPHDL\"]" -p $MY_ACCOUNT@active
# In case unstake deferred trx fails, you can manually refund the unstaked tokens:
cleos -u $DSP_ENDPOINT push action dappairhodl1 refund "[\"$MY_ACCOUNT\",\"$PROVIDER\
↪\",\"$SERVICE\"]" -p $MY_ACCOUNT@active
```

1.17.8 Withdraw DAPPHDL (AirHODL) Tokens

Please note: withdrawing your DAPPHDL tokens immediately makes you ineligible for further vesting and forfeits all your unvested tokens. **This action is irrevocable.** Vesting ends February 26th 2021. Also, you must hold DAPP token before executing this action. If you do not, use the *open* action below to open a 0 balance.

```
# Withdraw
cleos -u $DSP_ENDPOINT push action dappairhodl1 withdraw "[\"$MY_ACCOUNT\"]" -p $MY_
↪ACCOUNT@active
# Open DAPP balance to withdraw if needed
cleos -u $DSP_ENDPOINT push action dappservices open "[\"$MY_ACCOUNT\",\"4,DAPP\",\"
↪$MY_ACCOUNT\"]" -p $MY_ACCOUNT@active
```

1.17.9 Check DAPPHDL (AirHODL) Token Balance & Refresh Data

In the dappairhodl1 contract under the accounts table, enter your account as the scope to retrieve its information.

```
# Refresh accounts table data
cleos -u $DSP_ENDPOINT push action dappservices refresh "[\"$MY_ACCOUNT\"]" -p $MY_
↪ACCOUNT@active
```

1.17.10 Third Party Staking

Third parties may stake to a DSP package on behalf of a DAPP by calling the `staketo` and `unstaketo` actions. In order for a DAPP to select a new package after third parties have staked to them, all third party stakes must be removed.

The following two actions remove third party stakes, `preselectpkg` allows users to be removed in batches by supplying a `depth` parameter to indicate how many accounts to remove at a time. The second action is `retirestakes` which allows for the removal of specific third party stakes from a list of `delegators` account names.

Third party stakers can be identified by supplying the `ID` of the `accountext` table entry that matches the account, provider, service, and package (or pending package) selected by the account being staked to as the scope of the `stakingext` table, for example: `150`.

Examples:

```
cleos -u $DSP_ENDPOINT push action dappservices retirestake "{\"owner\":\"$MY_ACCOUNT\
↪",\"provider\":\"heliosselene\",\"service\":\"cronservices\",\"package\":\
↪"cronservices\",\"delegators\":["dappservice2","natdeveloper","oracletest22"]}" -p
↪$MY_ACCOUNT

cleos -u $DSP_ENDPOINT push action dappservices preselectpkg "{\"owner\":\"$MY_
↪ACCOUNT\",\"provider\":\"heliosselene\",\"service\":\"cronservices\",\"package\":\
↪"cronservices\",\"depth\":\"10\"}" -p $MY_ACCOUNT

cleos -u $DSP_ENDPOINT push action dappservices staketo "{\"from\":\"$MY_ACCOUNT\",\
↪"to\":\"asdfasdfasdy\",\"provider\":\"heliosselene\",\"service\":\"cronservices\",\
↪"quantity\":\"10.0000 DAPP\"}" -p $MY_ACCOUNT

cleos -u $DSP_ENDPOINT push action dappservices unstaketo "{\"from\":\"$MY_ACCOUNT\",\
↪"to\":\"asdfasdfasdy\",\"provider\":\"heliosselene\",\"service\":\"cronservices\",\
↪"quantity\":\"10.0000 DAPP\"}" -p $MY_ACCOUNT
```

(continues on next page)

(continued from previous page)

```
// if deferred trx for refund fails after unstaketo
cleos -u $DSP_ENDPOINT push action dappservices refundto "{\"from\":\"$MY_ACCOUNT\",\
↪"to\":\"asdfasdfasdy\",\"provider\":\"heliosselene\",\"service\":\"cronservices\",\
↪"symcode\":\"DAPP\"}" -p $MY_ACCOUNT
```

More on `preselectpkg` and `retirestakes`

`preselectpkg` allows the DAPP to simply supply a `depth` (number of third party stakes) to remove per tx ordered by the `ID` of "payer". The DAPP may simply execute this as many times as required until no more third party stakes remain. If a depth that is too deep is selected (for example, 100) the trx will simply fail, and a smaller depth can be selected. This method requires no external knowledge of who has staked to the account.

`retirestakes` is a more explicit and selective method for a DAPP. A list of third party stake payers (`name[] delegators`) can be provided. If the list is too large, the tx may time out. In order to discover who has staked to the DAPP's package the following steps can be utilized:

1. Determine the `id` of their package's `accountext` table entry. accountext entries all use the scope `DAPP`. The correct entry is the entry that has that same account, service, provider, and package (or pending_package) as the selected package. bloks.io accountext table
2. Find the `stakingext` entries, using the `id` from the `accountext` table as the scope. bloks.io stakingext table
3. Each entry under this scope will have payers equal to the account names of the third parties. These payers can be used to populate the delegators for the `retirestakes` action.

For both actions, if the `depth` is deeper than the number of stakes, or the `delegators` list includes payers that haven't actually staked, it will succeed gracefully, ignoring the erroneous entries and executing for the correct ones.

The `dappairhodl1` contract is the exception to all of this. It does not get added to the `stakingext` table since while it is a third party stake mechanically, it is essentially the same as a first party stake. We do not support third party staking using AirHODL'd DAPP.

1.18 Zeus Boxes

1.18.1 Browse Boxes:

- regression-tests
- helloworld
- coldtoken
- airhodl
- airdrop
- bancor-extensions
- cardgame
- dapp-services-deploy
- templates-emptycontract-eos-cpp
- all-dapp-services

- sample-zeus-extension
- deepfreeze
- vgrab
- dapp
- game
- ide
- dgoods
- eoscraft

1.19 Zeus Create Service

1.20 Create service boilerplate

The `templates-dsp-service` box contains a basic version of:

- consumer contract - contract showcasing simple examples of how to use the service
- unit test - file that shows examples of the consumer contract being used
- dsp-service.json - this goes in the `/models/dapp-service` directory of the service
- myservice-dapp-service-node.js file for running the DSPs node logic

```
mkdir templates-dsp-service; cd templates-dsp-service
zeus box create
zeus unbox templates-dsp-service
zeus create dsp-service myservice
# compile
zeus compile
# zeus test
zeus test
```

The gitignore ignores all extensions at the moment, in the future you will be able to install those extensions with `zeus install`, but until that time just ignore the `node_modules` folder

1.20.1 dsp-service.json

- name - define the simplest version of your DSP service, this is used for DSPs to register the service with the `zeus register dapp-service-provider-package`. It is the `PACKAGE` env variable
- port - select a port for your service to run on, ensure the other services don't overlap as each service must have a unique port
- prettyName - what the service will be officially referred to (LiquidAccounts, vRAM, etc..)
- stage - Work in Progress (WIP), Alpha, Beta, Stable
- version - current version
- description - short description of service
- commands - list of DSP commands

  - blocking - if true, blocking will treat the command as a synchronous event, if false it will be treated as an asynchonous event

```
{
    "name": "dsp-service",
    "port": 13150,
    "prettyName": "Liquid...",
    "stage":"WIP or Alpha, or BETA, or Stable",
    "version": "0.9",
    "description": "Allows interaction with contract without a native EOS Account",
    "contract": "account_service_contract_is_deployed_on",
    "commands": {
        "example_command": {
            "blocking (true  = syncronous, false = async)": false,
            "request": {
            },
            "callback": {
                "payload": "std::vector<char>",
                "sig": "eosio::signature",
                "pubkey": "eosio::public_key"
            },
            "signal": {
                "sig": "eosio::signature",
                "pubkey": "eosio::public_key"
            }
        }
    }
}
```

- search

CHAPTER 2

DSPs

2.1 Getting started

2.1.1 These docs are deprecated, please see new docs here: https://liquidapps.gitbook.io/

2.1.2 Overview

Overview

Architecture

2.1.3 Prerequisites

Account

2.1.4 Deploy

EOSIO Node

IPFS Node

PostgreSQL Database

DSP Service Node

2.1.5 Configuration

Packages

Testing

2.1.6 Claiming Rewards

Claim

2.1.7 Upgrade Version

Upgrade

2.1.8 Replay Contract and Cleanup IPFS Entries

Replay Contract

Cleanup IPFS Entries

2.1.9 Consumer Resource Usage

Consumer Permissions

2.2 Overview

2.2.1 Articles

- vRAM guide for experts
- EOS dApps and Their RAM Expenses

2.2.2 Videos

- Developer Explains - Decentralized Dapp Scaling w/ IPFS! How LiquidApps Dapp Service Providers Work
- EOS Weekly - The LiquidApps Game-Changer
- EOS Weekly - Unlimited DSP Possibilities

2.2.3 Have questions?

- Join our Dev Telegram channel
- Join our Telegram channel
- Email us: support@liquidapps.io

2.2.4 Want more information?

- Read our whitepaper and subscribe to our Medium posts.

2.3 Architecture

A DSP consists of an EOS state history node (non block producing node without a full history setup), an IPFS cluster, a PostgreSQL Database, and a DSP API endpoint. All 4 of these operations may be run on the same machine or separately. All necessary settings may be found in the `config.toml` file.

- EOS state history node - to run a DSP requires running a non block producing EOS node. A full history node is also not required. The EOS node is configured with a backend storage mechanism: `state_history_plugin`.
- IPFS Cluster node - the IPFS cluster stores all vRAM information so that it may be loaded into RAM as a caching mechanism. The InterPlanetary File System is a protocol and peer-to-peer network for storing and sharing data in a distributed file system. IPFS uses content-addressing to uniquely identify each file in a global namespace connecting all computing devices. The documentation shows how to setup a local IPFS cluster, but you may also configure an external IPFS cluster in the `config.toml` file.
- PostgreSQL Database - a PostgreSQL database is utilized to prevent duplicate transactions by creating, updating, and retrieving transaction data.
- DSP API - the DSP API is responsible for performing all DAPP service logic such as a vRAM `get_table_row` call, parsing and sending a LiquidAccount transaction, servicing an oracle call, etc.

2.4 Demux Backend

In the `config.toml` file in the DSP Node Setup you can configure the `state_history_plugin`.

You can also configure the `HEAD_BLOCK` to sync demux from. If you experience any issues with demux syncing from an older block, you may try syncing demux at the head block by finding it at bloks.io and setting it to `head_block`.

```
[demux]
backend = "state_history_plugin"

# head block to sync demux from
head_block = 35000000
```

2.5 Account

2.5.1 Prerequisites

Install cleos from: https://github.com/EOSIO/eos/releases

2.5.2 Create Account

Mainnet

```
cleos create key --to-console > keys.txt
export DSP_PRIVATE_KEY=`cat keys.txt | head -n 1 | cut -d ":" -f 2 | xargs echo`
export DSP_PUBLIC_KEY=`cat keys.txt | tail -n 1 | cut -d ":" -f 2 | xargs echo`
```

Save keys.txt somewhere safe!

Have an exising EOS Account

- Getting started on eos mainnet

First EOS Account

Fiat:

- EOS Account Creator
- EOS Lynx
- Scatter

Bitcoin/ETH/Bitcoin Cash/ALFAcoins:

- ZEOS

Kylin

Create an account

```
# Create a new available account name (replace 'yourdspaccount' with your account␣
↪name):
export DSP_ACCOUNT=yourdspaccount
curl http://faucet-kylin.blockzone.net/create/$DSP_ACCOUNT > keys.json
curl http://faucet-kylin.blockzone.net/get_token/$DSP_ACCOUNT
export DSP_PRIVATE_KEY=`cat keys.json | jq -e '.keys.active_key.private'`
export DSP_PUBLIC_KEY=`cat keys.json | jq -e '.keys.active_key.public'`
```

Save keys.json somewhere safe!

2.5.3 Account Name

```
# Create wallet
cleos wallet create --file wallet_password.pwd
```

Save wallet_password.pwd somewhere safe!

2.5.4 Import account

```
cleos wallet import --private-key $DSP_PRIVATE_KEY
```

2.6 EOSIO Node

A non block / non full history node is required for the DSP API to interact with. This node may be hosted with the rest of the DSP architecture or standalone.

2.6.1 Hardware Requirements

2.6.2 Prerequisites

- jq
- wget
- curl

2.6.3 Get EOSIO binary

```
# nodeos versions 1.8+ and 2.0+ are supported
VERSION=2.0.11
```

Ubuntu 18.04

```
FILENAME=eosio_$VERSION-1-ubuntu-18.04_amd64.deb
INSTALL_TOOL=apt
```

Ubuntu 16.04

```
FILENAME=eosio_$VERSION-1-ubuntu-16.04_amd64.deb
INSTALL_TOOL=apt
```

Fedora

```
FILENAME=eosio_$VERSION-1.fc27.x86_64.rpm
INSTALL_TOOL=yum
```

Centos

```
FILENAME=eosio_$VERSION-1.el7.x86_64.rpm
INSTALL_TOOL=yum
```

2.6.4 Install

```
wget https://github.com/EOSIO/eos/releases/download/v$VERSION/$FILENAME
sudo $INSTALL_TOOL install ./$FILENAME
```

2.6.5 Prepare Directories

```
#cleanup
rm -rf $HOME/.local/share/eosio/nodeos || true

#create dirs
mkdir $HOME/.local/share/eosio/nodeos/data/blocks -p
mkdir $HOME/.local/share/eosio/nodeos/data/snapshots -p
mkdir $HOME/.local/share/eosio/nodeos/config -p
```

Snapshots

If you would like an up to date snapshot, please visit: snapshots.eosnation.io and find the latest snapshot for the chain you are using. You will want to unpack the file and store it here with the following file name: `$HOME/.local/share/eosio/nodeos/data/snapshots/boot.bin`.

Kylin

```
URL="http://storage.googleapis.com/eos-kylin-snapshot/snapshot-2019-06-10-09(utc)-
↪0312d3b9843e2efa6831806962d6c219d37200e0b897a0d9243bcab40b2b546b.bin"
P2P_FILE=https://raw.githubusercontent.com/cryptokylin/CryptoKylin-Testnet/master/
↪fullnode/config/config.ini
GENESIS=https://raw.githubusercontent.com/cryptokylin/CryptoKylin-Testnet/master/
↪genesis.json
CHAIN_STATE_SIZE=256000
wget $URL -O $HOME/.local/share/eosio/nodeos/data/snapshots/boot.bin
```

Jungle

You can find more Jungle peers here: https://monitor.jungletestnet.io/#p2p

```
export MONTH=01
export DAY=09
wget https://eosn.sfo2.digitaloceanspaces.com/snapshots/snapshot-2020-$MONTH-$DAY-15-
↪jungle.bin.bz2
bzip2 -d ./snapshot-2020-01-09-15-jungle.bin.bz2
mv snapshot-2020-01-09-15-jungle.bin $HOME/.local/share/eosio/nodeos/data/snapshots/
↪boot.bin
P2P_FILE=https://validate.eosnation.io/jungle/reports/config.txt
GENESIS=https://raw.githubusercontent.com/EOS-Jungle-Testnet/Node-Manual-Installation/
↪master/genesis.json
CHAIN_STATE_SIZE=256000
```

Mainnet

```
URL="https://s3.eu-central-1.wasabisys.com/eosnodetools/snapshots/snap_2019-12-15-13-
↪00.tar.gz"
P2P_FILE=https://eosnodes.privex.io/?config=1
GENESIS=https://raw.githubusercontent.com/CryptoLions/EOS-MainNet/master/genesis.json
CHAIN_STATE_SIZE=16384
cd $HOME/.local/share/eosio/nodeos/data
wget $URL -O - | tar xvz
```

(continues on next page)

(continued from previous page)

```
SNAPFILE=`ls snapshots/*.bin | head -n 1 | xargs -n 1 basename`
mv snapshots/$SNAPFILE snapshots/boot.bin
```

2.6.6 Configuration

Please note that it is crucial that all of the following configuration flags are set. If any are missing, it will likely cause issues with running tht DSP software.

