
aepp-sdk Documentation

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Everything you need to know about the Aeternity Python SDK.

Are you new to Aeternity blockchain? Well, you came to the right place: read this material to quickly get up and running.

1.1 Quick install guide

Before you can use the Aeternity SDK, you'll need to get it installed. This guide will guide you to a minimal installation that'll work while you walk through the introduction. For more installation options check the [installation guide](#).

1.1.1 Install Python

The Aeternity Python SDK requires Python v3.7

Get the latest version of Python at <https://www.python.org/downloads/> or with your operating system's package manager.

You can verify that Python is installed by typing `python` from your shell; you should see something like:

```
Python 3.7.y
[GCC 4.x] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

1.1.2 Install the SDK

The Aeternity Python SDK package name is `aepp-sdk` and it is available via the pypi.org repository.

To install or upgrade run the command

```
pip install -U aepp-sdk
```

1.1.3 Verifying

To verify that the Aeternity SDK can be seen by Python, type `python` from your shell. Then at the Python prompt, try to import `aeternity`:

```
>>> import aeternity
>>> print(aeternity.__version())
snapshot
```

To verify that the CLI is available in your `PATH` run the command

```
$ aecli --version
aecli, version snapshot
```

1.1.4 That's it!

That's it – you can now *move onto the tutorial*.

1.2 Transfer funds

Let's learn by example.

Throughout this tutorial, we'll walk you through the creation of a basic script to transfer funds from an account to another.

It'll consist of three parts:

- Generate 2 accounts via command line client
- Get some funds for the first account
- Transfer the funds from an account to the other

We'll assume you have *the SDK installed* already. You can tell the SDK is installed and which version by running the following command in a shell prompt (indicated by the `$` prefix):

```
$ aecli --version
```

First step will be to generate two new accounts using the command line client:

First import the required libraries

```
from aeternity.node import NodeClient, Config
from aeternity.signing import Account
from aeternity import utils
import os
```

Then instantiate the node client and generate 2 accounts

```

NODE_URL = os.environ.get('TEST_URL', 'https://testnet.aeternity.io')

node_cli = NodeClient(Config(
    external_url=NODE_URL,
    blocking_mode=True,
))

# generate ALICE account
alice = Account.generate()

# generate BOB account
bob = Account.generate()

# retrieve the balances for the accounts
bob_balance = node_cli.get_balance(bob)
alice_balance = node_cli.get_balance(alice)

# print the balance of the two accounts
print(f"Alice address is {alice.get_address()}")
print(f"with balance {utils.format_amount(alice_balance)}")
print(f"Bob address is {bob.get_address()}")
print(f"with balance {utils.format_amount(bob_balance)}")

```

Now copy the Alice address and paste it into the [Aeternity Faucet](#) to top up the account; once the Alice account has some positive balance we can execute the spend transaction:

```

#TODO pause the execution while using the faucet
# execute the spend transaction
tx = node_cli.spend(alice, bob.get_address(), "3AE")
print(f"transaction hash: {tx.hash}")
print(f"inspect transaction at {NODE_URL}/v2/transactions/{tx.hash}")

```

And finally verify the new balance:

```

# retrieve the balances for the accounts
bob_balance = node_cli.get_balance(bob)
alice_balance = node_cli.get_balance(alice)

print(f"Alice balance is {utils.format_amount(alice_balance)}")
print(f"Bob balance is {utils.format_amount(bob_balance)}")

```

Thats it! You have successfully executed your transaction in the Aeternity Blockchain testnet network. For the mainnet network the procedure is the same except you will have to get some tokens via an exchange or via other means.

1.3 Working with Contracts

This guide describes how you can leverage aepp-sdk to compile, deploy and interact with aeternity smart contracts.

See also:

Sophia: An Æternity Blockchain Language

The Sophia is a language in the ML family. It is strongly typed and has restricted mutable state. Check out more about sophia [here](#).

1.3.1 Prerequisites

1. An account with some initial AE
2. A smart contract written in sophia
3. An aeternity node
4. A sophia aehttp compiler

Assumptions

We're going to assume that you have working knowledge of the SDK and know how to create an Account instance, a NodeClient, and a CompilerClient.

1.3.2 Sample Sophia Contract

Below is the sample sophia contract that we'll use in this guide.

We need to import the following classes to use contracts.

```
aeternity.node import NodeClient, Config
aeternity.compiler import CompilerClient
aeternity.contract_native import ContractNative
aeternity.signing import Account
```

1.3.3 Initializing NodeClient and Compiler

Below are the steps required to initialize the the *NodeClient* and *Compiler*. As you can see below, during the initialization of *NodeClient* we're also providing the *internal_url*.

internal_url provides the debug endpoint to *dry_run* a contract method which can also be used to do static calls on deployed contracts and this is what exactly we're going to use this for.

You can also not provide the *internal_url* but then you'll have to disable the use of *dry-run* endpoint. We'll see how to do that when we initialize our contract.

```
NODE_URL = os.environ.get('TEST_URL', 'http://127.0.0.1:3013')
NODE_INTERNAL_URL = os.environ.get('TEST_DEBUG_URL', 'http://127.0.0.1:3113')
COMPILER_URL = os.environ.get('TEST_COMPILER_URL', 'https://compiler.aepps.com')

node_cli = NodeClient(Config(
    external_url=NODE_URL,
    internal_url=NODE_INTERNAL_URL,
    blocking_mode=True,
))

compiler = CompilerClient(compiler_url=COMPILER_URL)
```

1.3.4 Generate an Account

You'll need an account (using the *Account* class) to deploy the contract and also for stateful contract calls.

```
# generate ALICE account (and transfer AE to alice account)
alice = Account.generate()
```

1.3.5 Read the Contract from file and initialize

You can read the contract from the stored *.aes* file and use it to initialize the contract instance. If you have not provided the *internal_endpoint* or simply do not want to use the *dry-run* functionality you can disable it by passing *use-dry-run=False* to the *ContractNative* constructor.

Warning: If you DO NOT provide the *internal_url* during *NodeClient* initialization and also DID NOT disable the *dry-run* then the contract method calls for *un-stateful* methods WILL FAIL.

```
CONTRACT_FILE = os.path.join(os.path.dirname(__file__), "testdata/CryptoHamster.aes")

# read contract file
with open(CONTRACT_FILE, 'r') as file:
    crypto_hamster_contract = file.read()

"""
Initialize the contract instance
To disable use of dry-run endpoint use:
crypto_hamster = ContractNative(client=node_cli, compiler=compiler, account=alice,
    ↳source=crypto_hamster_contract, use_dry_run=False)
"""
crypto_hamster = ContractNative(client=node_cli, compiler=compiler, account=alice,
    ↳source=crypto_hamster_contract)
```

1.3.6 Compile and deploy the contract

You can compile the contract and deploy it using the *deploy* method. If your *init* method accepts any arguments then please provide them inside the *deploy* method. Once the contract is compiled and deployed, the signed transaction is returned.

```
# deploy the contract (you can also pass the args if required by the init method of
    ↳the contract)
tx = crypto_hamster.deploy()
```

1.3.7 Call the contract methods

Once the contract is deployed, all the methods inside the contract are also available (with same signature) to use from the contract instance.

Note: All the methods that are NOT *stateful*, by default are processed using the *dry-run* endpoint to save gas. And therefore, a transaction hash will also not be provided for them. This functionality can be either disabled for the contract instance or per method by using *use_dry_run* argument.

```
# call the contract method (stateful)
tx_info, tx_result = crypto_hamster.add_test_value(1, 2)

print(f"Transaction Hash: {tx_info.tx_hash}")
print(f"Transaction Result/Return Data: {tx_result}")
```

```
# call contract method (not stateful)
tx_info, tx_result = crypto_hamster.get_hamster_dna("SuperCryptoHamster", None)

print(f"Transaction Result/Return Data: {tx_result}")
```

1.4 Claimin a name

This guide describes how you can leverage aepp-sdk to claim a name on the aternity blockchain.

1.4.1 Prerequisites

Assumptions

We're going to assume that you have working knowledge of the SDK and know how to create an Account instance, a NodeClient, and a CompilerClient.

TODO

1.5 Using Generalized Accounts

This page describe how to use the Python SDK to convert a basic account to a generalized one. For additional information about genrealized accounts visit the [‘protocol documentation’](#)

1.5.1 Example

The following example describe how to transform a basic account to a generalized one and how to execute a spend transaction from a generalized account.

```
from aeternity.node import NodeClient, Config
from aeternity.signing import Account
from aeternity.transactions import TxBuilder
from aeternity.compiler import CompilerClient
from aeternity import defaults, hashing, utils

import requests

def top_up_account(account_address):

    print()
    print(f"top up account {account_address} using the testnet.faucet.aepps.com app")
```

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```

    r = requests.post(f"https://testnet.faucet.aepps.com/account/{account_address}").
↪ json()
    tx_hash = r.get("tx_hash")
    balance = utils.format_amount(r.get("balance"))
    print(f"account {account_address} has now a balance of {balance}")
    print(f"faucet transaction hash {tx_hash}")
    print()

def main():

    """
    This example is divided in 2 parts
    - the first one is about transforming a Basic account to Generalized
    - the second shows how to post transactions from GA accounts
    """

    #
    # PART 1: fro Basic to GA
    #
    print("Part #1 - transform a Basic account to a Generalized one")
    print()

    # first we create a new account
    # this will be the ga account
    print(f"generate a new account")
    ga_account = Account.generate()
    print(f"your basic account address is {ga_account.get_address()}")

    # use the faucet to top up your ga account
    top_up_account(ga_account.get_address())

    # Instantiate a node client
    node_url = "http://sdk-testnet.aepps.com"
    print(f"using node at {node_url}")
    # get the node client
    n = NodeClient(Config(
        external_url=node_url,
        blocking_mode=True # we want the client to verify the transactions are_
↪ included in the chain
    ))

    # we are going to use a contract that will not be performing
    # any real authorization, just to provide a proof of concept
    # for the ga interaction
    #
    # DO NOT USE THIS CONTRACT IN A REAL SCENARIO
    # DO NOT USE THIS CONTRACT IN A REAL SCENARIO
    # DO NOT USE THIS CONTRACT IN A REAL SCENARIO
    #
    # this contract authorizes anybody to perform transactions
    # using the funds of the account!
    #
    blind_auth_contract = """contract BlindAuth =
    record state = { owner : address }

```

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```

entrypoint init(owner' : address) = { owner = owner' }

stateful entrypoint authorize(r: int) : bool =
  // r is a random number only used to make tx hashes unique
  switch(Auth.tx_hash)
    None      => abort("Not in Auth context")
    Some(tx_hash) => true
  ""

# Instantiate a compiler client
compiler_url = "https://compiler.aepps.com"
print(f"using compiler at {compiler_url}")
# get the node client
c = CompilerClient(compiler_url=compiler_url)

print()

# compile the contract for the ga and retrieve the bytecode
print("compile ga contract")
bytecode = c.compile(blind_auth_contract).bytecode

# prepare the calldata for the init function
print("encode the init function calldata")
init_calldata = c.encode_calldata(blind_auth_contract, "init", [ga_account.get_
↪address()]).calldata

# now we execute the first step, we'll be transforming the account into a ga
print("execute the GaAttach transaction")
ga_attach_tx = n.account_basic_to_ga(
  ga_account, # the ga account
  bytecode, # the bytecode of the ga contract
  init_calldata=init_calldata, # the encoded parameters of the init function
  auth_fun="authorize", # the name of the authentication function to use from
↪the contract
  gas=1000
)
print(f"GaAttachTx hash is {ga_attach_tx.hash}")
print(f"the account {ga_account.get_address()} is now generalized")

#
# END of PART 1
#

print()

#
# PART 2: posting a transaction from a GA account
#
# In this part we will be creating a spend transaction and we'll transfer 4AE
# from the generalized account to a newly created account
#
print("Part #2 - Create a spend transaction from a GA account")
print()