```
cd $HOME/.local/share/eosio/nodeos/config

# download genesis
wget $GENESIS
# config
cat <<EOF >> $HOME/.local/share/eosio/nodeos/config/config.ini
agent-name = "DSP"
http-server-address = 0.0.0.0:8888
p2p-listen-endpoint = 0.0.0.0:9876
blocks-dir = "blocks"
abi-serializer-max-time-ms = 3000
max-transaction-time = 150000
wasm-runtime = eos-vm
eos-vm-oc-enable = true
reversible-blocks-db-size-mb = 1024
contracts-console = true
p2p-max-nodes-per-host = 1
allowed-connection = any
max-clients = 100
sync-fetch-span = 500
connection-cleanup-period = 30
http-validate-host = false
access-control-allow-origin = *
access-control-allow-headers = *
access-control-allow-credentials = false
verbose-http-errors = true
http-threads=8
net-threads=8
chain-threads=8
eos-vm-oc-compile-threads=2
trace-history-debug-mode = true
trace-history = true
http-max-response-time-ms = 500
plugin = eosio::producer_plugin
plugin = eosio::chain_plugin
plugin = eosio::chain_api_plugin
plugin = eosio::net_plugin
plugin = eosio::state_history_plugin
state-history-endpoint = 0.0.0.0:8887
chain-state-db-size-mb = $CHAIN_STATE_SIZE
EOF

curl $P2P_FILE > p2p-config.ini
cat p2p-config.ini | grep "p2p-peer-address" >> $HOME/.local/share/eosio/nodeos/
↪config/config.ini
```

Please note the following about some `config.ini` settings:

- `read-mode = head` (default is: `read-more = speculative` and does not need to be specified in the `config.ini`) must not be used to prevent duplicate `xwarmup` actions | read more about read modes here
- if supporting the Hyperion API https://github.com/eosrio/Hyperion-History-API, must add the `chain-state-history = true`, note this will significantly increase storage requirements

2.6.7 Run

First run (from snapshot)

```
nodeos --disable-replay-opts --snapshot $HOME/.local/share/eosio/nodeos/data/
↪snapshots/boot.bin --delete-all-blocks
```

You will know that the node is fully synced once you see blocks being produced every half second at the head block. You can match the block number you are seeing in the nodeos logs to what bloks.io is indicating as the head block on the chain you are syncing (mainnet, Kylin etc). Once you have confirmed that it is synced press `CTRL+C` once, wait for the node to shutdown and proceed to the next step.

2.6.8 systemd

```
export NODEOS_EXEC=`which nodeos`
export NODEOS_USER=$USER
sudo -E su - -p
cat <<EOF > /lib/systemd/system/nodeos.service
[Unit]
Description=nodeos
After=network.target
[Service]
User=$NODEOS_USER
ExecStart=$NODEOS_EXEC --disable-replay-opts
[Install]
WantedBy=multi-user.target
EOF

systemctl start nodeos
systemctl enable nodeos
exit
sleep 3
systemctl status nodeos
```

2.6.9 Optimizations

- atticlab - cpu performance presentation

2.7 IPFS

The InterPlanetary File System is a protocol and peer-to-peer network for storing and sharing data in a distributed file system. IPFS uses content-addressing to uniquely identify each file in a global namespace connecting all computing devices. The DSPs utilize this as the storage layer to request and serve information to and from vRAM <> RAM as a caching solution.

2.7.1 Standalone

go-ipfs

Hardware Requirements

Prerequisites

- golang
- systemd

Ubuntu/Debian

```
sudo apt-get update
sudo apt-get install golang-go -y
```

Centos/Fedora/AWS Linux v2

```
sudo yum install golang -y
```

Install

```
sudo su -
VERS=0.4.22
DIST="go-ipfs_v${VERS}_linux-amd64.tar.gz"
wget https://dist.ipfs.io/go-ipfs/v$VERS/$DIST
tar xvfz $DIST
rm *.gz
mv go-ipfs/ipfs /usr/local/bin/ipfs
exit
```

Configure systemd

```
sudo su -
ipfs init
ipfs config Addresses.API /ip4/0.0.0.0/tcp/5001
ipfs config Addresses.Gateway /ip4/0.0.0.0/tcp/8080
cat <<EOF > /lib/systemd/system/ipfs.service
[Unit]
Description=IPFS daemon
After=network.target
[Service]
ExecStart=/usr/local/bin/ipfs daemon
Restart=always
[Install]
WantedBy=multi-user.target
EOF
```

(continues on next page)

(continued from previous page)

```
systemctl start ipfs
systemctl enable ipfs

exit
```

Adding Peers

To connect with your peers you may open port 4001 to the selected IPs that you wish to communicate with or open the port to all addresses.

Bootstrap Peers | Documentation

Bootstrap peers default to IPFS nodes provided by the core development team. They are scattered across the world. These peers are what your IPFS node will initially monitor upon startup. You may add our mainnet and kylin testnet IPFS nodes with the following commands:

```
# kylin

ipfs bootstrap add /ip4/52.70.167.190/tcp/4001/ipfs/
↪QmZ5gLTZwvfD5DkbbaFFX4YJCi7f4C5oQAgq8qpjL8S1ur
ipfs bootstrap add /ip4/34.224.152.33/tcp/4001/ipfs/
↪QmcCX4b3EF3eXaDe5dgxTL9mXbyci4FwcJAjWqpub5vCXM
```

Swarm Peers | Documentation

Swarm peers are addresses that the local daemon will listen on for connections from other IPFS peers. They are what your IPFS node will look to first when requesting a file that is not cached locally. Both your node as well as the node you are trying to connect to must run the following commands:

```
# kylin

ipfs swarm connect /ip4/52.70.167.190/tcp/4001/ipfs/
↪QmZ5gLTZwvfD5DkbbaFFX4YJCi7f4C5oQAgq8qpjL8S1ur
ipfs swarm connect /ip4/34.224.152.33/tcp/4001/ipfs/
↪QmcCX4b3EF3eXaDe5dgxTL9mXbyci4FwcJAjWqpub5vCXM
```

Reconnecting Periodically | Medium Article

Peers have a tendency to disconnect from each other if not reconnected manually periodically, so to combat this, you may add the following two files to periodically reconnect to your swarm peers.

```
sudo su -
cat <<EOF > /lib/systemd/system/gateway-connector.service
[Unit]
Description=Job that periodically connects this IPFS node to the gateway node
[Service]
ExecStart=/usr/local/bin/ipfs swarm connect <ADD_MULTIPLE_CONNECTIONS_HERE_SPACE_
↪SEPARATED> # /ip4/52.70.167.190/tcp/4001/ipfs/
↪QmZ5gLTZwvfD5DkbbaFFX4YJCi7f4C5oQAgq8qpjL8S1ur /ip4/34.224.152.33/tcp/4001/ipfs/
↪QmcCX4b3EF3eXaDe5dgxTL9mXbyci4FwcJAjWqpub5vCXM
```

(continues on next page)

(continued from previous page)

```
Environment="IPFS_PATH=/root/.ipfs"
EOF
exit
```

```
sudo su -
cat <<EOF > /lib/systemd/system/gateway-connector.timer
[Unit]
Description=Timer that periodically triggers gateway-connector.service
[Timer]
OnBootSec=3min
OnUnitActiveSec=1min
[Install]
WantedBy=timers.target
EOF
exit
```

Now you can enable and start the service:

```
sudo systemctl enable gateway-connector.timer
sudo systemctl start gateway-connector.timer
```

To double checked this worked, run:

```
systemctl list-timers
```

You should see an entry for your gateway connector service. You can also check the status of its last execution attempt by running:

```
systemctl status gateway-connector
```

Finally you can monitor the process with:

```
journalctl -f | grep ipfs
```

Running a private network | Documentation

Running a private IPFS network is possible by removing all default IPFS bootstrap peers and only adding those of your private network.

```
ipfs bootstrap rm all - Remove all peers from the bootstrap list
```

2.7.2 Cluster

IPFS-Cluster | Documentation

Bootsrapping from an existing IPFS Cluster | Documentation

IPFS is designed so that a node only stores files locally that are specifically requested. The following is one way of populating a new IPFS node with all existing files from a pre-existing node.

To do so, first create a secret from `node0`, the original node, then share that secret with `node1`, the node you want to bootstrap from `node0`. Then `node1` runs the bootstrap command specifying the cluster's address and setting the `CLUSTER_SECRET` as an env variable.

node0

- `export CLUSTER_SECRET=$(od -vN 32 -An -tx1 /dev/urandom | tr -d ' \n')`
- `echo $CLUSTER_SECRET`
- `ipfs-cluster-service init`
- `ipfs-cluster-service daemon`

node1 (bootstrapping from node0)

- `export CLUSTER_SECRET=<copy from node0>`
- `ipfs-cluster-service init`
- `ipfs-cluster-service daemon --bootstrap /ip4/192.168.1.2/tcp/9096/ipfs/QmZjSoXUQgJ9tutP1rXjjNYwTrRM9QPhmD9GHVjbtgWxEn` // replace with what you see from running node0's daemon
- `ipfs-cluster-ctl peers ls` check your peers to see you've added node0 correctly

node0

- if you want to remove a peer after the bootstrapping is complete, the following command will do that and shut down the IPFS cluster
- `ipfs-cluster-ctl peers rm QmYFYwnFUkjFhJcSJJGN72wwedZnpQQ4aNpAtPZt8g5fCd`

2.8 PostgreSQL Database Backend

A PostgreSQL databse is utilized to prevent duplicate DSP transactions by creating, getting, and updating service events as needed. An external database can be set by ensuring the `node_env` variable in the `config.toml` file is set to `production`. The database settings may be specified with the `url` variable, e.g., `postgres://user:pass@example.com:5432/dbname`.

2.8.1 config.toml:

```
[database]

# url syntax: postgres://user:pass@example.com:5432/dbname, only necessary for␣
↪production

url = "postgres://user:pass@example.com:5432/dbname"

# production (uses above database_url for database)

node_env = "production"
```

2.8.2 How to install postgres on Ubuntu

```
wget --quiet -O - https://www.postgresql.org/media/keys/ACCC4CF8.asc | sudo apt-key␣
↪add -
echo "deb http://apt.postgresql.org/pub/repos/apt/ `lsb_release -cs`-pgdg main" |sudo␣
↪tee  /etc/apt/sources.list.d/pgdg.list
sudo apt update
sudo apt -y install postgresql-12 postgresql-client-12
```

2.8.3 Setup database and user

```
sudo su - postgres
psql
CREATE DATABASE dsp;
CREATE USER dsp WITH ENCRYPTED PASSWORD 'Put-Some-Strong-Password-Here';
GRANT ALL PRIVILEGES ON DATABASE dsp to dsp;
```

2.8.4 How to wipe local database

```
sudo su - postgres
psql
\l  # to list database and find your DB name, mine is "dsp"
\c dsp #to connect to the DB
drop table "Settings";
drop table "ServiceRequests";
<CTRL> d # exit
```

2.9 DSP Node

2.9.1 Prerequisites

- git

Linux

```
sudo su -
curl -o- https://raw.githubusercontent.com/creationix/nvm/v0.34.0/install.sh | bash
export NVM_DIR="${XDG_CONFIG_HOME/:-$HOME/.}nvm"
[ -s "$NVM_DIR/nvm.sh" ] && \. "$NVM_DIR/nvm.sh" # This loads nvm
# latest is 10.17.0 which has issues
nvm install 10.16.3
nvm use 10.16.3
exit
```

Ubuntu/Debian

```
sudo apt install -y make cmake build-essential python npm git node-typescript
```

Centos/Fedora/AWS Linux:

```
sudo yum install -y make cmake3 python
```

2.9.2 Install

```
sudo su -
npm install -g pm2
npm install -g @liquidapps/dsp --unsafe-perm=true
exit
```

2.9.3 Configure Settings

Any changes to the `config.toml` file will require `setup-dsp` to be run again. Link to `sample-config.toml`

```
sudo su -
mkdir ~/.dsp
cp $(readlink -f `which setup-dsp` | xargs dirname)/sample-config.toml ~/.dsp/config.
↪toml
nano ~/.dsp/config.toml
exit
```

2.9.4 Launch DSP Services

```
sudo su -
cd $(readlink -f `which setup-dsp` | xargs dirname)
setup-dsp
exit
```

2.9.5 Logs

There are several log files when it comes to the DAPP Service Providers. The `logs` folder can be found in the directory the `dsp` software was installed in. Each service has its own log file, for example: `DSP_NAME_HERE-ipfs-dapp-service-node-2020-03-03.log`. The service file will log the service related information.

For verbose logs, set env variable: `DSP_VERBOSE_LOGS` to true.

There is also a demux and dapp service node log `DSP_NAME_HERE-demux-2020-03-03.log`, `DSP_NAME_HERE-dapp-services-node-2020-03-03.log`. The demux log tracks the interaction with the state history node, listening for relevant information for the DSP to act upon. The dapp service node log is the first point of contact when sending a transaction to the DSP, this is the gateway that fields requests to the correct

service files, to the nodeos RPC API in the case of say pushing a transaction or fetching a table row, or using the `/v1/dsp/version` endpoint for returning the current version of the DSP software on the node.

Finally for each chain a DSP supports with LiquidX there is an additional dapp service node and demux log `DSP_NAME_HERE-CHAIN_NAME_HERE-dapp-services-node-2020-03-03.log` `DSP_NAME_HERE-CHAIN_NAME_HERE-demux-2020-03-03.log`.

```
sudo su -
cd $(readlink -f `which setup-dsp` | xargs dirname)
cd logs
exit
```

2.9.6 Additional Logs

`pm2 logs` can be used to ensure that there are no issues outside of the logging statements used. For example, if a javascript file was improperly formatted, that error may show up in `pm2 logs`.

```
sudo su -
pm2 logs
exit
```

Output sample:

```
/root/.pm2/logs/readfn-dapp-service-node-error.log last 15 lines:
/root/.pm2/logs/dapp-services-node-out.log last 15 lines:
0|dapp-ser | 2019-06-03T00:46:49: services listening on port 3115!
0|dapp-ser | 2019-06-03T00:46:49: service node webhook listening on port 8812!

/root/.pm2/logs/demux-out.log last 15 lines:
1|demux    | 2019-06-05T14:41:12: count 1

/root/.pm2/logs/ipfs-dapp-service-node-out.log last 15 lines:
2|ipfs-dap | 2019-06-04T19:03:04: commited to: ipfs://
↪zb2rhXKc8zSVppFhKm8pHLBuyGb7vPeCnpZqcmjFnDLA9LLBb

/root/.pm2/logs/log-dapp-service-node-out.log last 15 lines:
3|log-dapp | 2019-06-03T00:46:49: log listening on port 13110!
3|log-dapp | 2019-06-03T00:46:52: LOG SVC NODE 2019-06-03T00:46:52.413Z INFO  index.
↪js:global:0             Started Service

/root/.pm2/logs/vaccounts-dapp-service-node-out.log last 15 lines:
4|vaccount | 2019-06-03T00:46:50: vaccounts listening on port 13129!

/root/.pm2/logs/oracle-dapp-service-node-out.log last 15 lines:
5|oracle-d | 2019-06-03T00:46:50: oracle listening on port 13112!

/root/.pm2/logs/cron-dapp-service-node-out.log last 15 lines:
6|cron-dap | 2019-06-03T00:46:50: cron listening on port 13131!