# we will be using the compiler client and the node client from the PART 1

```

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```

# first we create a new account
# this will be the recipient account
rc_account_address = "ak_2iBPH7HUz3cSDVEUWiHg76MZJ6tZooVNBmmxcgVK6VV8KAE688"
print(f"the recipient account address is {rc_account_address}")

# then we prepare the parameters for a spend transaction
sender_id = ga_account.get_address() # the ga sender account
amount = 4000000000000000000 # we will be sending 4.9AE
payload = "" # we'll be sending an empty payload
fee = defaults.FEE # we'll use the default fee (the client will generate the
→right fee for us)
ttl = defaults.TX_TTL # we'll use the default ttl for the transaction
nonce = defaults.GA_ACCOUNTS_NONCE # we'll use 0 as nonce since is is a special
→case

# now we'll use the builder to prepare the spend transaction
print(f"prepare a spend transaction from {sender_id} to {rc_account_address} of
→{utils.format_amount(amount)}")
builder = TxBuilder()
spend_tx = builder.tx_spend(sender_id, rc_account_address, amount, payload, fee,
→ttl, nonce)

# now that we have the transaction we need to prepare the authentication data for
→the ga transaction
print("encode the authorize function calldata")
auth_calldata = c.encode_calldata(blind_auth_contract, "authorize", [hashing.
→randint()]).calldata

# and use the sign_transaction with the auth_calldata to automatically
# prepare the ga transaction for us
print("execute the GaMeta transaction")
ga_meta_tx = n.sign_transaction(ga_account, spend_tx, auth_data=auth_calldata)

# and finally we can broadcast the transaction
ga_meta_tx_hash = n.broadcast_transaction(ga_meta_tx)
print(f"GaMetaTx hash is {ga_meta_tx_hash}")
print(f"the account spend transaction has been executed")

# note that you can verify all the steps above using the command line client
print()
print("Verify the steps using the command line client")
print("1. Check the ga account:")
print(f"aecli inspect {ga_account.get_address()}")
print("2. Check the GaAttachTx:")
print(f"aecli inspect {ga_attach_tx.hash}")
print("3. Check the GaMetaTx:")
print(f"aecli inspect {ga_meta_tx_hash}")

if __name__ == "__main__":
    main()

```

1.6 Command Line Interface (CLI)

We'll assume you have *the SDK installed* already. You can tell the SDK is installed and which version by running the following command in a shell prompt (indicated by the \$ prefix):

1.6.1 CLI Usage

See below for programmatic usage

You can launch the command line tool using

```
$ aecli
```

Available commands:

```
Usage: aecli [OPTIONS] COMMAND [ARGS]...

Welcome to the aecli client.

The client is to interact with an node node.

Options:
  --version          Show the version and exit.
  -u, --url URL      Node node url
  -d, --debug-url URL
  --force           Ignore node version compatibility check
  --wait            Wait for transactions to be included
  --json            Print output in JSON format
  --version          Show the version and exit.
  --help            Show this message and exit.

Commands:
  account  Handle account operations
  chain    Interact with the blockchain
  config   Print the client configuration
  inspect  Get information on transactions, blocks,...
  name     Handle name lifecycle
  oracle   Interact with oracles
  tx       Handle transactions creation
```

Environment variables

Use the environment variables

- NODE_URL
- NODE_URL_DEBUG

1.6.2 Example usage

The following is a walkthrough to execute a spend transaction on the **testnet** network

1. Set the environment variables

```
$ export NODE_URL=https://testnet.aeternity.io
```

When not set the command line client will connect to mainnet

1. Retrieve the top block

```
$ aecli chain top
<top for node at https://testnet.aeternity.io >
  Hash _____ mh_
  ↳ 2GKNC4Nft3mTtiUizsgmNySM6bmrtEk47AFd7QYxGLni6dHuSH
  Height _____ 171074
  Pof hash _____ no_fraud
  Prev hash _____ mh_
  ↳ 2ClqtupSRTIGHfgXStkFgPgTU7EtRpbj3R6JeqY94mKDnUM5erw
  Prev key hash _____ kh_
  ↳ 2mMnrh68xvs25qqnY6Q6BCYPPGEfW2AshvThNDugut12KGCjTp
  Signature _____ sg_
  ↳ UGs78hj7QJ96TZR4vLmrUPmXW2STFPQCR49q1mEvYEHWotC1k8DB6qfqwJGFjRtZL27rSEitLRee5wCqbs4XtGVZAFiCk
  State hash _____ bs_
  ↳ 2ZvCLwHsVPkEn43qvviRprlvQ1snpGdlizex6kScbU2Zd99s9S
  Time _____ 2019-11-20T11:11:22.934000+00:00
  Tx hash _____ bx_
  ↳ D4Y9x2RjobeCEETZqbVgYFsNu6UKhdSTAJXdXZBb5JbAuW7QA
  Version _____ 4
</top for node at https://testnet.aeternity.io >
```

1. Create a new account

```
$ aecli account create Bob.json
Enter the account password []:
<account>
  Address _____ ak_
  ↳ BobY97QUVR4iDLg4k3RKmy6shZYx9FR75nLaN33GsVmSnhWxn
  Path _____ /.../Bob.json
</account>
```

Make sure that you use a long and difficult-to-guess password for an account that you plan to use on mainnet

1. Go to testnet.faucet.aepps.com and top up your account
2. Inspect the transaction reported by the faucet app

```
$ aecli inspect th_2CV4a7xxDYj5ysaDjXNoCSLxnkowGM5bbyAvtdoPvHZwTSYykX
<transaction>
  <data>
    Block height _____ 12472
    Block hash _____ mh_
    ↳ 2vjFffExUZPVG03q6CHRSzxVUhzLcUnQQUWpijFtSvKfoHwQWe
    Hash _____ th_
    ↳ 2CV4a7xxDYj5ysaDjXNoCSLxnkowGM5bbyAvtdoPvHZwTSYykX
    <signatures 1>
      Signature #1 _____ sg_
      ↳ WtPeyKWN4zmcnZZXpAxCT8EvjF3qSjiUidc9cdxQooxe1JCLADTVbKDFm9S5bNwv3yq57PQKTG4XuUP4eTzD5jymPHpNu
    </signatures>
    <tx>
      <data>
        Amount _____ 5AE
        Fee _____ 2.0000E-14AE
        Nonce _____ 146
        Payload _____ ba_RmF1Y2V0IFR4tYtyuw==
        Recipient id _____ ak_
        ↳ 2ioQbdSViNKjknaLUWphdRjpbTNVpMHPXf9X5ZkoVrhrCZGuyW
        Sender id _____ ak_
        ↳ 2iBPH7HUz3cSDVEUWiHg76MZJ6tZooVNBmmxcgVK6VV8KAE688
```