/root/.pm2/logs/readfn-dapp-service-node-out.log last 15 lines:
7|readfn-d | 2019-06-03T00:46:50: readfn listening on port 13141!
```

All logs may be monitored with this script:

```
#! /bin/bash

tail -f /root/.pm2/logs/*log* ~/.nvm/versions/node/$(node -v)/lib/node_modules/
↪@liquidapps/dsp/zeus_boxes/dapp-services-deploy/logs/*log*
```

2.10 Packages

2.10.1 Register

These json files are primarily used by DSP portals to display information.

Prepare and host dsp.json

```
{
    "name": "acme DSP",
    "website": "https://acme-dsp.com",
    "code_of_conduct":"https://...",
    "ownership_disclosure" : "https://...",
    "email":"dsp@acme-dsp.com",
    "branding":{
      "logo_256":"https://....",
      "logo_1024":"https://....",
      "logo_svg":"https://...."
    },
    "location": {
      "name": "Atlantis",
      "country": "ATL",
      "latitude": 2.082652,
      "longitude": 1.781132
    },
    "social":{
      "steemit": "",
      "twitter": "",
      "youtube": "",
      "facebook": "",
      "github":"",
      "reddit": "",
      "keybase": "",
      "telegram": "",
      "wechat":""
    }

}
```

Prepare and host dsp-package.json

```
{
    "name": "Package 1",
    "description": "Best for low vgrabs",
```

(continues on next page)

(continued from previous page)

```
    "dsp_json_uri": "https://acme-dsp.com/dsp.json",
    "logo":{
      "logo_256":"https://....",
      "logo_1024":"https://....",
      "logo_svg":"https://...."
    },
    "service_level_agreement": {
        "availability":{
            "uptime_9s": 5
        },
        "performance":{
            "95": 500
        }
    },
    "pinning":{
        "ttl": 2400,
        "public": false
    },
    "locations":[
        {
          "name": "Atlantis",
          "country": "ATL",
          "latitude": 2.082652,
          "longitude": 1.781132
        }
    ]
}
```

Register Package

Packages are needed for consumers to stake to in order for DAPP Service Providers to provide services. Packages are disabled by default.

Once the register command has been run with cleos or zeus, **the package must be enabled!** See *Enable/Disable Package*

- Mainnet DSP packages
- Kylin DSP packages

```
npm install -g @liquidapps/zeus-cmd
# the package must be chosen from the following list:
# packages: (ipfs, cron, log, oracle, readfn, vaccounts, storage, auth)
export PACKAGE=ipfs
export DSP_ACCOUNT=
# active key to sign package creation trx
export DSP_PRIVATE_KEY=
# customizable and unique name for your package
export PACKAGE_ID=package1
export EOS_CHAIN=mainnet
# or
export EOS_CHAIN=kylin
# the minimum stake quantity is the amount of DAPP and/or DAPPHDL that must be staked␣
↪to meet the package's threshold for use
export MIN_STAKE_QUANTITY="10.0000"
# package period is in seconds, so 86400 = 1 day, 3600 = 1 hour
```

(continues on next page)

(continued from previous page)

```
export PACKAGE_PERIOD=86400
# the time to unstake is the greater of the package period remaining and the minimum␣
↪unstake period, which is also in seconds
export MIN_UNSTAKE_PERIOD=3600
# QUOTA is the measurement for total actions allowed within the package period to be␣
↪processed by the DSP.  1.0000 QUOTA = 10,000 actions. 0.0001 QUOTA = 1 action
export QUOTA="1.0000"
export DSP_ENDPOINT=https://acme-dsp.com
# package json uri is the link to your package's information, this is customizable␣
↪without a required syntax
export PACKAGE_JSON_URI=https://acme-dsp.com/package1.dsp-package.json
# The annual inflation rate of the DAPP token may be tuned by the community. This is␣
↪done by DSP's specifying a desired inflation rate during package registration. All␣
↪existing packages default to the original annual inflation rate of 2.71%
export ANNUAL_INFLATION=2.71

cd $(readlink -f `which setup-dsp` | xargs dirname)/../..
zeus register dapp-service-provider-package \
    $PACKAGE $DSP_ACCOUNT $PACKAGE_ID \
    --key $DSP_PRIVATE_KEY \
    --min-stake-quantity $MIN_STAKE_QUANTITY \
    --package-period $PACKAGE_PERIOD \
    --quota $QUOTA \
    --network $EOS_CHAIN \
    --api-endpoint $DSP_ENDPOINT \
    --package-json-uri $PACKAGE_JSON_URI \
    --min-unstake-period $MIN_UNSTAKE_PERIOD \
    --inflation $ANNUAL_INFLATION
```

Or in cleos:

```
# currently available services: (ipfsservice1, cronservices, logservices1,␣
↪oracleservic, readfndspsvc, accountless1)
# the services use EOS account names to fascilitate usage
# service contract names may be found in the boxes/groups/services/SERVICE_NAME/
↪models/dapp-services/*.json file as the ( contract ) parameter
export SERVICE=ipfsservice1
# zeus command automatically adds QUOTA / DAPP, so we must add it here
export QUOTA="1.0000 QUOTA"
export MIN_STAKE_QUANTITY="10.0000 DAPP"
export EOS_ENDPOINT=https://kylin-dsp-1.liquidapps.io # or mainnet: https://api.
↪eosnewyork.io
cleos -u $EOS_ENDPOINT push action dappservices regpkg "{\"newpackage\":{\"api_
↪endpoint\":\"$DSP_ENDPOINT\",\"enabled\":0,\"id\":0,\"min_stake_quantity\":\"$MIN_
↪STAKE_QUANTITY\",\"min_unstake_period\":\"$MIN_UNSTAKE_PERIOD\",\"package_id\":\"
↪$PACKAGE_ID\",\"package_json_uri\":\"$PACKAGE_JSON_URI\",\"package_period\":\"
↪$PACKAGE_PERIOD\",\"provider\":\"$DSP_ACCOUNT\",\"quota\":\"$QUOTA\",\"service\":\"
↪$SERVICE\"},
\"annual_inflation\":$ANNUAL_INFLATION}" -p $DSP_ACCOUNT
```

Example service contract name for LiquidAccounts: https://github.com/liquidapps-io/zeus-sdk/blob/master/boxes/groups/services/vaccounts-dapp-service/models/dapp-services/vaccounts.json#L7

List of all services, please note some of which may not be testable yet: https://github.com/liquidapps-io/zeus-sdk/tree/master/boxes/groups/services, see the stage for each service to monitor its development maturity (WIP - work in progress, Alpha, Beta, Stable).

output should be:

```
registering package:package1
✓package:package1 registered successfully
```

For more options:

```
zeus register dapp-service-provider-package --help
```

Don't forget to stake CPU/NET to your DSP account:

```
cleos -u $DSP_ENDPOINT system delegatebw $DSP_ACCOUNT $DSP_ACCOUNT "5.000 EOS" "95.
↪000 EOS" -p $DSP_ACCOUNT@active
```

Modify Package metadata:

Currently only `package_json_uri` and `api_endpoint` are modifyable. To signal to DSP Portals / Developers that your package is no longer in service, set your `api_endpoint` to `null`.

To modify package metadata: use the "modifypkg" action of the dappservices contract.

Using cleos:

```
cleos -u $DSP_ENDPOINT push action dappservices modifypkg "[\"$DSP_ACCOUNT\",\"
↪$PACKAGE_ID\",\"ipfsservice1\",\"$DSP_ENDPOINT\",\"https://acme-dsp.com/modified-
↪package1.dsp-package.json\"]" -p $DSP_ACCOUNT@active
```

Enable/Disable Package:

Packages are disabled by default. A package may be disabled or enabled by using the `disablepkg` or `enablepkg` on the `dappservices` contract. If a package is disabled, the consumer will no longer be able to utilize DSP services for that package.

Update cost per action in QUOTA

The `pricepkg` action on the `dappservices` contract allows a DSP to set how much QUOTA to bill for per action. For example, a DSP could decide to charge 0.0002 QUOTA per vRAM warmup. The default for each action is 0.0001 QUOTA. The billable actions for all services may be found in the `zeus-sdk/boxes/groups/services/SERVICE_NAME-dapp-service/models/dapp-services/SERVICE_NAME.json`, for example: vRAM.

- name provider - DSP name
- name package_id - package name
- name service - service name, e.g., ipfsservice1
- name action - action name, e.g., warmup, commit, geturi, etc
- uint64_t cost - QUOTA cost per action, e.g., 1 = 0.0001 QUOTA, 5, = 0.0005 QUOTA, etc

2.11 Testing

2.11.1 Test your DSP with vRAM

Please note, if you wish to test on the mainnet, this will require the purchase of DAPP tokens or the use of DAPPHDL tokens (Air-HODL). In the case of Kylin, we provide a DAPP token faucet.

Create Mainnet or Kylin Account:

- *Kylin*
- Mainnet

Install Zeus:

```
npm install -g @liquidapps/zeus-cmd
```

Unbox coldtoken contract:

```
mkdir coldtoken; cd coldtoken
zeus box create
zeus unbox coldtoken
```

Compile and deploy contract for testing:

```
# your DSP's API endpoint
export DSP_ENDPOINT=
# a new account to deploy your contract to
export ACCOUNT=
# your new account's active public key
export ACTIVE_PUBLIC_KEY=
# compile coldtoken contract
zeus compile
cd contracts/eos
# set eosio.code permission
cleos -u $DSP_ENDPOINT set account permission $ACCOUNT active "{\"threshold\":1,\
↪"keys\":[{\"weight\":1,\"key\":\"$ACTIVE_PUBLIC_KEY\"}],\"accounts\":[{\"permission\
↪":{\"actor\":\"$ACCOUNT\",\"permission\":\"eosio.code\"},\"weight\":1}]}" owner -p
↪$ACCOUNT@active
# set contract
cleos -u $DSP_ENDPOINT set contract $ACCOUNT ./coldtoken
```

Select and stake to DSP:

```
# your DSP's account
export DSP_ACCOUNT=
# your DSP's service
export DSP_SERVICE=
# your DSP's package
```

(continues on next page)

(continued from previous page)

```
export DSP_PACKAGE=
# your DSP's minimum stake quantity in DAPP or DAPPHDL (example: 10.0000 DAPP or 10.
↪0000 DAPPHDL)
export MIN_STAKE_QUANTITY=
# select DSP package
cleos -u $DSP_ENDPOINT push action dappservices selectpkg "{\"owner\":\"$ACCOUNT\",\
↪"provider\":\"$DSP_ACCOUNT\",\"service\":\"$DSP_SERVICE\",\"package\":\"$DSP_
↪PACKAGE\"}" -p $ACCOUNT
# stake to DSP package with DAPP
cleos -u $DSP_ENDPOINT push action dappservices stake "{\"owner\":\"$ACCOUNT\",\
↪"provider\":\"$DSP_ACCOUNT\",\"service\":\"$DSP_SERVICE\",\"quantity\":\"$MIN_STAKE_
↪QUANTITY\"}" -p $ACCOUNT
# stake to DSP package with DAPPHDL, only available on mainnet
cleos -u $DSP_ENDPOINT push action dappairhodl1 stake "{\"owner\":\"$ACCOUNT\",\
↪"provider\":\"$DSP_ACCOUNT\",\"service\":\"$DSP_SERVICE\",\"quantity\":\"$MIN_STAKE_
↪QUANTITY\"}" -p $ACCOUNT
```

Run test commands:

```
# create coldtoken
cleos -u $DSP_ENDPOINT push action $ACCOUNT create "{\"issuer\":\"$ACCOUNT\",\
↪"maximum_supply\":\"1000000000 TEST\"}" -p $ACCOUNT
# issue some TEST
cleos -u $DSP_ENDPOINT push action $ACCOUNT issue "{\"to\":\"$ACCOUNT\",\"quantity\":\
↪"1000 TEST\",\"memo\":\"Testing issue\"}" -p $ACCOUNT
```

Test vRAM get table row:

```
# you must be in the root of the box to run this command
cd ../../
zeus get-table-row $ACCOUNT "accounts" $ACCOUNT "TEST" --endpoint $DSP_ENDPOINT |␣
↪python -m json.tool
# with curl:
curl http://$DSP_ENDPOINT/v1/dsp/ipfsservice1/get_table_row -d '{"contract":"CONTRACT_
↪ACCOUNT","scope":"SCOPE","table":"TABLE_NAME","key":"TABLE_PRIMARY_KEY"}' | python -
↪m json.tool
```

Transfer:

```
cleos -u $DSP_ENDPOINT push action $ACCOUNT transfer "{\"from\":\"$ACCOUNT\",\"to\":\
↪"natdeveloper\",\"quantity\":\"1000 TEST\",\"memo\":\"Testing transfer\"}" -p
↪$ACCOUNT
zeus get-table-row $ACCOUNT "accounts" "natdeveloper" "TEST" --endpoint $DSP_ENDPOINT␣
↪| python -m json.tool
```

Check logs on your DSP Node

```
pm2 logs
```

vRAM related actions to look for in a block explorer:

Look for "xcommit" and "xcleanup" actions on your contract: https://bloks.io/

- **xcommit** - The commit request instructs a DSP to write new data to their local IPFS cluster node. A developer can utilize the setData function from within their smart contract to first hash the new data in order to return a URI, before dispatching a commit request which is caught by the DSP node. In a similar way the getData function can be utilized in order to fetch the data for the smart contract or request a Warmup in case it is missing.
- **xcleanup** - A cleanup request sends a request to the DSP to evict a file from the cache. This is an asynchronous request.

More information on vRAM related actions can be found here: https://medium.com/@liquidapps/vram-guide-for-experts-f809c8f82a27

2.12 Claim Rewards

2.12.1 Claim your DAPP daily rewards:

```
cleos push action dappservices claimrewards "[\"$DSP_ACCOUNT\"]" -p $DSP_ACCOUNT
```

2.12.2 With Bloks.io:

Claim

2.13 Replay Contract

As a DSP, you will want the ability to replay a contract's vRAM (IPFS) related transactions to load that data into your IPFS cluster. We provide a file that does just that replay-contract.js.

To do this you will need to sign up for an API key from dfuse.io, you can select the *Server to Server* option from the dropdown when creating it. Dfuse offers free keys that last 24 hours, so there's no need to pay.

There are some mandatory and optional environment variables.

Hyperion may also be used thanks to Christoph Michel: replay-contract-hyperion.js. List of endpoints here: https://hyperion.docs.eosrio.io/endpoint/, status of endpoint (UP/DOWN) here: https://bloks.io/hyperion

2.13.1 Mandatory:

```
# contract to replay
export CONTRACT=
export NODEOS_CHAINID=
↪"aca376f206b8fc25a6ed44dbdc66547c36c6c33e3a119ffbeaef943642f0e906" # < mainnet |␣
↪kylin > "5fff1dae8dc8e2fc4d5b23b2c7665c97f9e9d8edf2b6485a86ba311c25639191"
export DSP_ALLOW_API_NON_BROADCAST=true # enables the `/event` DSP API endpoint to␣
↪accept non-blocking service events such as xcommits.
export DSP_ENDPOINT=
# using Dfuse?
export DFUSE_API_KEY=
# using Hyperion?
```

(continues on next page)

(continued from previous page)

```
export HYPERION_ENDPOINT=https://eos.hyperion.eosrio.io
export HYPERION_SORT_DIRECTION=asc # can also be desc, ascending starts from first␣
↪block, descending starts from head block of chains
```

2.13.2 Sidechain:

If replaying an account on a sidechain, must add the following environment variables.

- `SIDECHAIN` if using a sidechain, must specify sidechain name (sidechain names can be found *here*)
- `SIDECHAIN_DSP_PORT` if using a sidechain, must specify sidechain DSP's port
- `DSP_LIQUIDX_CONTRACT` the liquidx contract name must be set `liquidx.dsp` on mainnet if cleaning a sidechain
- `NODEOS_MAINNET_ENDPOINT` set mainnet nodeos endpoint

2.13.3 Optional:

```
export LAST_BLOCK= # defaults to 35000000, this is the last block to sync from, find␣
↪the first vRAM transaction for the contract and set the block before it
export DFUSE_ENDPOINT= # defaults to 'mainnet.eos.dfuse.io', can set to `kylin.eos.
↪dfuse.io`
export BLOCK_COUNT_PER_QUERY= # defaults to 1000000
export NODEOS_SECURED= # defaults to true
export NODEOS_HOST= # defaults to localhost
export NODEOS_PORT= # defaults to 13015
```

Once you've set those, simply run with:

```
sudo find / -name replay-contract.js
node /root/.nvm/versions/node/v10.16.0/lib/node_modules/@liquidapps/dsp/utils/ipfs-
↪service/replay-contract.js
# or hyperion
node /root/.nvm/versions/node/v10.16.0/lib/node_modules/@liquidapps/dsp/utils/ipfs-
↪service/replay-contract-hyperion.js

# sent 6513 saved 7725.26KB 6.42KB/s Block:77756949
```

2.14 Cleanup IPFS and Oracle Entries

Sometimes IPFS or Oracle entries are not evicted from a developer's contract due to the DSP experiencing unpredictable behavior. This causes the developer's smart contract RAM supply to increase as the `ipfsentry` / `oracleentry` table rows are not evicted. If this happens, you may run the cleanup.js file with the following environment variables:

The cleanup script will auto detect which table to cleanup `ipfsentry` or `oracleentry` depending on which one is present on the contract. If both are set, you can use the `TABLE` env variable to specify which to cleanup.

2.14.1 Mandatory:

- `CONTRACT` contract to clean IPFS / oracle entries

- `DSP_ENDPOINT` the DSP's endpoint that you staked to for IPFS and/or Oracle services
- `TABLE` specify table name to be cleaed: (ipfs (vRAM) table: `ipfsentry` or oracle table: `oracleentry`)
- `DSP_ALLOW_API_NON_BROADCAST` enables the `/event` DSP API endpoint to accept non-blocking service events such as xcommits.