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```

    Ttl _____ 12522
    Type _____ SpendTx
    Version _____ 1
    Tag _____ 12
  </data>
  <metadata>
    Min fee _____ 0.00001706AE
  </metadata>
  Tx _____ tx_+GEMAAEB4TK48d23oE5jt/
  ↳ qWR5pUu8UlpTGn8bwM5JISGQMGf7ChAeKbvpV6jbxY/
  ↳ le3tbquBoRjk0ehgOsRdSzc09bKfw3uiEVjkYJE9AAAgk4ggjDqgZKJRmF1Y2V0IFR47rafGA==
  </tx>
  Tag _____ 11
  Type _____ SignedTx
  Version _____ 1
</data>
Tx _____ tx_+KsLAfhCuEDkb9XQq/
↳ ihtZ+DNbDBI/9ntVGwcJJLCV0qZE8c9wMxAeTyyG3hVqthIco/
↳ NLuaVQ0N3XRYhYb6PsYOjAf8hzMJuGP4YQwBoQHhMrjx3begTmO3+pZHmlS7xSWlMafxvAzkkhIZAwZ/
↳ sKEB4pu+lxqNvHL+V7e1uq4GhGOTR6GA6xF1LNzTlsp/
↳ De6IRWORgkT0AACCTiCCMOqBkolGYXVjZXQgVHgQZGwg
  Hash _____ th_
  ↳ 2CV4a7xxDYj5ysaDjXNoCSLxnkowGM5bbyAvtdoPvHZwTSYykX
</transaction>

```

1. Create another account

:: \$ aecli account create Alice.json Enter the account password []: <account>

```

Address _____ ak_9j8akv2PE2Mnt5khFeDvS9BGc3TBBRjkfcgaJHgBXcLL
Path _____ ../../Alice.json

```

</account>

1. Transfer some tokens to an account to the other

:: \$ aecli account spend Bob.json ak_9j8akv2PE2Mnt5khFeDvS9BGc3TBBRjkfcgaJHgBXcLLagX8M 1AE Enter the account password []: <spend transaction>

```

<data> Tag _____
      12      Vsn _____
      1      Sender      id _____
      ak_BobY97QUVR4iDLg4k3RKmy6shZYx9FR75nLaN33GsVmSnhWxn      Recipient      id
      _____ ak_9j8akv2PE2Mnt5khFeDvS9BGc3TBBRjkfcgaJHgBXcLLagX8M
      Amount _____ 1AE      Fee
      _____ 0.00001686AE
      Ttl _____ 0      Nonce
      _____ 4      Payload
      _____

</data> Metadata Tx _____
tx_+KMLAfhCuEAKN05UwTV0fSgO5woziVNnAMBcDrh46XINFTZTJQII05fz/8pVSyrblguCLcw8n7++O887k/JEu6/X
Hash _____ th_2gAL72dtnaeDcZoZA9MbfSL1JrWzNErMJuikmTRvB
Signature _____ sg_2LX9hnJRiYGSspzpS34QeN3PLT9bGSKFRbad9LXvLj5
Network id _____ ae_uat

```

</spend transaction>

1. Verify the balance of the new account

```
:: $ aecli inspect ak_9j8akv2PE2Mnt5khFeDvS9BGc3TBBBrJkfcgaJHgBXcLLagX8M <account>
```

Balance	_____	1 AE	Id
	_____ ak_9j8akv2PE2Mnt5khFeDvS9BGc3TBBBrJkfcgaJHgBXcLLag		
Kind	_____		basic
Nonce	_____	0	Payable
	_____ True		

```
</account>
```

1.7 Contributing

Contributing to the Aeternity Python SDK

1.7.1 Pull Requests

- [Squash your commits](#) to ensure each resulting commit is stable and can be tested.
- Include issue numbers in the PR title, e.g. “GH-128. Resolves issue #123”.
- Add unit tests for self-contained modules.
- Add integration tests as needed.
- Document new code.

1.7.2 Git Commit Messages

- Use the present tense (“Add feature” not “Added feature”)
- Use the imperative mood (“Move cursor to...” not “Moves cursor to...”)
- Limit the first line to 72 characters or less
- Reference issues and pull requests liberally after the first line

Learn more about [writing a good commit message](#).

See also:

If you are new to Aeternity blockchain, you may want to start by checking the [website](#) and the [forum](#).

See also:

If you’re new to [Python](#), you might want to start by getting an idea of what the language is like.

If you’re new to programming entirely, you might want to start with this [list of Python resources for non-programmers](#)

If you already know a few other languages and want to get up to speed with Python quickly, we recommend [Dive Into Python](#). If that’s not quite your style, there are many other [books about Python](#).

CHAPTER 2

“How-to” guides

Here you’ll find short answers to “How do I . . . ?” types of questions. These how-to guides don’t cover topics in depth. However, these guides will help you quickly accomplish common tasks.

2.1 Account management via CLI

The Python SDK comes with a command line client (CLI) that can be used among other things to generate, store, inspect and load accounts

2.1.1 Generate a new account

The command to generate a new (non HD) account is:

```
$ aecli account create KEYSTORE_FILENAME.json
```

the command will ask for a password and will store the account in the file named `KEYSTORE_FILENAME.json`; here an example:

```
aecli account create BOB.json
Enter the account password []:
<account>
  Address _____ ak_
  ↪ 2P44NhGFT7fP1TFpZ62FwabWP9djg5sDwFNDVVpiGgd3p4yA7X
  Path _____ /howto/BOB.json
</account>
```

2.1.2 Print the secret key of an account

Warning: The secret key is printed in “clear text”, by printing it on the terminal or saving it unencrypted you expose your account

the command to print the public and secret key of an account saved in a keystore file is:

```
$ aecli account address --secret-key KEYSTORE_FILENAME.json
```

Example:

```
aecli account address BOB.json --secret-key
Enter the account password:
!Warning! this will print your secret key on the screen, are you sure? [y/N]: y
<account>
  Address _____ ak_
↪ 2P44NhGFT7fP1TFpZ62FwabWP9djg5sDwFNDVVpiGgd3p4yA7X
  Secretkey _____ c226bf650f30740287f77a715.....
↪ .....f49ddff758971112fb5cfb0e66975a8f
</account>
```

See also:

Many writers in the [Aeternity forum](#) write this sort of how-to material.

3.1 How to install the Aeternity SDK

This document will explain different ways to install the Aeternity Python SDK

3.1.1 Install Python

Get the latest version of Python at <https://www.python.org/downloads/> or with your operating system's package manager.

3.1.2 Install the SDK

Installation instructions are slightly different depending on whether you're installing official release or fetching the latest development version.

Installing an official release with `pip`

This is the recommended way to install the Aeternity SDK

1. Install `pip`. The easiest is to use the [standalone pip installer](#). If your distribution already has `pip` installed, you might need to update it if it's outdated. If it's outdated, you'll know because installation won't work.
2. Take a look at [virtualenv](#) and [virtualenvwrapper](#). These tools provide isolated Python environments, which are more practical than installing packages systemwide. They also allow installing packages without administrator privileges. The [contributing tutorial](#) walks through how to create a `virtualenv`.
3. After you've created and activated a virtual environment, enter the command:

```
$ python -m pip install aepp-sdk
```

Installing the development version

If you'd like to be able to update your SDK code occasionally with the latest bug fixes and improvements, follow these instructions:

1. Make sure that you have **Git** installed and that you can run its commands from a shell. (Enter `git help` at a shell prompt to test this.)
2. Install **Poetry** and make sure it is available in your `PATH`
3. Check out the SDK main development branch like so:

```
$ git clone https://github.com/aeternity/aepp-sdk-python.git
```

This will create a directory `aepp-sdk-python` in your current directory.

1. Make sure that the Python interpreter can load the SDK's code. The most convenient way to do this is to use **virtualenv**, **virtualenvwrapper**, and **pip**.
2. After setting up and activating the virtualenv, run the following command:

```
$ poetry build
$ python -m pip install dist/$(ls -tr dist | grep whl | tail -1)
```

This will make the SDK code importable, and will also make the `aecli` utility command available. In other words, you're all set!

When you want to update your copy of the SDK source code, run the command `git pull` from within the `aepp-sdk-directory` directory. When you do this, Git will download any changes.

Where is the command line client?

The Python SDK bundles a command line client `aecli` that can be used to submit transactions and poke around the Aeternity blockchain. To be able to access the command line client you have to add it to your executable path. To find out where is your base path for installed python libraries use the command `python -m site --user-base`

3.2 Keystore format change [LEGACY]

The release 0.25.0.1 of the Python SDK change the format of the keystore used to store a secret key in an encrypted format.

The previous format, supported till version 0.25.0.1b1 is not supported anymore and secret keys encrypted with the legacy format will have to be updated manually.

Warning: BEFORE YOU START

The following procedure will print your secret key unencrypted on the terminal.

Make sure you perform this procedure in a secret setting.

The following steps are required to upgrade a keystore (named `my_account.json`).

1. Install the `aepp-sdk` v0.25.0.1b1

```
$ pip install aepp-sdk==0.25.0.1b1
```

Verify that you are using the correct version

```
$ aecli --version
aecli, version 0.25.0.1b1
```

1. Print your secret key to the terminal

```
aecli account address --secret-key my_account.json
Enter the account password []:
!Warning! this will print your secret key on the screen, are you sure? [y/N]: y
<account>
  Address _____ ak_
  ↳ 2UeaQn7Ei7HoMvDTiq2jyDuE8ymEQMPZExzC64qWTxpUnanYsE
  Signing key _____
  ↳ 507f598f2fac1a4ab57edae53650cbf7ffae9eeeee1a297cc7c3b6172052e55ec27954c4ba901cf9b3760dc12b2c313d60
</account>
```

1. Install the *aepp-sdk* v0.25.0.1

```
$ pip install aepp-sdk==0.25.0.1
```

Verify that you are using the correct version

```
$ aecli --version
aecli, version 0.25.0.1
```

1. Save the secret key to the new format

```
aecli account save my_account_new.json
↳ 507f598f2fac1a4ab57edae53650cbf7ffae9eeeee1a297cc7c3b6172052e55ec27954c4ba901cf9b3760dc12b2c313d60
Enter the account password []:
<account>
  Address _____ ak_
  ↳ 2UeaQn7Ei7HoMvDTiq2jyDuE8ymEQMPZExzC64qWTxpUnanYsE
  Path _____ /Users/andrea/tmp/aeternity/my_
  ↳ account_new.json
</account>
```

5. Verify that the new keystore has the correct format

the content of the keystore file should appear as the following:

```
$ cat my_account_new.json
{"public_key": "ak_2UeaQn7Ei7HoMvDTiq2jyDuE8ymEQMPZExzC64qWTxpUnanYsE", "crypto": {
  ↳ "secret_type": "ed25519", "symmetric_alg": "xsalsa20-poly1305", "ciphertext":
  ↳ "f431af7e6f00da7f9acc8187900b97d42526eb135f4db0da80a7809f36a00e37f3a313f7c611784f381e58620bb2c23ef
  ↳ ", "cipher_params": {"nonce": "1ea25d885a68adf13998e0fad17b22e7ade78f5cf1670eb1"},
  ↳ "kdf": "argon2id", "kdf_params": {"memlimit_kib": 262144, "opslimit": 3, "salt":
  ↳ "c3dd4a4ac8347b3ad706756b96919387", "parallelism": 1}}, "id": "44c3d693-a890-4ac1-
  ↳ 936b-0a65c8293388", "name": "", "version": 1}
```

6. Cleanup!

Once the operation is completed, cleanup the terminal history that contains your secret key