```
export CONTRACT=lqdportfolio
export DSP_ENDPOINT=http://kylin-dsp-2.liquidapps.io
export TABLE=ipfsentry
export DSP_ALLOW_API_NON_BROADCAST=true
```

2.14.2 Sidechain:

If cleaning an account on a sidechain, must add the following environment variables.

- `SIDECHAIN` if using a sidechain, must specify sidechain name (sidechain names can be found *here*)
- `SIDECHAIN_DSP_PORT` if using a sidechain, must specify sidechain DSP's port
- `DSP_LIQUIDX_CONTRACT` the liquidx contract name must be set `liquidx.dsp` on mainnet if cleaning a sidechain
- `NODEOS_MAINNET_ENDPOINT` set mainnet nodeos endpoint

2.14.3 Optional:

- `CHUNK_SIZE` represents the number of async requests for cleanups to send to the DSP at a time

```
export CHUNK_SIZE= # defaults to 5
export TABLE= # defaults to ipfsentry or oracleentry by detecting from contract
# if using dfuse
export DFUSE_PUSH_ENABLE=true
export DFUSE_API_KEY="" # long-lived API key, see https://docs.dfuse.io/guides/core-
↪concepts/authentication/, e.g. (server_abcdef12312312300000000000000000)
export DFUSE_PUSH_GUARANTEE="in-block" # handoff:1, handoffs:2, handoffs:3,␣
↪irreversible
export DFUSE_NETWORK="mainnet"
```

Then run with:

```
sudo find / -name cleanup.js
node /root/.nvm/versions/node/v10.16.3/lib/node_modules/@liquidapps/dsp/zeus_boxes/
↪seed-utils-cleanup/utils/cleanup.js
```

2.15 Consumer Permissions

The consumer of DSP services may optionally create permissions that allow the consumer to pay for all CPU, NET, and RAM costs associated with the DSP services. This permission is optional. Without it, DSP services will continue to operate normally.

Process

- The consuming contract creates a `dsp` permission under the `active` permission

- The `dsp` permissions requires that each provider used by the consumer must be added, for example: provider1@active, provider2@active
- Each `xaction` required for the services used must be Link Authed to the `dsp` permission

2.15.1 Example of adding DSP_ACCOUNT_NAME_HERE@active to a DSP permission level

with Bloks.io

Login with your account's name using the cleos login option: https://kylin.bloks.io/wallet/permissions/advanced, and the cleos command will be auto generated for you.

- click "Add New Permission
- click on permission to get it to open up
- permission name: dsp
- parent: active
- threshold: 1
- add as many DSP to the accounts section with the active permission (heliosslene - active, uuddlrlrbass - active, etc)
- click save permission to have the cleos command auto generated

or Cleos

```
# CONTRACT_ACCOUNT_HERE - the account name that the consumer contract is deployed to
# DSP_ACCOUNT_NAME_HERE - the account name of the DSP staked to, if staked to␣
↪multiple DSPs, must add all DSP permissions
cleos -u https://kylin.eos.dfuse.io push transaction '{"delay_sec":0,"max_cpu_usage_ms
↪":0,"actions":[{"account":"eosio","name":"updateauth","data":{"account":"CONTRACT_
↪ACCOUNT_HERE","permission":"dsp","parent":"active","auth":{"threshold":1,"keys":[],
↪"accounts":[{"permission":{"actor":"DSP_ACCOUNT_NAME_HERE","permission":"active"},
↪"weight":1}],"waits":[]}},"authorization":[{"actor":"CONTRACT_ACCOUNT_HERE",
↪"permission":"active"}]}]}'
```

2.15.2 Example of linkauthing to each DSP xaction

with Bloks.io

Go here: https://kylin.bloks.io/wallet/permissions/link

- login using your contract's name for the cleos option
- Permission: dsp
- Contract name: CONTRACT_ACCOUNT_HERE, not the DSP name
- Contract action: xsignal
- Link Auth -> presto you have your cleos command
- You must repeat this process for all of the contract xactions you are using, you may find them by checking your ABI or using a block explorer to view your actions

or Cleos

```
# CONTRACT_ACCOUNT_HERE - the account name that the consumer contract is deployed to
# ACTION_NAME_HERE - action to linkauth dsp permission levle to
cleos -u https://kylin.eos.dfuse.io push transaction '{"delay_sec":0,"max_cpu_usage_ms
↪":0,"actions":[{"account":"eosio","name":"linkauth","data":{"account":"CONTRACT_
↪ACCOUNT_HERE","code":"CONTRACT_ACCOUNT_HERE","type":"ACTION_NAME_HERE","requirement
↪":"dsp"},"authorization":[{"actor":"CONTRACT_ACCOUNT_HERE","permission":"active"}]}
↪]}'
```

2.16 Upgrade DSP Node

For all new releases, please test on the Kylin testnet for at least one week before deploying to a production environment.

Link: sample-config.toml

```
sudo su -
systemctl stop ipfs
systemctl stop nodeos
# if changes to sample-config.toml syntax:
nano ~/.dsp/config.toml
pm2 del all
pm2 kill
npm uninstall -g @liquidapps/dsp
exit

# as USER
sudo chown ubuntu:ubuntu /home/ubuntu/.pm2/rpc.sock /home/ubuntu/.pm2/pub.sock
npm uninstall -g @liquidapps/dsp

sudo su -
npm install -g @liquidapps/dsp --unsafe-perm=true
# Ensure no new updates to the `sample-config.toml` file are present, if so, update␣
↪your config.toml accordingly.
sudo find / -name sample-config.toml
# nano <PATH>
setup-dsp
systemctl start nodeos
systemctl start ipfs
exit
```

If a DSP is not updating properly, you may try `pm2 restart all` to restart all processes.

2.16.1 Script for updating:

```
#! /bin/bash
systemctl stop dsp
pm2 del all
pm2 kill
npm uninstall -g @liquidapps/dsp
npm i -g @liquidapps/dsp --unsafe-perm=true
cd $(readlink -f `which setup-dsp` | xargs dirname)
```

- search

CHAPTER 3

Liquidx

3.1 LiquidX Getting Started

LiquidX enables DAPP Network services to be used between chains. A user can stake DAPP on the EOS mainnet for an account on another eosio based chain.

This is accomplished by creating a set of mappings between accounts. DSPs and Users must create a 2 way mapping where by they verify on the mainnet and on the chain in question that each account is linked. This topic is explored in more detail in the docs to follow.

3.1.1 Docs:

Use DAPP Network Services

Become a DSP on another chain

Example chains to add as a DSP

Add a Chain to LiquidX

3.2 Use DAPP Network Services

To utilize the DAPP Network on another chain as a developer, a two way mapping must first be established between the EOS mainnet account that is staking the DAPP to the service package and the account on the side chain that will use the services. The point of this mapping is to verify that an account on the EOS mainnet has given permission to an account on another chain to be able to bill on the EOS mainnet account's behalf. This mapping must also be verified on the new chain in question. A mainnet account can allow multiple new chain accounts to bill for services.

On the EOS mainnet this mapping is performed with the `addaccount` action on the `liquidx.dsp` account. On the new chain in question, this is performed with the `setlink` action on the account that has deployed the `dappservicex.cpp` contract (hopefully `dappservicex` for simplicity, but any account name can be used). To figure out what account name this is, a DSP, BP, or community member can be asked.

Guide:

- *Smart Contract Steps*
- *Add DSP on New Chain*
- *Map Mainnet to New Chain*
- *Map New Chain to Mainnet*

3.2.1 Smart Contract Steps

At the smart contract level, the `liquidx` box must be unboxed and `#define LIQUIDX` must be added at the top of the smart contract which uses the DAPP Network services. In order for the compiler to know which network the contract intends to be deployed on the `--sidechain` flag must be passed to `zeus compile --sidechain $SIDE_CHAIN_NAME`.

Ensure that you add `@eosio.code` to the active permission level of the account. This can be done with the `--add-code` flag on the `cleos set account permission` command.

The side chain name is the account on the EOS mainnet that has registered the chain. You may find what this contract is by asking a DSP, a BP, or the chain team itself.

2 files must be added. One to the `/zeus_boxes/liquidx/models/eosio-chains/` directory and one to the `/zeus_boxes/liquidx/models/liquidx-mappings/` directory.

`/zeus_boxes/liquidx/models/liquidx-mappings/sidechain_name.dappservices.json` - this maps the dappservices account on the mainnet to the dappservicex account name on the new chain

- sidechain_name - EOS mainnet account that has registered the chain
- mainnet_account - dappservices account on EOS mainnet
- chain_account - dappservicex account on new chain - enter the sidechain_name as the scope for the `chainentry` table, the `dappservices_contract` key will list the account name needed

```
{
    "sidechain_name":"",
    "mainnet_account":"dappservices",
    "chain_account":""
}
```

`/zeus_boxes/liquidx/models/eosio-chains/${CHAIN_ACCOUNT}.json` - this maps the chain's configuration details

- dsp_port - port DSP gateway runs on
- webhook_dapp_port - webhook port
- nodeos_host - nodeos host address
- nodeos_port - nodeos port
- secured - bool true/false for http/https for the nodeos address
- nodeos_state_history_port - port for nodeos state history websocket
- nodeos_p2p_port - nodeos peer 2 peer port
- nodeos_endpoint - full nodeos endpoint
- demux_port - demux port
- name - name of the chain account

- local - bool whether chain is local or not

```
{
    "dsp_port":13016,
    "webhook_dapp_port": 8813,
    "nodeos_host":"localhost",
    "nodeos_port":2424,
    "secured":false,
    "nodeos_state_history_port":12341,
    "nodeos_p2p_port":12451,
    "nodeos_endpoint":"http://localhost:2424",
    "demux_port":1232,
    "name":"CHAIN_ACCOUNT_HERE",
    "local":true
}
```

```
npm i -g @liquidapps/zeus-cmd
mkir liquidx; cd liquidx
zeus unbox liquidx
export MY_CONTRACT_NAME=
zeus create contract $MY_CONTRACT_NAME
cd zeus_boxes/contracts/eos
# edit MY_CONTRACT_NAME.cpp
cd ../../../
export SIDE_CHAIN_NAME=
zeus compile --sidechain $SIDE_CHAIN_NAME
cd zeus_boxes/contracts/eos
export EOS_ENDPOINT=
export ACCOUNT=
cleos -u $EOS_ENDPOINT set contract $ACCOUNT $MY_CONTRACT_NAME
```

3.2.2 Add DSP on New Chain

To use a DSP on a new chain, the consumer must submit an `adddsp` command on the new chain on the account that is hosting the `dappservicex.cpp` contract.

- owner {name} - name of consumer contract on new chain
- dsp {name} - dsp name on new chain (could be different from the mainnet DSP name), enter the mainnet DSP's account into the `accountlink` table on the `liquidx.dsp` contract to find this name

3.2.3 Map Mainnet to New Chain

To map an EOS mainnet account to a new chain's account, perform the `addaccount` action on the `liquidx.dsp` account.

- owner {name} - name of account on the EOS mainnet staked to services
- chain_account {name} - name of account on new chain to use services
- chain_name {name} - account on mainnet that has registered the new chain, should be publicly available from a representative of the chain (DSP, BP, community)

Example cleos command:

```
cleos -u https://nodes.get-scatter.com:443 push transaction '{"delay_sec":0,"max_cpu_
↪usage_ms":0,"actions":[{"account":"liquidx.dsp","name":"addaccount","data":{"owner":
↪"natdeveloper","chain_account":"liquidxcnsmr","chain_name":"mynewchainname"},
↪"authorization":[{"actor":"natdeveloper","permission":"active"}]}]}'
```

(continues on next page)

(continued from previous page)

3.2.4 Map New Chain to Mainnet

To map a new chain's account to the EOS mainnet, navigate to the contract that has deployed the `dappservicex.cpp` contract and perform the `setlink` action.

- owner {name} - name of account on the new chain to link, using services
- mainnet_owner {name} - name of account on mainnet, staking to services

Example cleos command:

```
cleos -u $NEW_CHAIN_NODEOS_ENDPOINT push transaction '{"delay_sec":0,"max_cpu_usage_ms
↪":0,"actions":[{"account":"dappservicex","name":"setlink","data":{"owner":
↪"liquidxcnsmr","mainnet_owner":"natdeveloper"},"authorization":[{"actor":
↪"liquidxcnsmr","permission":"active"}]}]}'
```

In short you have run the `adddsp` and the `setlink` action on the new chain's `dappservicex` account and the `addaccount` action on the EOS mainet's `liquidx.dsp` account.

The new chain account now has the ability to access any service staked to by the mainnet account.

3.3 Become a DSP on another chain

LiquidX enables DSPs (DAPP Service Providers) to offer services on new chains. All existing and newly created packages may be staked to and used by developers without any additional modifications.

To add a chain, a DSP must configure their DSP API's `config.toml` file with the sidechain's details then two way map their EOS mainnet DSP account, the account that will be staked to and will receive rewards, to their sidechain DSP account. This is done with the `addaccount` action on the mainnet `liquidx.dsp` account and `adddsp` on the `dappservicex.cpp` contract on the new chain. As a note, the `dappservicex.cpp` contract's account can be called anything (hopefully `dappservicex` for simplicity), so the name must be found from the community.

To add a chain from an architecture perspective requires adding a new nodeos instance for that chain and having another demux instance running on the DSP's API endpoint. The nodeos instance can be run external to the DSP API. There are two additional log files produced for the new chain. A new dapp-service-node log file for the new gateway port and another demux log file.

See list of example chains to add here.

Guide:

- *Editing config.toml file*
- *Push DSP account mapping action*

3.3.1 Editing config.toml file

In order to enable a new chain, a DSP must add the following to the `config.toml` environment variable file. This is the file that holds the environment variables for your DSP's API instance. Each sidechain will need a new `[sidechains.CHAIN_NAME]` section. `CHAIN_NAME` - this is the account on the EOS mainnet that has registered with the `liquidx.dsp` contract as the chain's name. This name can be found from the block producers of the chain, other DSPs, or the community.

```
# sidechain section, if no sidechains, leave as [sidechains], can add additional␣
↪sidechains with [sidechains.newchain] ...
[sidechains]
  [sidechains.test1]
    # dsp
    dsp_port = 3116 # dsp port to run new chain's services on, this is the port␣
↪developers will push to, must be unique per new chain
    dsp_account = "test1" # DSP Account on new chain
    dsp_private_key = "" # DSP active private key on new chain
    # nodeos
    nodeos_host = "localhost" # nodeos host running new chain
    nodeos_port = 8888 # nodeos host port
    nodeos_secured = false # nodeos secured bool (true: https, false: http)
    nodeos_chainid = "" # chainid of new chain
    nodeos_websocket_port = 8887 # nodeos websocket port, can be same per nodeos␣
↪instance
    nodoes_latest = true # if using 2.0+ version of nodeos, true, if less than 2.0,␣
↪false
    webhook_dapp_port = 8113 # nodeos webhook port, must be unique per chain
    # demux
    demux_webhook_port = 3196 # port demux runs on, must be unique per new chain
    demux_socket_mode = "sub"
    demux_head_block = 1 # head block to sync demux from
    # demux defaults to first pulling head block from toml file if postgres database␣
↪is not set
    # after database is set, defaults to database, to overwrite and default to toml␣
↪file, pass true
    demux_bypass_database_head_block = false
    demux_max_pending_messages = 500 # amount of pending messages to add to the stack␣
↪before disconnecting the demux websocket to allow pending messages to process
    # sidechain
    liquidx_contract = "liquidx.dsp" # liquidx contract on the EOS mainnet
    name = "test1" # CHAIN_NAME - contract on the EOS mainnet that registered the new␣
↪chain
    # the mapping below contains the dappservices:dappservicex and mainnet DSP␣
↪account to the new chain's DSP account mapping
    mapping = "dappservices:dappservicex,heliosselene:heliosselene"
  # [sidechains.ANOTHER_CHAIN_NAME]
    # ...
```

Once this has been configured, the environment variables for the DSP can be updated with:

```
systemctl stop dsp
cd $(readlink -f `which setup-dsp` | xargs dirname)
setup-dsp
systemctl start dsp
```

You can also upgrade to the latest version of the DSP software by following the steps: *here*.

3.3.2 Push DSP account mapping action

On the EOS mainnet, the EOS mainnet's DSP account must be connected to the new chain's DSP account. This is done using the `addaccount` command on the `liquidx.dsp` account.

- owner {name} - DSP account name on the EOS mainnet
- chain_account {name} - DSP account name on the new chain

- chain_name {name} - account name of contract on the EOS mainnet that registered the chain

Cleos example:

```
cleos -u https://nodes.get-scatter.com:443 push transaction '{"delay_sec":0,"max_cpu_
↪usage_ms":0,"actions":[{"account":"liquidx.dsp","name":"addaccount","data":{"owner":
↪"uuddlrlrbass","chain_account":"uuddlrlrbass","chain_name":"mynewchainnn"},
↪"authorization":[{"actor":"uuddlrlrbass","permission":"active"}]}]}'
```

On the new chain you must find the account that has deployed the `dappservicex.cpp` code. This can be found by asking a BP, a member of the community, or by checking the `chainentry` table on the `liquidx.dsp` contract and providing the scope of the `chain_name` used to register in the previous step.

This will return the `chain_meta` field:

```
{ "is_public": 1, "is_single_node": 0, "dappservices_contract": "dappservicex",
↪"chain_id": "e70aaab8997e1dfce58fbfac80cbbb8fecec7b99cf982a9444273cbc64c41473",
↪"type": "EOSIO", "endpoints": [], "p2p_seeds": [], "chain_json_uri": "" }
```

The `dappservices_contract` value is the name of the contract that has deployed the `dappservicex.cpp` code, `dappservicex` in this case.

Once you have that then on the new chain, submit an `adddsp` action on that account.

- owner {name} - DSP name on new chain
- dsp {name} - DSP name on mainnet

Cleos example:

```
cleos -u $NEW_CHAIN_NODEOS_ENDPOINT push transaction '{"delay_sec":0,"max_cpu_usage_ms
↪":0,"actions":[{"account":"dappservicex","name":"adddsp","data":{"owner":
↪"uuddlrlrbass","dsp":"uuddlrlrbass"},"authorization":[{"actor":"uuddlrlrbass",
↪"permission":"active"}]}]}'
```

With that you have 2 way mapped your DSP account name. On the EOS Mainnet, the DSP's account has been linked to the new chain's network. And on the new network, the EOS Mainnet's DSP account has been verified.

With that, the DSP is ready to offer services.

Next: Use Services

3.4 Example Chains to Add

The following chains have the `dappservicex` contract deployed and mapped.

Guide:

- *CoVax* - CoVax, powered by the DAPP Network, is a community-driven project to fight against COVID-19 collectively, read more *here*
- *WAX*
- *WAX Test*
- *Telos*
- *Telos Test*
- *BOS*

as a note, the `dsp_port`, `webhook_dapp_port`, `demux_webhook_port` must be unique per chain

3.4.1 CoVax

```
[sidechains.liquidxcovax]
    # dsp
    dsp_port = 3116
    dsp_account = ""
    dsp_private_key = ""
    # nodeos
    nodeos_host = ""
    nodeos_port = 8888
    nodeos_secured = false
    nodeos_chainid = "63788f6e75cdb4ec9d8bb64ce128fa08005326a8b91702d0d03e81ba80e14d27
↪"
    nodeos_websocket_port = 8887
    nodeos_latest = true
    webhook_dapp_port = 8113
    # demux
    demux_webhook_port = 3196
    demux_socket_mode = "sub"
    demux_bypass_database_head_block = false
    demux_max_pending_messages = 500
    # sidechain
    name = "liquidxcovax"
    mapping = "dappservices:dappservicex,EOS_MAINNET_DSP_ACCOUNT:COVAX_DSP_ACCOUNT"
```

3.4.2 WAX

```
[sidechains.liquidxxxwax]
    # dsp
    dsp_port = 3117
    dsp_account = ""
    dsp_private_key = ""
    # nodeos
    nodeos_host = ""
    nodeos_port = 8888
    nodeos_secured = false
    nodeos_chainid = "1064487b3cd1a897ce03ae5b6a865651747e2e152090f99c1d19d44e01aea5a4
↪"
    nodeos_websocket_port = 8887
    nodeos_latest = true
    webhook_dapp_port = 8114
    # demux
    demux_webhook_port = 3197
    demux_socket_mode = "sub"
    demux_bypass_database_head_block = false
    demux_max_pending_messages = 500
    # sidechain
    name = "liquidxxxwax"
    mapping = "dappservices:dappservicex,EOS_MAINNET_DSP_ACCOUNT:WAX_DSP_ACCOUNT"
```

3.4.3 WAX Test

```
[sidechains.liquidxxtwax]
    # dsp
    dsp_port = 3118
    dsp_account = ""
    dsp_private_key = ""
    # nodeos
    nodeos_host = ""
    nodeos_port = 8888
    nodeos_secured = false
    nodeos_chainid = "f16b1833c747c43682f4386fca9cbb327929334a762755ebec17f6f23c9b8a12
↪"
    nodeos_websocket_port = 8887
    nodeos_latest = true
    webhook_dapp_port = 8115
    # demux
    demux_webhook_port = 3198
    demux_socket_mode = "sub"
    demux_bypass_database_head_block = false
    demux_max_pending_messages = 500
    # sidechain
    name = "liquidxxtwax"
    mapping = "dappservices:dappservicex,EOS_MAINNET_DSP_ACCOUNT:WAX_TEST_DSP_ACCOUNT"
```

3.4.4 Telos

```
[sidechains.liquidxxtlos]
    # dsp
    dsp_port = 3119
    dsp_account = ""
    dsp_private_key = ""
    # nodeos
    nodeos_host = ""
    nodeos_port = 8888
    nodeos_secured = false
    nodeos_chainid = "4667b205c6838ef70ff7988f6e8257e8be0e1284a2f59699054a018f743b1d11
↪"
    nodeos_websocket_port = 8887
    nodeos_latest = true
    webhook_dapp_port = 8116
    # demux
    demux_webhook_port = 3199
    demux_socket_mode = "sub"
    demux_bypass_database_head_block = false
    demux_max_pending_messages = 500
    # sidechain
    name = "liquidxxtlos"
    mapping = "dappservices:dappservicex,EOS_MAINNET_DSP_ACCOUNT:TELOS_DSP_ACCOUNT"
```

3.4.5 Telos Test

```
[sidechains.liquidxttlos]
    # dsp
    dsp_port = 3120
```

(continues on next page)

(continued from previous page)

```
    dsp_account = ""
    dsp_private_key = ""
    # nodeos
    nodeos_host = ""
    nodeos_port = 8888
    nodeos_secured = false
    nodeos_chainid = "1eaa0824707c8c16bd25145493bf062aecddfeb56c736f6ba6397f3195f33c9f
↪"
    nodeos_websocket_port = 8887
    nodeos_latest = true
    webhook_dapp_port = 8117
    # demux
    demux_webhook_port = 3200
    demux_socket_mode = "sub"
    demux_bypass_database_head_block = false
    demux_max_pending_messages = 500
    # sidechain
    name = "liquidxttlos"
    mapping = "dappservices:dappservicex,EOS_MAINNET_DSP_ACCOUNT:TELOS_TEST_DSP_
↪ACCOUNT"
```

3.4.6 BOS

```
[sidechains.liquidxxxbos]
    # dsp
    dsp_port = 3121
    dsp_account = ""
    dsp_private_key = ""
    # nodeos
    nodeos_host = ""
    nodeos_port = 8888
    nodeos_secured = false
    nodeos_chainid = "d5a3d18fbb3c084e3b1f3fa98c21014b5f3db536cc15d08f9f6479517c6a3d86
↪"
    nodeos_websocket_port = 8887
    nodeos_latest = true
    webhook_dapp_port = 8118
    # demux
    demux_webhook_port = 3201
    demux_socket_mode = "sub"
    demux_bypass_database_head_block = false
    demux_max_pending_messages = 500
    # sidechain
    name = "liquidxxxbos"
    mapping = "dappservices:dappservicex,EOS_MAINNET_DSP_ACCOUNT:BOS_DSP_ACCOUNT"
```

3.5 Add a Chain to LiquidX

The following steps will cover how to enable the DAPP Network on a new chain. After performing these steps DSPs will be able to set themselves up on the new chain.

Guide:

- *Create accounts and set dappservicex contract*
- *Register chain*

3.5.1 Create accounts and set dappservicex contract

There are two accounts that must be created to enable LiquidX. One mainnet account to represent the chain name, and one sidechain account to handle the DAPP service logic.

EOS Mainnet Account:

- Create an account that will become the name for the chain. A good name should be chosen that easily represents the new chain as it is used in many places. This account will register the chain with the `liquidx.dsp` contract on the mainnet. This account does not have a contract set to it.

New Chain:

- dappservicex - this contract is used to add new DSPs and to create links between accounts. This account will need to be known to DSPs and developers wishing to operate on the network.

After both accounts are created, the `dappservicex.cpp` contract must be set to the account created on the side chain. This contract can be found in the Zeus-sdk repo, or by unboxing the `liquidx` box with the following commands:

```
npm i -g @liquidapps/zeus-cmd
mkdir liquidx; cd liquidx
zeus unbox liquidx
zeus compile
cd zeus_boxes/contracts/eos
```

Ensure that you add `dappservicex@eosio.code` to the active permission level of the account.

3.5.2 Register chain

You must execute the `setchain` action on the `liquidx.dsp` account on the EOS mainnet with the mainnet account created to represent the chain name. The syntax is as follows:

- chain_name {name} - name of EOS mainnet account deploying chain, e.g., mynewchainnn
- chain_meta {chain_metadata_t} - chain data
  - is_public {bool} - whether the chain is public
  - is_single_node {bool} - whether chain is a single node
  - dappservices_contract {std::string} - account that `dappservicex.cpp` is deployed to, e.g., dappservicex
  - chain_id {std::string} - chain ID of sidechain
  - type {std::string} - type of blockchain, e.g., EOSIO
  - endpoints {std::vectorstd::string} - list of public endpoints for developers to use
  - chain_json_uri {std::vectorstd::string} - publicly available json file that declares chain statistics

Example cleos command:

```
cleos -u https://nodes.get-scatter.com:443 push transaction '{"delay_sec":0,"max_cpu_
↪usage_ms":0,"actions":[{"account":"liquidx.dsp","name":"setchain","data":{"chain_
↪name":"mynewchainnn","chain_meta":{"is_public":true,"is_single_node":false,
↪"dappservices_contract":"dappservicex","chain_id":
↪"e70aaab8997e1dfce58fbfac80cbbb8fecec7b99cf982a9444273cbc64c41473","type":"EOSIO",
↪"endpoints":[],"p2p_seeds":[],"chain_json_uri":""}},"authorization":[{"actor":
↪"mynewchainnn","permission":"active"}]}]}'
```

(continues on next page)

(continued from previous page)

After that, you must run the `init` action on the `dappservicex` contract.

- `chain_name` {name} - name of EOS mainnet account deploying chain, e.g., mynewchainnn

Example cleos command:

```
cleos -u https://api.jungle.alohaeos.com push transaction '{"delay_sec":0,"max_cpu_
↪usage_ms":0,"actions":[{"account":"dappservicex","name":"init","data":{"chain_name":
↪"liquidjungle"},"authorization":[{"actor":"dappservicex","permission":"active"}]}]}'
```

And now you're setup to begin configuring DSPs and then enabling users to use DAPP Network services. DSPs and developers will need to know the `chain_name` used on the mainnet and the account the `dappservicex.cpp` contract was set to on the new chain.

After that: Become a DSP

After that: Use Services

- search

CHAPTER 4

Covax

4.1 CoVax Chain Getting Started

CoVax, powered by the DAPP Network, is a community-driven project to fight against COVID-19 collectively. If you would like to become a block producer or a DAPP Service Provider for the chain, please visit the Telegram and ask for information on obtaining an account(s).

Telegram link: https://t.me/CoVaxApp

Read more in our blog article release: https://medium.com/@liquidapps/take-up-arms-against-covid-19-with-covax-964af0ec2951

bloks.io Block Explorer | courtesy of EOSUSA

Hyperion Block Explorer | courtesy of EOSUSA

4.1.1 Docs:

Become a Block Producer

Become a DAPP Service Provider

4.2 Become a DAPP Service Provider

The CoVax chain utilizes the LiquidX technology to enable DAPP Network services to be provided on EOSIO based chains. To read more on LiquidX, please *see the LiquidX section*. To learn more about setting up a DAPP Service Provider, see the *getting started section*.

To obtain a DAPP Service Provider account on CoVax, reach out in the CoVax Telegram channel: https://t.me/CoVaxApp.

Guide:

- *Update config.toml file* update config.toml environment variable file with the CoVax chain sidechain section

- *Push DSP account mapping action on EOS mainnet* run `adddsp` action on the `dappservicex` contract on the CoVax chain to link the CoVax chain DSP account to your EOS mainnet DSP account
- *Push DSP account mapping action on CoVax Chain* run the `addaccount` action on the `liquidx.dsp` contract on the EOS mainnet to link the EOS mainnet DSP account to the CoVax chain DSP account

4.2.1 Update config.toml file

The `config.toml` file is the environment variable file used for DAPP Service Providers.

```
[sidechains]
  [sidechains.liquidxcovax]
    # dsp
    dsp_port = 3116 # dsp port to run new chain's services on, this is the port␣
↪developers will push to, must be unique per new chain
    dsp_account = "" # DSP Account on new chain
    dsp_private_key = "" # DSP active private key on new chain
    # nodeos
    nodeos_host = "" # state history nodeos host running new chain
    nodeos_port = 8888 # nodeos host port
    nodeos_secured = false # nodeos secured bool (true: https, false: http)
    nodeos_chainid = "63788f6e75cdb4ec9d8bb64ce128fa08005326a8b91702d0d03e81ba80e14d27
↪" # chainid of new chain
    nodeos_websocket_port = 8887 # nodeos websocket port, can be same per nodeos␣
↪instance
    nodeos_latest = true # using 2.x nodeos
    webhook_dapp_port = 8113 # nodeos webhook port, must be unique per chain
    # demux
    demux_webhook_port = 3196 # port demux runs on, must be unique per new chain
    demux_socket_mode = "sub"
    demux_bypass_database_head_block = false
    # sidechain
    name = "liquidxcovax" # CHAIN_NAME - contract on the EOS mainnet that registered␣
↪the new chain
    # the mapping below contains the dappservices:dappservicex and mainnet DSP␣
↪account to the new chain's DSP account mapping
    mapping = "dappservices:dappservicex,MAINNET_DSP_ACCOUNT:COVAX_CHAIN_DSP_ACCOUNT"
```

4.2.2 Push DSP account mapping action on EOS mainnet

On the EOS mainnet, the EOS mainnet's DSP account must be connected to the new chain's DSP account. This is done using the `addaccount` command on the `liquidx.dsp` account.

- owner {name} - DSP account name on the EOS mainnet
- chain_account {name} - DSP account name on the new chain, `liquidxcovax`
- chain_name {name} - account name of contract on the EOS mainnet that registered the chain

Cleos example:

```
cleos -u https://nodes.get-scatter.com:443 push transaction '{"delay_sec":0,"max_cpu_
↪usage_ms":0,"actions":[{"account":"liquidx.dsp","name":"addaccount","data":{"owner":
↪"uuddlrlrbass","chain_account":"uuddlrlrbass","chain_name":"liquidxcovax"},
↪"authorization":[{"actor":"uuddlrlrbass","permission":"active"}]}]}'
```

4.2.3 Push DSP account mapping action on CoVax Chain

Once you have that then on the CoVax chain, submit an `adddsp` action on that account.

- owner {name} - DSP name on new chain
- dsp {name} - DSP name on mainnet

Cleos example:

```
cleos -u http://eosnode-covax.liquidapps.io push transaction '{"delay_sec":0,"max_cpu_
↪usage_ms":0,"actions":[{"account":"dappservicex","name":"adddsp","data":{"owner":
↪"uuddlrlrbass","dsp":"uuddlrlrbass"},"authorization":[{"actor":"uuddlrlrbass",
↪"permission":"active"}]}]}'
```

4.3 Become a Block Producer

To obtain a Block Producer account on CoVax, reach out in the CoVax Telegram channel: https://t.me/CoVaxApp.

Hyperion: https://covax.eosrio.io/v2/docs/index.html | courtesy of `eosriobrazil`

Block Producer Scorecard | courtesy of EOS Nation

EOS Block Producer Benchmarks | courtesy of Aloha EOS

Guide:

- *Genesis JSON*
- *Peers*
- *API Endpoints*
- *Snapshots*
- *Scripts*

4.3.1 Genesis JSON:

```
{
  "initial_timestamp": "2018-03-18T08:55:11.000",
  "initial_key": "EOS6HyUZskuWbHzhZx4Vi8ZxcaW28hte5MVGhejFGJeDbd6iYYXBn",
  "initial_configuration": {
    "max_block_net_usage": 1048576,
    "target_block_net_usage_pct": 1000,
    "max_transaction_net_usage": 524288,
    "base_per_transaction_net_usage": 12,
    "net_usage_leeway": 500,
    "context_free_discount_net_usage_num": 20,
    "context_free_discount_net_usage_den": 100,
    "max_block_cpu_usage": 100000,
    "target_block_cpu_usage_pct": 500,
    "max_transaction_cpu_usage": 50000,
    "min_transaction_cpu_usage": 100,
    "max_transaction_lifetime": 3600,
    "deferred_trx_expiration_window": 600,
    "max_transaction_delay": 3888000,
    "max_inline_action_size": 4096,
```

(continues on next page)

(continued from previous page)

```
    "max_inline_action_depth": 4,
    "max_authority_depth": 6
  },
  "initial_chain_id":
↪"63788f6e75cdb4ec9d8bb64ce128fa08005326a8b91702d0d03e81ba80e14d27"
}
```

4.3.2 Peers:

```
eosnode-covax.liquidapps.io:9876
node1.eosdsp.com:9888
dsp1.dappsolutions.app:9875
covax.maltablock.org:9876
covax.eosrio.io:8132
covax.eosn.io:9876
node3.blockstartdsp.com:8132
```

4.3.3 API Endpoints:

- http://eosnode-covax.liquidapps.io
- https://covax.eosn.io
- https://covax.eosdsp.com
- http://node3.blockstartdsp.com:8200

4.3.4 Snapshots:

https://snapshots.eosnation.io/ | courtesy of EOS Nation

4.3.5 Scripts:

- *genesis_start.sh*
- *start.sh*
- *stop.sh*
- *hard_replay.sh*
- *clean.sh*

The following are a list of scripts from the bios boot sequence tutorial located here. The `PURBLIC_KEY_HERE` and `PRIVATE_KEY_HERE` fields must be updated in the `genesis_start.sh`, `start.sh`, and `hard_replay.sh` scripts.

To start the chain from genesis, run the `genesis_start.sh` file, then if you need to stop the chain, run `stop.sh`, if you need to start again, run `start.sh`. If you get a dirty flag, run `hard_replay.sh`.

If you need to wipe everything, run `stop.sh`, `clean.sh`, `genesis_start.sh`.

If you need to install eosio, see the *eosio node* section of the docs.

```
mkdir biosboot
touch genesis.json
nano genesis.json
mkdir genesis
cd genesis
mkdir YOUR_BP_NAME_HERE
cd YOUR_BP_NAME_HERE
touch genesis_start.sh
nano genesis_start.sh
chmod 755 genesis_start.sh
./genesis_start.sh
# create start.sh, stop.sh, hard_replay.sh, and clean.sh
```

genesis_start.sh

```
#!/bin/bash
DATADIR="./blockchain"
CURDIRNAME=${PWD##*/}
if [ ! -d $DATADIR ]; then
  mkdir -p $DATADIR;
fi
nodeos \
--genesis-json $DATADIR"/../../../genesis.json" \
--signature-provider PURBLIC_KEY_HERE=KEY:PRIVATE_KEY_HERE \
--plugin eosio::producer_plugin \
--plugin eosio::producer_api_plugin \
--plugin eosio::chain_plugin \
--plugin eosio::chain_api_plugin \
--plugin eosio::http_plugin \
--plugin eosio::history_api_plugin \
--plugin eosio::history_plugin \
--data-dir $DATADIR"/data" \
--blocks-dir $DATADIR"/blocks" \
--config-dir $DATADIR"/config" \
--producer-name $CURDIRNAME \
--http-server-address 127.0.0.1:8888 \
--p2p-listen-endpoint 127.0.0.1:9876 \
--p2p-peer-address localhost:9877 \
--access-control-allow-origin=* \
--contracts-console \
--http-validate-host=false \
--verbose-http-errors \
--enable-stale-production \
--wasm-runtime=eos-vm-jit \
--eos-vm-oc-enable \
--p2p-peer-address eosnode-covax.liquidapps.io:9876 \
--p2p-peer-address node1.eosdsp.com:9888 \
--p2p-peer-address dsp1.dappsolutions.app:9875 \
--p2p-peer-address covax.maltablock.org:9876 \
--p2p-peer-address covax.eosrio.io:8132 \
--p2p-peer-address covax.eosn.io:9876 \
--p2p-peer-address node3.blockstartdsp.com:8132 \
>> $DATADIR"/nodeos.log" 2>&1 & \
echo $! > $DATADIR"/eosd.pid"
```

start.sh

```
#!/bin/bash
DATADIR="./blockchain"
        CURDIRNAME=${PWD##*/}

if [ ! -d $DATADIR ]; then
  mkdir -p $DATADIR;
fi

nodeos \
--signature-provider PURBLIC_KEY_HERE=KEY:PRIVATE_KEY_HERE \
--plugin eosio::producer_plugin \
--plugin eosio::producer_api_plugin \
--plugin eosio::chain_plugin \
--plugin eosio::chain_api_plugin \
--plugin eosio::http_plugin \
--plugin eosio::history_api_plugin \
--plugin eosio::history_plugin \
--data-dir $DATADIR"/data" \
--blocks-dir $DATADIR"/blocks" \
--config-dir $DATADIR"/config" \
--producer-name $CURDIRNAME \
--http-server-address 0.0.0.0:8888 \
--p2p-listen-endpoint 0.0.0.0:9876 \
--access-control-allow-origin=* \
--contracts-console \
--http-validate-host=false \
--verbose-http-errors \
--enable-stale-production \
--wasm-runtime=eos-vm-jit \
--eos-vm-oc-enable \
--p2p-peer-address eosnode-covax.liquidapps.io:9876 \
--p2p-peer-address node1.eosdsp.com:9888 \
--p2p-peer-address dsp1.dappsolutions.app:9875 \
--p2p-peer-address covax.maltablock.org:9876 \
--p2p-peer-address covax.eosrio.io:8132 \
--p2p-peer-address covax.eosn.io:9876 \
--p2p-peer-address node3.blockstartdsp.com:8132 \
>> $DATADIR"/nodeos.log" 2>&1 & \
echo $! > $DATADIR"/eosd.pid"
```

stop.sh

```
#!/bin/bash
DATADIR="./blockchain/"

if [ -f $DATADIR"/eosd.pid" ]; then
pid=`cat $DATADIR"/eosd.pid"`
echo $pid
kill $pid
rm -r $DATADIR"/eosd.pid"
echo -ne "Stoping Node"
while true; do
[ ! -d "/proc/$pid/fd" ] && break
echo -ne "."
```

(continues on next page)

(continued from previous page)

```
sleep 1
done
echo -ne "\rNode Stopped. \n"
fi
```

hard_replay.sh

```
#!/bin/bash
DATADIR="./blockchain"
CURDIRNAME=${PWD##*/}

if [ ! -d $DATADIR ]; then
  mkdir -p $DATADIR;
fi

nodeos \
--signature-provider PURBLIC_KEY_HERE=KEY:PRIVATE_KEY_HERE \
--plugin eosio::producer_plugin \
--plugin eosio::producer_api_plugin \
--plugin eosio::chain_plugin \
--plugin eosio::chain_api_plugin \
--plugin eosio::http_plugin \
--plugin eosio::history_api_plugin \
--plugin eosio::history_plugin \
--data-dir $DATADIR"/data" \
--blocks-dir $DATADIR"/blocks" \
--config-dir $DATADIR"/config" \
--producer-name $CURDIRNAME \
--http-server-address 127.0.0.1:8888 \
--p2p-listen-endpoint 127.0.0.1:9876 \
--p2p-peer-address localhost:9877 \
--access-control-allow-origin=* \
--contracts-console \
--http-validate-host=false \
--verbose-http-errors \
--enable-stale-production \
--wasm-runtime=eos-vm-jit \
--eos-vm-oc-enable \
--hard-replay-blockchain \
--p2p-peer-address eosnode-covax.liquidapps.io:9876 \
--p2p-peer-address node1.eosdsp.com:9888 \
--p2p-peer-address dsp1.dappsolutions.app:9875 \
--p2p-peer-address covax.maltablock.org:9876 \
--p2p-peer-address covax.eosrio.io:8132 \
--p2p-peer-address covax.eosn.io:9876 \
--p2p-peer-address node3.blockstartdsp.com:8132 \
>> $DATADIR"/nodeos.log" 2>&1 & \
echo $! > $DATADIR"/eosd.pid"
```

clean.sh

```
#!/bin/bash
rm -fr blockchain
```

(continues on next page)

(continued from previous page)