```
history -c
```

And remove the old account file

```
rm my_account.json
```

4.1 Node Client

The `Config` class is used to initialize the `NodeClient`

```
class aeternity.node.Config(external_url='http://localhost:3013',          in-
                             ternal_url='http://localhost:3113',      web-
                             socket_url='http://localhost:3014',      force_compatibility=False,
                             **kwargs)
```

```
__init__(external_url='http://localhost:3013',    internal_url='http://localhost:3113',    web-
          socket_url='http://localhost:3014', force_compatibility=False, **kwargs)
```

Initialize a configuration object to be used with the `NodeClient`

Parameters

- **external_url** – the node external url
- **internal_url** – the node internal url
- **websocket_url** – the node websocket url
- **force_compatibility** – ignore node version compatibility check (default `False`)
- ****kwargs** – see below

Kwargs:

blocking_mode (bool) whenever to block the execution when broadcasting a transaction until the transaction is mined in the chain, default: `False`

tx_gas_per_byte (int) the amount of gas per byte used to calculate the transaction fees, [optional, default: `defaults.GAS_PER_BYTE`]

tx_base_gas (int) the amount of gas per byte used to calculate the transaction fees, [optional, default: `defaults.BASE_GAS`]

tx_gas_price (int) the gas price used to calculate the transaction fees, it is set by consensus but can be increased by miners [optional, default: defaults.GAS_PRICE]

network_id (str) the id of the network that is the target for the transactions, if not provided it will be automatically selected by the client

contract_gas (int) default gas limit to be used for contract calls, [optional, default: defaults.CONTRACT_GAS]

contract_gas_price (int) default gas price used for contract calls, [optional, default: defaults.CONTRACT_GAS_PRICE]

oracle_ttl_type (int) default oracle ttl type

key_block_interval (int) the key block interval in minutes

key_block_confirmation_num (int) the number of key blocks to consider a transaction confirmed

poll_tx_max_retries (int) max poll retries when checking if a transaction has been included

poll_tx_retries_interval (int) the interval in seconds between retries

poll_block_max_retries (int) TODO

poll_block_retries_interval (int) TODO

debug (bool) TODO

The `NodeClient` is the main object to interact with an Aeternity node.

```
class aeternity.node.NodeClient (config=<aeternity.node.Config object>)
```

```
account_basic_to_ga (account: aeternity.signing.Account, ga_contract: str, calldata: str,  
                     auth_fun: str = 'authorize', fee=0, tx_ttl: int = 0, gas: int = 10000,  
                     gas_price=1000000000) → aeternity.transactions.TxObject
```

Transform a Basic to a GA (Generalized Account)

Parameters

- **account** – the account to transform
- **ga_contract** – the compiled contract associated to the GA
- **calldata** – the calldata for the authentication function
- **auth_fun** – the name of the contract function to use for authorization (default: authorize)
- **gas** – the gas limit for the authorization function execution
- **gas_price** – the gas price for the contract execution
- **fee** – TODO
- **ttl** – TODO

Returns the TxObject of the transaction

Raises

- **TypeError** – if the auth_fun is missing
- **TypeError** – if the auth_fun is no found in the contract

broadcast_transaction (*tx: aeternity.transactions.TxObject*)

Post a transaction to the chain and verify that the hash match the local calculated hash It blocks for a period of time to wait for the transaction to be included if in blocking_mode

Parameters **tx** – the transaction to broadcast

Returns the transaction hash of the transaction

Raises **TransactionHashMismatch** – if the transaction hash returned by the node is different from the one calculated

compute_absolute_ttl (*relative_ttl*)

Compute the absolute ttl by adding the ttl to the current height of the chain

Parameters **relative_ttl** – the relative ttl, if 0 will set the ttl to 0

get_account (*address: str*) → aeternity.signing.Account

Retrieve an account by it's public key

get_balance (*account*) → int

Retrieve the balance of an account, return 0 if the account has not balance

Parameters **account** – either an account address or a signing.Account object

Returns the account balance or 0 if the account is not known to the network

get_block_by_hash (*hash=None*)

Retrieve a key block or a micro block header based on the block hash_prefix

Parameters **block_hash** – either a key block or micro block hash

Returns the block matching the hash

get_consensus_protocol_version (*height: int = None*) → int

Get the consensus protocol version number :param height: the height to get the protocol version for, if None the current height will be used :return: the version

get_next_nonce (*account_address*)

Get the next nonce to be used for a transaction for an account

Parameters **node** – the node client

Returns the next nonce for an account

get_top_block ()

Override the native method to transform the get top block response object to a Block

Returns a block (either key block or micro block)

get_vm_abi_versions ()

Check the version of the node and retrieve the correct values for abi and vm version

sign_transaction (*account: aeternity.signing.Account, tx: aeternity.transactions.TxObject, metadata: dict = {}, **kwargs*) → aeternity.transactions.TxObject

The function sign a transaction to be broadcast to the chain. It automatically detect if the account is Basic or GA and return the correct transaction to be broadcast.

Parameters

- **account** – the account signing the transaction
- **tx** – the transaction to be signed
- **metadata** – additional metadata to maintain in the TxObject
- ****kwargs** – for GA accounts, see below

Kwargs:

- auth_data (str)** the encoded calldata for the GA auth function
- gas (int)** the gas limit for the GA auth function [optional]
- gas_price (int)** the gas price for the GA auth function [optional]
- fee (int)** the fee for the GA transaction [optional, automatically calculated]
- abi_version (int)** the abi_version to select FATE or AEVM [optional, default 3/FATE]
- ttl (str)** the transaction ttl expressed in relative number of blocks [optional, default 0/max_ttl]:

Returns a TxObject of the signed transaction or metat transaction for GA

Raises

- **TypeError** – if the auth_data is missing and the account is GA
- **TypeError** – if the gas for auth_func is gt defaults.GA_MAX_AUTH_FUN_GAS

spend (*account: aeternity.signing.Account, recipient_id: str, amount, payload: str = "", fee: int = 0, tx_ttl: int = 0*) → aeternity.transactions.TxObject

Create and execute a spend transaction, automatically retrieve the nonce for the signing account and calculate the absolute ttl.

Parameters

- **account** – the account signing the spend transaction (sender)
- **recipient_id** – the recipient address or name_id
- **amount** – the amount to spend
- **payload** – the payload for the transaction
- **fee** – the fee for the transaction (automatically calculated if not provided)
- **tx_ttl** – the transaction ttl expressed in relative number of blocks

Returns the TxObject of the transaction

Raises **TypeError** – if the recipient_id is not a valid name_id or address

transfer_funds (*account: aeternity.signing.Account, recipient_id: str, percentage: float, payload: str = "", tx_ttl: int = 0, fee: int = 0, include_fee=True*)

Create and execute a spend transaction

verify (*encoded_tx: str*) → aeternity.transactions.TxObject

Unpack and verify an encoded transaction

wait_for_confirmation (*tx_hash, max_retries=None, polling_interval=None*)

Wait for a transaction to be confirmed by at least “key_block_confirmation_num” blocks (default 3) The amount of blocks can be configured in the Config object using key_block_confirmation_num parameter

Parameters

- **tx_hash** – the hash of the transaction to wait for
- **max_retries** – the maximum number of retries to test for transaction
- **polling_interval** – the interval between transaction polls

Returns the block height of the transaction if it has been found

wait_for_transaction (*tx_hash, max_retries=None, polling_interval=None*)

Wait for a transaction to be mined for an account The method will wait for a specific transaction to be included in the chain, it will return False if one of the following conditions are met: - the chain reply with a 404 not found (the transaction was expunged) - the account nonce is $\geq$ of the transaction nonce (transaction is in an illegal state) - the ttl of the transaction or the one passed as parameter has been reached

Parameters

- **tx_hash** – the hash of the transaction to wait for
- **max_retries** – the maximum number of retries to test for transaction
- **polling_interval** – the interval between transaction polls

Returns the block height of the transaction if it has been found

Raises **TransactionWaitTimeoutExpired** – if the transaction hasn't been found

4.2 TxObject

class aeternity.transactions.**TxObject** (***kwargs*)

This is a TxObject that is used throughout the SDK for transactions It contains all the info associated to a transaction like transaction data, transaction hash, etc

get_signature (*index*)

get the signature at the requested index, or raise type error if there is no such index

get_signatures ()

retrieves the list of signatures for a signed transaction, otherwise returns a empty list

4.3 Constants

The following are a list of constants used throughout the SDK