```
ls -al
```

- search

CHAPTER 5

Services

5.1 LiquidAuthenticator Service

5.1.1 Overview

Authentication of offchain APIs and services using EOSIO permissions and contract

5.1.2 Stage

Beta

5.1.3 Version

0.9

5.1.4 Contract

`authfndspsvc`

5.1.5 Box

auth-dapp-service

5.1.6 Service Commands

authusage

5.1.7 Tests

- authenticator.spec.js

5.2 LiquidBilling Service

5.2.1 Overview

Transaction signing service for resource payment

5.2.2 Stage

WIP

5.2.3 Version

0.0

5.2.4 Contract

`liquidbillin`

5.2.5 Box

bill-dapp-service

5.2.6 Service Commands

sdummy2

5.2.7 Tests

- bill.spec.js

5.3 LiquidScheduler Service

5.3.1 Overview

Scheduled Transactions

5.3.2 Stage

beta

5.3.3 Version

0.9

5.3.4 Contract

`cronservices`

5.3.5 Box

cron-dapp-service

5.3.6 Service Commands

schedule

interval

rminterval

5.3.7 Tests

- cronconsumer.spec.js
- Consumer Contract Example

5.4 LiquidDNS Service

5.4.1 Overview

DSP Hosted DNS Service

5.4.2 Stage

WIP

5.4.3 Version

0.5

5.4.4 Contract

`dnsservices1`

5.4.5 Box

dns-dapp-service

5.4.6 Service Commands

dnsq

5.4.7 Tests

- dnsconsumer.spec.js
- Consumer Contract Example

5.5 LiquidArchive Service

5.5.1 Overview

History API Provisioning

5.5.2 Stage

WIP

5.5.3 Version

0.0

5.5.4 Contract

`historyservc`

5.5.5 Box

history-dapp-service

5.5.6 Service Commands

hststore

hsthold

hstserve

hstreg

5.5.7 Tests

- history.spec.js

5.6 LiquidVRAM Service

5.6.1 Overview

Virtual Memory Service

5.6.2 Stage

Stable

5.6.3 Version

1.5

5.6.4 Contract

`ipfsservice1`

5.6.5 Box

ipfs-dapp-service

5.6.6 Service Commands

commit

cleanup

warmup

warmupcode

warmuprow

warmupchain

cleanuprow

cleanchain

5.6.7 Tests

- dappservices.spec.js
- ipfsconsumer.spec.js
- oldipfscons.spec.js
- Consumer Contract Example

5.7 LiquidKMS Service

5.7.1 Overview

Key Management Service

5.7.2 Stage

WIP

5.7.3 Version

0.0

5.7.4 Contract

`kmsservices1`

5.7.5 Box

kms-dapp-service

5.7.6 Service Commands

sdummy3

5.7.7 Tests

- kmsconsumer.spec.js

5.8 LiquidLog Service

5.8.1 Overview

Log Service

5.8.2 Stage

Beta

5.8.3 Version

0.9

5.8.4 Contract

`logservices1`

5.8.5 Box

log-dapp-service

5.8.6 Service Commands

logevent

logclear

5.8.7 Tests

- logconsumer.spec.js
- Consumer Contract Example

5.9 LiquidHarmony Service

5.9.1 Overview

Web/IBC/XIBC/VCPU/SQL Services

5.9.2 Stage

Beta

5.9.3 Version

0.9

5.9.4 Contract

`oracleservic`

5.9.5 Box

oracle-dapp-service

5.9.6 Service Commands

geturi

orcclean

5.9.7 Tests

- oracleconsumer.spec.js
- Consumer Contract Example

5.10 LiquidLens Service

5.10.1 Overview

Read Functions Service

5.10.2 Stage

Alpha

5.10.3 Version

0.9

5.10.4 Contract

`readfndspsvc`

5.10.5 Box

readfn-dapp-service

5.10.6 Service Commands

rfnuse

5.10.7 Tests

- readfnconsumer.spec.js
- Consumer Contract Example

5.11 LiquidLink Service

5.11.1 Overview

IBC MultiSig Service

5.11.2 Stage

Beta

5.11.3 Version

0.9

5.11.4 Contract

`signfndspsvc`

5.11.5 Box

sign-dapp-service

5.11.6 Service Commands

signtrx

sgcleanup

5.11.7 Tests

- signer-kms.spec.js
- signer.spec.js

5.12 LiquidStorage Service

5.12.1 Overview

Distributed storage and hosting

5.12.2 Stage

Beta

5.12.3 Version

0.9

5.12.4 Contract

`liquidstorag`

5.12.5 Box

storage-dapp-service

5.12.6 Service Commands

sdummy

5.12.7 Tests

- storage.spec.js
- Consumer Contract Example

5.13 LiquidAccounts Service

5.13.1 Overview

Allows interaction with contract without a native EOS Account

5.13.2 Stage

Beta

5.13.3 Version

0.9

5.13.4 Contract

`accountless1`

5.13.5 Box

vaccounts-dapp-service

5.13.6 Service Commands

vexec

5.13.7 Tests

- vaccountsconsumer.spec.js
- Consumer Contract Example

5.14 VCPU Service

5.14.1 Overview

DSP Hosted Computation Service

5.14.2 Stage

PoC

5.14.3 Version

0.1

5.14.4 Contract

`vcpuservices`

5.14.5 Box

vcpu-dapp-service

5.14.6 Service Commands

vrun

vrunclean

5.14.7 Tests

- vcpuconsumer.spec.js
- Consumer Contract Example
- search

CHAPTER 6

DAPP Tokens

6.1 DAPP Token Overview

The DAPP token is a multi-purpose utility token that grants access to the DAPP Network. It is designed to power an ecosystem of utilities, resources, and services specifically serving the needs of dApp developers building user-centric dApps.

6.1.1 Videos

- EOS Weekly - The LiquidApps Game-Changer
- EOS Weekly - Unlimited DSP Possibilities

6.1.2 Have questions?

- Join our Telegram channel

6.1.3 Want more information?

- Read our whitepaper and subscribe to our Medium posts.

6.2 DAPP Tokens Tracks

Link to auction: https://liquidapps.io/auction

6.2.1 Instant Track

Users wishing to purchase DAPP with EOS tokens can do so through the instant track. Simply send EOS to the Instant Registration Track Vendor Smart Contract and you will receive your DAPP tokens at the end of the current cycle (see "Claiming DAPP Tokens" for further information about the claiming process).

6.2.2 Regular Track

The Regular Registration Track provides flexibility in purchasing DAPP tokens. You can use EOS tokens for any desired purchase amount. For amounts exceeding 15,000 Swiss Franc (CHF) you may also purchase with ETH, BTC or Fiat.

In order to open up the opportunity to all potential purchasers the DAPP Generation Event includes a verified track for buyers who wish to use their ETH, BTC, FIAT or EOS to purchase DAPP tokens.

If you wish to participate in the DAPP Generation Event through the Regular Registration Track, you must complete a KYC (Know Your Customer) verification process, facilitated by Altcoinomy, a Swiss-based licensed KYC operator.

6.3 Claiming DAPP Tokens

6.3.1 Automatic

The auto claim mechanism does not require participants to push an action themselves to claim the tokens. This is handled by the website automatically at the end of each cycle.

6.3.2 Manual

The manual claim function is always available and participants can claim their DAPP Tokens immediately after the cycle ends by sending an explicit action depending on the track they selected.

Instant Registration Track

Regular Registration Track

Login with the wallet of your choice and enter your account in the "payer" field (**YOUR_ACCOUNT_HERE**) and hit "Push Transaction".

6.4 DAPP Tokens Distribution

The year-long DAPP token Generation Event began on February 26th, 2019 and will last until January 2020, for a total of 333 days. These 333 days will be split into 444 18-hour cycles, with each cycle receiving an allocation of 1,127,127 tokens.

The DAPP tokens are distributed through two unique independent purchase tracks—the Instant Registration Track and the Regular Registration Track. At the end of each cycle, each one of the two Registration Tracks distributes 563,063.0630 DAPP tokens amongst that cycle's participants, proportional to the amount of EOS sent by each purchaser in that cycle.

6.4.1 Integrity is Our Priority

Blockchain technology has the potential to enable a more free and fair economy to emerge by introducing an unprecedented level of transparency and accountability to markets. At LiquidApps, we are firm proponents of the free market ethos. Maintaining the integrity of the DAPP Generation Event is of the utmost importance to us, and, as such, LiquidApps hereby commits to abstaining from participation in the DAPP Token Generation Event.

More information may be found in our whitepaper

6.5 Air-HODL

A total amount of 100,000,000 DAPP will be allocated and divided between all the accounts that hold EOS at block #36,568,000 ("Pioneer Holders") and distributed via our unique Air-HODL mechanism.

You can view all snapshot information here.

The Air-HODLed DAPP tokens will be distributed on a block by block basis, matching up to a maximum of 3 million EOS per account. The tokens will be continuously vested on a block to block basis over a period of 2 years, so the complete withdrawal will only be possible at the end of this period. These 2 years began as soon as the DAPP Generation Event was launched. Any Pioneer Holder choosing to withdraw the Air-HODLed tokens before the end of those 2 years will only receive the vested portion (i.e. 50% of the distributed DAPP tokens will be vested after 1 year). The remainder of their unvested DAPP tokens will be distributed to Pioneer Holders who are still holding their Air-HODL DAPP tokens.

HODLers are allowed to stake their vested Air-HODLed tokens immediately using our new staking mechanics. Withdrawing the tokens will transfer the vested tokens to their DAPP account, forfeiting the unvested portion to be redistributed amongst remaining eligible participants.

You can get more information on the Air-HODL and view your balance at: https://liquidapps.io/air-hodl

- search

CHAPTER 7

FAQs

7.1 Frequently Asked Questions The DAPP Token

- *What is the DAPP token?*
- *What is the supply schedule of DAPP token?*
- *How are DAPP tokens distributed?*
- *Why do you need to use DAPP Token and not just EOS?*
- *Why is the sale cycle 18 hours?*
- *What is an airHODL?*
- *Is this an EOS fork?*

7.1.1 What is the DAPP token?

The DAPP token is a multi-purpose utility token designed to power an ecosystem of utilities, resources, & services specifically serving the needs of dApp developers building user-centric dApps.

7.1.2 What is the supply schedule of DAPP token?

DAPP will have an intial supply of 1 billion tokens. The DAPP Token Smart Contract generates new DAPP Tokens on an ongoing basis, at an annual inflation rate of 1-5%.

7.1.3 How are DAPP tokens distributed?

50% of the DAPP tokens will be distributed in a year-long token sale, while 10% will be Air-Hodl'd to EOS holders. The team will receive 20% of the DAPP tokens, of which 6.5% is unlocked and the rest continuously vested (on a block-by-block basis) over a period of 2 years. Our partners and advisors will receive 10% of the DAPP tokens, with the remaining 10% designated towards our grant and bounty programs.

7.1.4 Why do you need to use DAPP Token and not just EOS?

While we considered this approach at the beginning of our building journey, we decided against it for a number of reasons:

- We look forward to growing the network exponentially and will require ever more hardware to provide quick handling of large amounts of data accessible through a high-availability API. It is fair to assume that this kind of service would require significant resources to operate and market, thus it would not be optimal for a BP to take on this as a "side-job" (using a "free market" model that allows adapting price to cost).
- The BPs have a special role as trusted entities in the EOS ecosystem. DSPs are more similar to a cloud service in this respect, where they are less reputational and more technical. Anyone, including BPs, corporate entities, and private individuals, can become a DSP.
- Adding the DAPP Network mechanism as an additional utility of the EOS token would not only require a complete consensus between all BPs, but adoption by all API nodes as well. Lack of complete consensus to adopt this model as an integral part of the EOS protocol would result in a hard fork. (Unlike a system contract update, this change would require everyone's approval, not only 15 out of 21).
- Since the DAPP Network's mechanism does not require the active 21 BPs' consensus, it doesn't require every BP to cache ALL the data. Sharding the data across different entities enables true horizontal scaling. By separating the functions and reward mechanisms of BPs and DSPs, The DAPP Network creates an incentive structure that makes it possible for vRAM to scale successfully.
- We foresee many potential utilities for vRAM. One of those is getting vRAM to serve as a shared memory solution between EOS side-chains when using IBC (Inter-Blockchain Communication). This can be extended to chains with a different native token than EOS, allowing DAPP token to be a token for utilizing cross-chain resources.
- We believe The DAPP Network should be a separate, complementary ecosystem (economy) to EOS. While the EOS Mainnet is where consensus is established, the DAPP Network is a secondary trustless layer. DAPP token, as the access token to the DSPs, will potentially power massive scaling of dApps for the first time.

7.1.5 Why is the sale cycle 18 hours?

An 18 hour cycle causes the start and end time to be constantly changing, giving people in all time zones an equal opportunity to participate.

7.1.6 What is an airHODL?

An Air-HODL is an airdrop with a vesting period. EOS token holders on the snapshot block receive DAPP tokens on a pro-rata basis every block, with the complete withdrawal of funds possible only after 2 years. Should they choose to sell their DAPP tokens, these holders forfeit the right to any future airdrop, increasing the share of DAPP tokens for the remaining holders.

7.1.7 Is this an EOS fork?

The DAPP Network is not a fork nor a side-chain but a trustless service layer (with an EOSIO compatible interface to the mainnet), provided by DSPs (DAPP Service providers). This layer potentially allows better utilization of the existing resources (the RAM and CPU resources provided to you as an EOS token holder). It does not require a change in the base protocol (hard fork) nor a change in the system contract. DSPs don't have to be active BPs nor trusted/elected entities and can price their own services.

7.2 Frequently Asked Questions DAPP Service Providers (DSPs)

- *What is a DSP?*
- *Who can be a DSP?*
- *Are DSPs required to run a full node?*
- *How are DSPs incentivized?*

7.2.1 What is a DSP?

DSPs are individuals or entities who provide external storage capacity, communication services, and/or utilities to dApp developers building on the blockchain, playing a crucial role in the DAPP network.

7.2.2 Who can be a DSP?

DSPs can be BPs, private individuals, corporations, or even anonymous entities. The only requirement is that each DSP must meet the minimum specifications for operating a full node on EOS.

7.2.3 Are DSPs required to run a full node?

While DSPs could use a third-party node, this would add latency to many services, including vRAM. In some cases, this latency could be significant. LiquidApps does not recommend running a DSP without a full node.

7.2.4 How are DSPs incentivized?

DSPs receive 1-5% of token inflation proportional to the total amount of DAPP tokens staked to their service packages.

7.3 Frequently Asked Questions vRAM

- *Why do I need vRAM?*
- *How is vRAM different from RAM?*
- *How can we be sure that data cached with DSPs is not tampered with?*
- *How much does vRAM cost?*

7.3.1 Why do I need vRAM?

RAM is a memory device used to store smart contract data on EOS. However, its limited capacity makes it difficult to build and scale dApps. vRAM provides dApp developers with an efficient and affordable alternative for their data storage needs.

7.3.2 How is vRAM different from RAM?

vRAM is a complement to RAM. It is an alternative storage solution for developers building EOS dApps that are RAM-compatible, decentralized, and enables storing & retrieving of potentially unlimited amounts of data affordably and efficiently. It allows dApp developers to cache all relevant data in RAM to distributed file storage systems (IPFS, BitTorent, HODLONG) hosted by DAPP Service Providers (DSPs), utilizing RAM to store only the data currently in use. vRAM transactions are still stored in chain history and so are replayable even if all DSPs go offline.

7.3.3 How can we be sure that data cached with DSPs is not tampered with?

DSPs cache files on IPFS, a decentralized file-storage system that uses a hash function to ensure the integrity of the data. You can learn more about IPFS here: https://www.youtube.com/watch?time_continue=2&v=8CMxDNuuAiQ

7.3.4 How much does vRAM cost?

Developers who wish to use the vRAM System do so by staking DAPP tokens to their chosen DSP for the amount specified by the Service Package they've chosen based on their needs. By staking DAPP, they receive access to the DSP services, vRAM included.

- search

CHAPTER 8

Patch Notes

8.1 latest

8.1.1 docs

8.1.2 @liquidapps/zeus-cmd

- use simple eos example in gitpod, create a simple eosio contract with 1 command, test in under 10 seconds with zeus test, and migrate within 15 seconds to kylin or another network :)
- add network to zeus contract deployment to allow deployments to each multiple networks
- enable flexible migration of contracts to other networks `zeus migrate --creator natdeveloper --network=development`, e.g., deploys all migrations for creator natdeveloper on development
- allow only specific services to be run with `--services "cron,ipfs,oracle"`, etc, add to start-localenv
- add `zeus start-localenv --kill` to kill all existing nodes and processes
- add `zeus start-localenv --enable-features` which runs the latest eosio contracts and enables EOSIO features such as bill first auth, etc.
- add `zeus start-localenv --single-chain` to only run the provisioning chain if say a box like tokenpeg in unboxed, so you're not running additional nodeos instances
- add `zeus start-localenv --basic-env` which spins up the most basic nodeos env
- allow `zeus migrate CONTRACT_NAME`
- move working contracts dir from `./zeus_boxes/contracts` to `./contracts`
- move sql logs to `./logs` folder
- update eosio contracts to latest, still access legacy contracts if not using `--enable-features`, add rex
- add `--plugin eosio::producer_api_plugin` and `--plugin eosio::chain_plugin` to local tests

- update to 1.8.0-rc2 default eosio.cdt install, 1.7 has boost errors that appear to be on b1's side
- allow contracts keys to be fetched automatically if not supplied to deployer
- add jungle3 network option, update kylin endpoint
- add initial transfer for created accounts
- don't run IPFS node if not needed
- update self history unit test
- update ethtokenpeg contract to issue then transfer
- add various command console logs and emojis :)
- add `getTestAccountName` to unit test library
- add `testinterval` and `rminterval` actions to cronconsumer unit test and example contract
- add simple contract template `zeus create contract mycontract --template=simplecontract`

8.1.3 @liquidapps/dsp

- reduce default `DSP_BACKOFF_EXPONENT` from 1.5 to 1.1

8.1.4 @liquidapps/dapp-client

8.1.5 @liquidapps/box-utils

- support existing boxes to create local directory

8.1.6 dappservices contract

8.1.7 DSP Services:

LiquidAccount Service

LiquidVRAM Service

LiquidStorage Service

LiquidHarmony Service

LiquidScheduler Service

- add interval service for running real realiable crons, crons stored in postgresql and fetched when DSP starts, `interval`, and `rminterval`
- upgrade sign service to beta stage

LiquidLink Service

- add additional checks for external requests and undocumented models

Link Library

- update EOSIO side to use new intervals to handle crons

8.2 2.0.4719

8.2.1 LiquidVRAM Service

- add new service responses and requests when `#define USE_ADVANCED_IPFS` is used
- add warmuprow and cleanuprow, these allow for more efficient loading and cleaning of vram shard information
- add warmupcode, which allows for vram to be accessed from external contracts and third party DSPs
- warmupcode is used automatically when required when the `code` specified in a multi-index table is something other than `self`

8.2.2 LiquidAccounts Service

- add ability for a contract to use vaccounts from another contract when `#define VACCOUNTS_SUBSCRIBER` is used
  - xvinit argument is replaced in this case with a name (instead of a chainid)
  - xvinit must be used to set the name of the contract providing vaccounts functionality
  - contract using vaccounts_subscriber must be staked to a DSP, but does not have to be same DSP that the vaccounts host contract is staked to -fixes
  - fixed issue where vaccount push requests are not forwarded to a staked provider

8.2.3 @liquidapps/dsp

- update get table row secodary index changes in 2.0
- cease support for pre nodeos 2.0 nodes
- added max pending messages for demux to prevent memory crashes
- fixed demux get starting block logic, added possibility for head block
- expose `DEMUX_MAX_PENDING_MESSAGES` in toml file to set pending messages from demux web socket to process before disconnecting to allow pending messages to process. Behavior is once max pending messages amount hit to disconnect websocket until 50% of messages are processed, then reconnect to continue processing.
- fixes
  - fix demux head block handler using brackets
  - support new `/v1/chain/send_transaction` endpoint in addition to `/v1/chain/push_transaction`

8.2.4 @liquidapps/zeus-cmd

- split mapping into builtin and local file stored in ~/.zeus/ storage directory
- boxes added to the mapping using zeus deploy box and zeus box add go to the local mapping file to persist between zeus updates
- when unboxing a box found in both files, the local mapping is given priority, but a warning is displayed
- added zeus box remove command to remove boxes from the local mapping
- added RC file ignore flag –rc-ignore to bypass it | thank you prcolaco

Example `zeusrc.json`:

```
{
    "verbose": true,
    "type": "local",
    "update-mapping": true,
    "test": true
}
```

- added utility/tool for deserializing `xvexec` data (vaccount action data) Example: `deserializeVactionPayload('dappaccoun.t', '6136465e000000002a00000000000000aca376f206b 'https://mainnet.eos.dfuse.io')` returns

```
{
   "payload":{
      "expiry":"1581659745",
      "nonce":"42",
      "chainid":"ACA376F206B8FC25A6ED44DBDC66547C36C6C33E3A119FFBEAEF943642F0E906",
      "action":{
         "account":"",
         "action_name":"transfervacc",
         "authorization":[