```
# fee calculation
BASE_GAS = 15000
GAS_PER_BYTE = 20
GAS_PRICE = 1000000000
# default relative ttl in number of blocks for executing transaction on the chain
MAX_TX_TTL = 256
TX_TTL = 0
FEE = 0
# contracts
CONTRACT_GAS = 10000
CONTRACT_GAS_PRICE = 1000000000
CONTRACT_DEPOSIT = 0
CONTRACT_AMOUNT = 0
# calldata for the init function with no parameters
CONTRACT_INIT_CALldata = "cb_
↳AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAACC5yVbyizFJqfWYeqUF89obIgnMVzkjQAYrtsG9n5"
↳+ \
  "+26gAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAHQYrA=="
# https://github.com/aeternity/protocol/blob/master/oracles/oracles.md#technical-
↳aspects-of-oracle-operations
ORACLE_VM_VERSION = identifiers.NO_VM
ORACLE_TTL_TYPE = identifiers.ORACLE_TTL_TYPE_DELTA
```

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```

ORACLE_QUERY_FEE = 0
ORACLE_TTL_VALUE = 500
ORACLE_QUERY_TTL_VALUE = 10
ORACLE_RESPONSE_TTL_VALUE = 10
# Chain
KEY_BLOCK_INTERVAL = 3 # average time between key-blocks in minutes
KEY_BLOCK_CONFIRMATION_NUM = 3 # number of key blocks to wait for to consider a key-
↳block confirmed
# network id
NETWORK_ID = identifiers.NETWORK_ID_MAINNET
# TUNING
POLL_TX_MAX_RETRIES = 8 # used in exponential backoff when checking a transaction
POLL_TX_RETRIES_INTERVAL = 2 # in seconds
POLL_BLOCK_MAX_RETRIES = 20 # number of retries
POLL_BLOCK_RETRIES_INTERVAL = 30 # in seconds
# channels
CHANNEL_ENDPOINT = 'channel'
CHANNEL_URL = 'ws://127.0.0.1:3014'
# Generalized accounts
GA_AUTH_FUNCTION = "authorize"
GA_MAX_AUTH_FUN_GAS = 50000
GA_ACCOUNTS_NONCE = 0 # for tx in ga transactions the nonce must be 0
# Aens
# max number of block into the future that the name is going to be available
# https://github.com/aeternity/protocol/blob/master/AENS.md#aens-entry
NAME_MAX_TTL = 50000 # in blocks
NAME_MAX_CLIENT_TTL = 84600 # in seconds
NAME_FEE = 0
# see https://github.com/aeternity/aeternity/blob/
↳72e440b8731422e335f879a31ecbbee7ac23a1cf/apps/aecore/src/aec_governance.erl#L67
NAME_FEE_MULTIPLIER = 100000000000000
NAME_FEE_BID_INCREMENT = 0.05 # the increment is in percentage
# see https://github.com/aeternity/aeternity/blob/
↳72e440b8731422e335f879a31ecbbee7ac23a1cf/apps/aecore/src/aec_governance.erl#L272
NAME_BID_TIMEOUT_BLOCKS = 480 # ~1 day
NAME_BID_MAX_LENGTH = 12 # this is the max length for a domain to be part of a bid
# ref: https://github.com/aeternity/aeternity/blob/
↳72e440b8731422e335f879a31ecbbee7ac23a1cf/apps/aecore/src/aec_governance.erl#L290
# bid ranges:
NAME_BID_RANGES = {
    31: 3 * NAME_FEE_MULTIPLIER,
    30: 5 * NAME_FEE_MULTIPLIER,
    29: 8 * NAME_FEE_MULTIPLIER,
    28: 13 * NAME_FEE_MULTIPLIER,
    27: 21 * NAME_FEE_MULTIPLIER,
    26: 34 * NAME_FEE_MULTIPLIER,
    25: 55 * NAME_FEE_MULTIPLIER,
    24: 89 * NAME_FEE_MULTIPLIER,
    23: 144 * NAME_FEE_MULTIPLIER,
    22: 233 * NAME_FEE_MULTIPLIER,
    21: 377 * NAME_FEE_MULTIPLIER,
    20: 610 * NAME_FEE_MULTIPLIER,
    19: 987 * NAME_FEE_MULTIPLIER,
    18: 1597 * NAME_FEE_MULTIPLIER,
    17: 2584 * NAME_FEE_MULTIPLIER,
    16: 4181 * NAME_FEE_MULTIPLIER,
    15: 6765 * NAME_FEE_MULTIPLIER,

```

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CHAPTER 5

FAQ

TODO

This is a collection of code snippets and scripts that may be used for copy/paste or quick references.

6.1 Top up account from the Faucet

Code to programmatically top-up an account using the [Faucet](#)

```
def top_up_account(account_address):  
  
    print(f"top up account {account_address} using the testnet.faucet.aepps.com app")  
    r = requests.post(f"https://testnet.faucet.aepps.com/account/{account_address}")  
    ↪ json()  
    tx_hash = r.get("tx_hash")  
    balance = utils.format_amount(r.get("balance"))  
    print(f"account {account_address} has now a balance of {balance}")  
    print(f"faucet transaction hash {tx_hash}")
```

6.2 Generate multiple accounts

The following is a command line tool to generate multiple accounts and to export the accounts secret/public keys.
Useful for testing

```
#!/usr/bin/env python  
import argparse  
import json  
from aeternity.signing import Account  
  
"""  
Example app to deal with common dev issues:  
- export secret/public key from a keystore
```

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```

- generate a number of accounts to be used
"""

# max number of account to generate
MAX_N_ACCOUNTS = 1000

def cmd_export(args):
    try:
        a = Account.from_keystore(args.keystore_path, args.password)
        print(json.dumps(
            {
                "keystore": args.keystore_path,
                "secret_key": a.get_secret_key(),
                "address": a.get_address()
            }, indent=2))
    except Exception as e:
        print(f"Invalid keystore or password: {e}")

def cmd_generate(args):
    try:
        if args.n > MAX_N_ACCOUNTS:
            print(f"Max number of accounts to generate is {MAX_N_ACCOUNTS}, ↵
↪requested: {args.n}")
        accounts = []
        for i in range(args.n):
            a = Account.generate()
            accounts.append({
                "index": i,
                "secret_key": a.get_secret_key(),
                "address": a.get_address()
            })
        print(json.dumps(accounts, indent=2))
    except Exception as e:
        print(f"Generation error: {e}")

if __name__ == "__main__":
    commands = [
        {
            'name': 'export',
            'help': 'export the secret/public key of a encrypted keystore as plain_
↪text WARNING! THIS IS UNSAFE, USE FOR DEV ONLY',
            'target': cmd_export,
            'opts': [
                {
                    "names": ["keystore_path"],
                    "help": "the keystore to use export",
                },
                {
                    "names": ["-p", "--password"],
                    "help": "the keystore password (default blank)",
                    "default": ""
                }
            ]
        },
        {
            'name': 'generate',

```

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```
'help': 'generate one or more accounts and print them on the stdout',
'target': cmd_generate,
'opts': [
    {
        "names": ["-n"],
        "help": "number of accounts to generate (default 10)",
        "default": 10,
    }
]
}
]
parser = argparse.ArgumentParser()
subparsers = parser.add_subparsers()
subparsers.required = True
subparsers.dest = 'command'
# register all the commands
for c in commands:
    subparser = subparsers.add_parser(c['name'], help=c['help'])
    subparser.set_defaults(func=c['target'])
    # add the sub arguments
    for sa in c.get('opts', []):
        subparser.add_argument(*sa['names'],
                               help=sa['help'],
                               action=sa.get('action'),
                               default=sa.get('default'))

# parse the arguments
args = parser.parse_args()
# call the function
args.func(args)
```

How the documentation is organized

A high-level overview of how it's organized will help you know where to look for certain things:

- *Tutorials* take you by the hand through a series of steps to create a python aepp. Start here if you're new to Aeternity application development. Also look at the “*First steps*” below.
- *Topic guides* discuss key topics and concepts at a fairly high level and provide useful background information and explanation.
- *Reference guides* contain technical reference for APIs and other aspects of Aeternity SDK machinery. They describe how it works and how to use it but assume that you have a basic understanding of key concepts.
- *How-to guides* are recipes. They guide you through the steps involved in addressing key problems and use-cases. They are more advanced than tutorials and assume some knowledge of how the Aeternity SDK works.
- *Code snippets* are various pieces of codes to copy/paste. They may be useful to find pieces of codes to get stuff done.

Are you new to the Aeternity SDK? This is the place to start!

- **From scratch:**
 - *Installation*
- **Tutorial:**
 - *Spend transactions*
 - *Deploy a contract*
 - *Claiming a name*
 - *Using Generalized accounts*
 - *The CLI*
- **How to:**
 - Coming soon...
- **Reference:**
 - *The NodeClient and Config*
 - *The TxObject*

CHAPTER 9

Getting help

Having trouble? We'd like to help!

- Try the [FAQ](#) – it's got answers to many common questions.
- Looking for specific information? Try the [genindex](#) or [modindex](#)
- Search for information in the [Aeternity forum](#), or [post a question](#).
- Report bugs with the Python SDK in our [issue tracker](#).

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`wait_for_transaction()` (*aeternity.node.NodeClient method*), 26