         ],
         "action_data":
↪"70AE375C19FEAA49E0D336557DF8AA4901000000000000000004454F5300000000026869"
      }
   },
   "deserializedAction":{
      "payload":{
         "vaccount":"dapjwaewayrb",
         "to":"dapjkzepavdy",
         "quantity":"0.0001 EOS",
         "memo":"hi"
      }
   }
}
```

- add RC file to load regular zeus-cmd options from, on ~/.zeus/zeusrc.json by default, changeable with –rc-file option | thank you prcolaco
- `zeus create contract <MY_CONTRACT>` now creates `MY_CONTRACT.cpp` instead of `main.cpp`, update cmake to use `MY_CONTRACT.cpp`
- use v2.0.4 nodeos
- fixes

  - fix portfolio app requesting new oracle entries twice on load
  - fix portfolio app double adding eos token balances
  - `Read past end of buffer` - The issue was that an additional parameter was added to IPFS warmup to enable new functionality. This caused a conflict for pre-existing contracts attempting to warmup IPFS data. The parameter was removed.
  - fixed and refactored `get-table` utility to work with new dsp api (`get_uri`) and nodeos >= 2.0.0.

8.2.5 @liquidapps/dapp-client

8.2.6 docs

- update to using nodeos v2+, pre 2.0 no longer supported
- add `developers/contract-logs` section and add details on DSP logs
- add `/liquidx/models/eosio-chains/${CHAIN_ACCOUNT}.json` section to consumer liquidx docs

8.2.7 LiquidX

- Service contracts and service contract mapping no longer mandatory
  - If a service contract is not mapped, it will default to the same name as the mainnet

8.2.8 dappservices contract

- Moved quota calculation logic into dappservices
- Deprecated individual service contracts for quota management, i.e. `ipfsservice1`,`cronservices`, etc
  - Providers that have already registered packages will have their RAM freed using a new `freeprovider(provider)` action
- billing will default to 0.0001 QUOTA for all actions
  - This allows for new actions to be added to services
- use `pricepkg` action to price action in quota
- add @eosio.code note for dappservicex and consumer contracts in liquidx section

8.2.9 LiquidStorage Service

- Added unauthenticated `get_uri` api endpoint.

8.2.10 LiquidStorage for LiquidAccounts PR - thank you https://github.com/MrToph

- Added `public_upload_vaccount` endpoint. This endpoint can be used directly from the frontend by vaccounts. The vaccount signs the file to upload, sends it to the DSP, which verifies and stores the file. Optionally, it does some additional quota checks defined by the consumer contract: It can define max file sizes, daily global upload limits, and daily limits on a per vaccount level.
- Added a `storageconsumer` contract testing the vaccount uploads + limits checking.

- Refactored the `upload_public` endpoint to a `common.js` file as most functionality is now also required by the new `upload_public_vaccount` endpoint.
- Added two quick-fix options `external` and `box` to the `sync-builtin-boxes` command, because it did not work with the public zeus-sdk repo. External should be set to true when using the public repo. The default args are chosen in a way that they shouldn't change anything if invoked as usual.
- changed the uploads to use base64 encoding instead of hex (in both dapp-client and server) to save some bandwidth. Fixed the bytelength quota calculation
- Disable vaccount archive upload
- Use base64 as encoding for archive as well to match other encodings.
- Support public archive upload in dapp-client lib
- fixes
  - Fix archive upload test

Special thank you to Michael of the EOSUSA team for helping us test and deploy LiquidX

8.3 2.0.4002

8.3.1 LiquidVRAM Service

- **Backwards Compatability Warning**
  - To Support new features some schema changes have taken place
  - If you already have a vram contract in production, it is recommended that you do not use the changes
  - Migration details and tools will be provided at a later time
  - To use the new features place `#define USE_ADVANCED_IPFS` at the start of your contract
- New Advanced Multi Index features
  - Primary key may be `uint32`, `uint64`, `uint128`, and `checksum256`
  - Ability to backup, restore, and clear vram datasets with versioning

8.3.2 @liquidapps/dsp - 2.0.4002-latest

- add DSP console log in `common.js` if minimum stake threshold not met for account's DAPP stake to DSP's service package
- add reconnect mechanism to demux nodeos websocket
- update eos 1.8.7 nodeos
- add `keysize` support to the ipfs `index.js` file
- add `DSP_CONSUMER_PAYS` logic to `config.toml`, if true throws error if DSP permission not setup
- add `DEMUX_BYPASS_DATABASE_HEAD_BLOCK` to `config.toml`, if true bypasses database last processed block as head block and uses `config.toml` head block
- add `LIQUIDX_CONTRACT` to `config.toml`, points to EOS mainnet account that hosts the `liquidx` contract
- add `[sidechains]` section to `config.toml`

- add `liquidx` ability to offer service to other eosio based chains while using the EOS mainnet for staking, billing, and claim rewards
- fixes
  - add custom permissions for xcallback in generic-dapp-service-node file
  - fix cron reschedule on error, use `nextTrySeconds` time
  - `NODEOS_SECURED`, `DSP_CONSUMER_PAYS`, `DEMUX_BYPASS_DATABASE_HEAD_BLOCK`, accepted as bool or string when passed from toml, toml passes bools as strings, if set as an env variable manually, will accept as a bool

8.3.3 @liquidapps/zeus-cmd - 2.0.4002

- add `--type=local` flag to `zeus deploy box` command: deploys boxes locally to `~/.zeus/boxes/` instead of `IPFS` or `s3`. *Must use with the `--update-mapping` flag*. Together both flags (`zeus deploy box --type=local --update-mapping`) updates the `mapping.json` file with `file://..` as the pointer | thank you prcolaco
- made `--type=local` and `--update-mapping` flags default for `zeus deploy box` command
- only use invalidation of ipfs with `zeus deploy box` command when the `--type` is `ipfs` | thank you prcolaco
- modified and fixed ipfs cleanup script to support oracle cleanups
- allow `zeus compile <CONTRACT_NAME>`, zeus now allows you to only compile a contract by its name if you like, or you can run `zeus compile` to run all
- add `kill-port` npm dependency to `eos-extensions` box
- move `ipfs-daemon` dependency from `boxes/groups/core/build-extensions/zeus-box.json` to `boxes/groups/dapp-network/dapp-services/zeus-box.json` as `IPFS` is only needed with the `dapp-services` box
- add `utils/ipfs-service/get-table.js` - Reads all vRAM tables of a smart contract and stores them with the naming syntax: `${contract_name}-${table_name}-table.json`
- add `utils/ipfs-service/get-ordered-keys.js` - Prints ordered vRAM table keys in ascending order account/table/scope. This can be used to iterate over the entire table client side
- allow `zeus test <CONTRACT_NAME>`, zeus now allows you to only compile/test a contract by its name if you like, or you can run `zeus test -c` to compile/test all
- add `zeus vaccounts push-action test1v regaccount '{"vaccount":"vaccount1"}'`
- add ability to import/export LiquidAccount keys
- implement storage `dapp-client` into storage service test `storage-dapp-service/test/storage.spec.js`
- build `dapp-client` from source instead of installing by adding step to `start-localenv`
- use base58 instead of default base32 for LiquidStorage's `ipfs.files.add` to match ipfs service
- add `zeus test -c` alias to compile all contracts, `zeus test` now does not compile by default
- Implementing reset, load, and save functionality for multi-index tables
  - save: add `zeus backup-table` command which calls `zeus/boxes/groups/services/ipfs-dapp-service/utils/ipfs-service/backup.js` to backup a `dapp::multi_index` table

  - add manifest table to `advanced_multi_index.hpp` which provides the sharding details for a table, includes params: `checksum256 next_available_key`, `uint32_t shards`, `uint32_t buckets_per_shard`, and `std::map<uint64_t,std::vector<char>> shardbuckets`
  - add backup table to `advanced_multi_index.hpp` which provides the manifest details, includes params: `uint64_t id`, `ipfsmultihash_t manifest_uri`, `time_point timestamp`, and `string description`
  - add the following actions to the ipfsconsumer example contract:
    * `testman` - load a manifest
    * `testclear` - incrementing table version and clear the `shards` and `buckets_per_shard` params
    * `testbig` - tests storing an entry with a `checksum256` primary key and stores a `uint64_t` test number
    * `checkbig` - checks entry `checksum256` primary key returns correct value of test number
    * `testmed` - tests storing an entry with a `uint128_t` primary key and stores a `uint64_t` test number
    * `checkmed` - checks entry `uint128_t` primary key returns correct value value of test number
    * `testindex` - tests storing an entry with a `uint64_t` primary key and stores a `uint64_t` test number
    * `testfind` - checks entry `uint64_t` primary key returns correct value value of test number
  - add following tables to ipfsconsumer example contract: `bigentry` - uses a `checksum256` primary key, `medentry` - uses a `uint128_t` primary key
  - add `keysize` as parameter for `zeus get-table-row` command, options: `64 (uint64_t), 128 (uint128_t), 256 (uint256_t) and hex (eosio::checksum256)`
  - added the following unit tests: `dapp::multi_index checksum256 Get Available Key`, `IPFS Save Manifest`, `IPFS Clear`, `IPFS Load Manifest`, and `IPFS cache cleaned after write`
- add `vmanifest` table, `getRawTreeData` and `getTreeData` functions, and `warmuprow` and `cleanuprow` service responses to `_ipfs_impl.hpp` file
- added new service request types `warmuprow`,`cleanuprow` to the ipfs service
- utilize over-eager loading in `dapp::multi_index` via `warmuprow` to reduce vRam latency by attempting to load all required data in a single action
- update coldtoken unit tests to reflect new decrease in latency
- moved nodeos.log to /logs folder
- tail last 1mb of nodeos.log folder to keep upon restarting zeus test
- flag ipfsentries as pending commit to prevent duplicate requests
  - If a contract uses a shardbucket multiple times, it will only have unique commits
  - If multiple actions in the same block (or prior to the `xcommit`) need to lookup the same shardbucket, there will be a single unique commit, and no additional warmups required
  - If a contract uses a delayed commit, this delayed commit won't be overwritten by an immediate commit
- update eosio.cdt to default to 1.6.3 if not installed
- add `zeus box create` and `zeus box add` commands

- add `--sidechains ['{sidechain_provider:"dspnameeeeee", service_contract:"ipfservice2",nodeos_endpoint:"https://api.jungle.alohaeos.com:443",active_key:""}','{ ... another sidechain object }']` option to `zeus register dapp-service-provider-package"` to regprovider with sidechains
- add `zeus compile --sidechain=mychainnamee` flag to compile a side chain name when using liquidx
- use gateway port (3115) instead of service port (e.g. `13112` oracles) when running local zeus tests
- add `liquidjungle` box with `/models/liquid-mappings` for DSP files, service files, and the `dappservices:dappservicex` mapping as well as `/models/eosio-chains liquidjungle.json` chain config file
- add `dappservicex` (DAPP service contract for new chain) and `liquidx` (DAPP service contract for EOS mainnet)
- rename all instances of `local-sidechains` to `eosio-chains`
- update eos to default to 1.8.7 if not installed
- fixes
  - update example frontend to eosjs2 and latest scatter
  - update cleanup script to work with new dsp logic
  - add CONTRACT_END syntax to example contract
  - fix cardgame unit test
    - use dapp-client for vaccounts
    - move xvinit for vaccounts to happen in migration
    - add xvinit to coldtoken contract
    - update to eosj2
  - fix chess.json to enable migration by updating contract / account
  - fix OSX `zeus deploy box` breaking issue
  - remove prints from vaccount code to prevent `required service` error
  - remove `all-dapp-services` box from `templates-emptycontract-eos-cpp` (zeus create contract)
  - Remove Babel as a dependency from zeus-cmd and all zeus boxes
  - add sub prefix to local unit test localenv files, i.e., `20-eos-local-dapp-services.js` → `20-a-eos-local-dapp-services.js`, `20-eos-local-sidechains-dapp-services.js` → `20-b-eos-eosio-chains-dapp-services.js`

8.3.4 @liquidapps/dapp-client - 2.0.4002

- add `keysize` as argument for get vram row command, options: `64 (uint64_t), 128 (uint128_t), 256 (uint256_t) and hex (eosio::checksum256)`
- add support for `vconfig` file, `warmuprow` and `cleanuprow` actions in node logic to support faster data warmups
- fixes
  - add fix text encode/decode in vaccounts service

8.3.5 docs

- removed `read-mode = head` from default `config.ini` setup for eosio node
- clarified `wasm-runtime = wabt` must be used over `wasm-runtime = wavm` due to bugs in `wavm`
- add `zeus compile <CONTRACT_NAME>` syntax to *zeus-getting-started*
- update path for `cleanup.js` script for DSPs
- add cleanup oracle info to *Cleanup IPFS and Oracle Entries*
- fixed little mistakes in *vram-getting-started*
- added usage docs for `get-table` and `get-ordered-keys`
- update `chain-state-db-size-mb` from `131072` to `16384` see here
- update eos 1.8.7 nodeos
- update cardgame link to: http://elemental.liquidapps.io/
- update vram getting started section with new `get-table-row` syntax
- add info on how to save load and clear a `dapp::multi_index` table
- add `macros` section to developer docs
- add `docs/liquidx/add-a-chain` section
- add `docs/liquidx/become-a-dsp` section
- add `docs/liquidx/getting-started` section
- add `docs/liquidx/use-services` section

8.3.6 dappservices contract

- add usagex for LiquidX and other off chain service billing LiquidStorage, LiquidLens, LiquidAuth
- contract pays for CPU/NET/RAM associated with xactions `xwarmup`, `xsignal`, `xcommit`, `xdcommit`, `xvexec`, etc
- fixes
  - add DAPP token assertion to `regpkg` command to ensure DAPP symbol and 4 decimals of precision used

8.4 2.0.3107

8.4.1 @liquidapps/dsp - 2.0.3107-latest

- add `'Content-Type': 'application/json'` to oracle `https+post+json` request
- add timeout proxy for database calls
- add LiquidX
- add LiquidHarmony, extension oracle service that allows plug and play oracle options (Web/IBC/XIBC/VCPU/SQL Services)
- add LiquidSQL, state storage alternative for smart contracts

- dappservicesx contract - add setlink (create link between side chain account and mainnet owner), adddsp (side chain account add DSP name), rmvdsp (side chain - account remove DSP name)
- liquidx contract - add addaccount (add sidechain account to allow billing to another chain account) and rmvaccount (remove link) actions
- add sidechain billing to dapp-services-node/common.js
- add LiquidKMS boilerplate
- add LiquidStorage node logic for unpin / upload_public
- add LiquidBilling boilerplate

8.4.2 @liquidapps/zeus-cmd - 2.0.3107

- update eos 1.8.6
- add example portolio dapp
- update LiquidStorage unit test
- add boxes: oracle-web oracle-self-history oracle-foreign-chain oracle-sister-chain oracle-wolframalpha oracle-random oracle-sql oracle-vcpu
- split up oracle services
- add functional LiquidStorage unit test
- fixes
  - replace unzip install with unzipper, allow node v11
  - update create contract example unit test eosjs2

8.4.3 @liquidapps/dapp-client - 2.0.3107

- add LiquidStorage client extension to upload / unpin

8.4.4 docs

- add local postgresql info
- add zeus-ide
- replace unzip install with unzipper, allow node v11
- update overview section with new links / videos
- add dapp-client section
- add example portolio dapp
- update oracle getting started links
- LiquidAuthenticator - WIP → Alpha
- LiquidBilling - WIP - Transaction signing service for resource payment
- LiquidKMS - WIP - Key Management Service
- LiquidStorage - WIP → Alpha

- LiquidSQL - Alpha

8.4.5 dappservices contract

- add usagex for LiquidX and other off chain service billing LiquidStorage, LiquidLens, LiquidAuth

8.5 2.0.2812

8.5.1 @liquidapps/dsp - 2.0.2812-latest

- separated pm2 log files
- add dsp version endpoint /v1/dsp/version
- add `keytype` parameter to `/v1/dsp/get_table_row` request (`"keytype":"symbol"` if passing a symbol or string as primary key, `"keytype":"number"` if passing number). The keytype field adds precision to ensure the correct primary key is returned and it is an optional parameter
- add support pass body to oracle POST request
- fixes
  - demux database sync issue
  - speed up demux sync and fix log messages
  - allow demux to sync from head_block in config.toml
  - prevent demux block processing from hanging
  - enable DSP API to use non-local nodeos instance
  - fix vram collision issue
  - auto generate dsp node index files
  - fix demux high CPU issue

8.5.2 @liquidapps/zeus-cmd - 2.0.2812

- add vcpu-dapp-service
- add chess game zeus unbox chess
- enable large LiquidAccount payload sizes
- add unit test for oracle POST request
- add `--phase` command to specify dapp services file `dapp-services-eos.js`, install npm files `npm`, or compile eos files `eos`
- fixes
  - change instantiateBuffer to instantiateSync for vcpu vrun.js
  - fix debian install for eosio.cdt due to syntax change in download link

8.5.3 @liquidapps/dapp-client - 2.0.2812

8.5.4 docs

- add unit testing section
- add email support: support@liquidapps.io
- add vCPU & LiquidChess
- add LiquidOracles, LiquidAccounts, LiquidScheduler docs

8.5.5 dappservices contract

8.6 2.0.2527

8.6.1 @liquidapps/dsp - 2.0.2527-latest

- add logging in /dsp/logs
- config.toml
  - Demux: head_block - can now set head block for demux to sync from
  - Demux: deprecated zmq_plugin support
  - Database: url - must set PostgressSQL database URL. Avoid duplicates, last processed block in db, etc.
  - Database: node_env - set to production to enable PostgressSQL database
- fixes
  - demux out-of-sync issue
  - de-duplication of requests and ability to resume dsp from last block
  - read past end of Buffer demux issue

8.6.2 @liquidapps/zeus-cmd - 2.0.2527

- updated to eosjs 20
- added eosjs1 compatibility wrapper
- enable migration to non-local eos chains
- LiquidAccounts - add nonce, chain_id, and expiry to transactions params
- fixes
  - Oracles - K out of N DSP results support. multi-dsp support fixes - adjust results size | code
  - Scheduler - added callback retries and better contract verification of timers. easier rescheduling of timers from callback (by returning 'true' in the function)
  - LiquidAccounts - fixed potential replay attack. added expiry, nonce and chainid verification in contract. Requires `xvinit` action to set chain_id for contract | code

8.6.3 @liquidapps/dapp-client - 2.0.2527

- get dappservices and dappairhodl1 tables
- push readfn and LiquidAccount transactions

8.6.4 docs

- Added IPFS info - bootstrap from existing node, swarm / bootstrap peers
- Added PostgressSQL Database info
- Updated EOS v1.8.4
- Updates IPFS v0.4.22
- Add cleanup and replay-contract information
- added support email: support@liquidapps.io

8.6.5 dappservices contract

- Enable/Disable Package - enablepkg, disablepkg
- 3rd party staking support
- search
- search