

# Integration Tests

Integration tests enable to deploy your contract in the NEARtestnet or a localsandbox , and create test-users to interact with it. In this way, you can thoroughly test your contract in a realistic environment.

Moreover, when using the localsandbox you gain complete control of the network:

1. Create testAccounts
2. and manipulate theirState
3. andBalance
4. .
5. Simulate errors on callbacks.
6. Control the time-flow and fast-forward into the future (Rust ready, TS coming soon).

NEAR Workspaces In NEAR, integration tests are implemented using a framework calledWorkspaces . Workspaces comes in two flavors: [Rust](#) and [Typescript](#) .

All of our[examples](#) come with integration testing.

## Snippet I: Testing Hello NEAR

Lets take a look at the test of our[Quickstart Project](#) [Hello NEAR](#) , where we deploy the contract on an account and test it correctly retrieves and sets the greeting.

- [JavaScript](#)

contract-ts/sandbox-ts/src/main.ava.ts loading ... [See full example on GitHub](#)

## Snippet II: Testing Donations

In most cases we will want to test complex methods involving multiple users and money transfers. A perfect example for this is our[Donation Example](#) , which enables users todonate money to a beneficiary. Lets see its integration tests

- [JavaScript](#)

contract-rs/sandbox-ts/src/main.ava.ts loading ... [See full example on GitHub](#)

## Sandbox Testing

NEAR Workspaces allows you to write tests once, and run them either ontestnet or a localSandbox . Bydefault , Workspaces will start asandbox and run your testslocally . Lets dive into the features of our framework and see how they can help you.

### Spooning Contracts

[Spooning a blockchain](#) is copying the data from one network into a different network. NEAR Workspaces makes it easy to copy data from Mainnet or Testnet contracts into your local Sandbox environment:

- [JavaScript](#)
- [Rust](#)

```
const refFinance =
```

```
await root . importContract ( { mainnetContract :
```

```
'v2.ref-finance.near' , blockId :
```

```
50_000_000 , withData :
```

```
true , } ) ; This would copy the Wasm bytes and contract state from v2.ref-finance.near to your local blockchain as it existed at block50_000_000 . This makes use of Sandbox's specialpatch state feature to keep the contract name the same, even though the top level account might not exist locally (note that this means it only works in Sandbox testing mode). You can then interact with the contract in a deterministic way the same way you interact with all other accounts created with near-workspaces.
```

note withData will only work out-of-the-box if the contract's data is 50kB or less. This is due to the default configuration of RPC servers; see[the "Heads Up" note here](#) . See [aTypeScript example of spooning](#) contracts. Specify the contract name fromtestnet you want to be pulling, and a specific block ID referencing back to a specific time. (Just in case the contract you're referencing has been changed or updated)

```

const
CONTRACT_ACCOUNT :

& str

=

"contract_account_name_on_testnet.testnet" ; const

BLOCK_HEIGHT :

BlockHeight

=

12345 ; Create a function called pull_contract which will pull the contract's.wasm file from the chain and deploy it onto your
local sandbox. You'll have to re-initialize it with all the data to run tests.

async

fn

pull_contract ( owner :

& Account , worker :

& Worker < Sandbox

)

->

anyhow :: Result < Contract

{ let testnet =

workspaces :: testnet_archival ( ) ; let contract_id :

AccountId

=

CONTRACT_ACCOUNT . parse ( ) ? ; This next line will actually pull down the relevant contract from testnet and set an
initial balance on it with 1000 NEAR.

let contract = worker . import_contract ( & contract_id ,

& testnet ) . initial_balance ( parse_near! ( "1000 N" ) ) . block_height ( BLOCK_HEIGHT ) . transact ( ) . await ? ; Following
that you'll have to init the contract again with your metadata. This is because the contract's data is too big for the RPC
service to pull down. (limits are set to 50Mb)

owner . call ( & worker , contract . id ( ) ,

"init_method_name" ) . args_json ( serde_json :: json! ( { "arg1" : value1 , "arg2" : value2 , } ) ) ? . transact ( ) . await ? ; Ok (
contract ) }

```

## Patch State on the Fly

In Sandbox-mode, you can add or modify any contract state, contract code, account or access key with `patchState` .

tip You can alter contract code, accounts, and access keys using normal transactions via `theDeployContract` , `CreateAccount` , and `AddKey` [actions](#) . But this limits you to altering your own account or sub-account. `patchState` allows you to perform these operations on any account. Keep in mind that you cannot perform arbitrary mutation on contract state with transactions since transactions can only include contract calls that mutate state in a contract-programmed way. For example, with an NFT contract, you can perform some operation with NFTs you have ownership of, but you cannot manipulate NFTs that are owned by other accounts since the smart contract is coded with checks to reject that. This is the expected behavior of the NFT contract. However, you may want to change another person's NFT for a test setup. This is called "arbitrary mutation on contract state" and can be done with `patchState` :

- JavaScript
- Rust

```

const
{ contract , ali }

= t . context . accounts ; // Contract must have some state for viewState & patchState to work await ali . call ( contract ,
'set_status' ,
{ message :
'hello' } ) ; // Get state const state =
await contract . viewState ( ) ; // Get raw value const statusMessage = state . get ( 'STATE' ,
{ schema ,
type :
StatusMessage } ) ; // Update contract state statusMessage . records . push ( new
BorshRecord ( { k :
'alice.near' ,
v :
'hello world' } ) , ) ; // Serialize and patch state back to runtime await contract . patchState ( 'STATE' , borsh . serialize (
schema , statusMessage ) , ) ; // Check again that the update worked const result =
await contract . view ( 'get_status' ,
{ account_id :
'alice.near' , } ) ; t . is ( result ,
'hello world' ) ; To see a complete example of how to do this, see the patch-state test . // Grab STATE from the testnet
status_message contract. This contract contains the following data: // get_status(dev-20211013002148-59466083160385)
=> "hello from testnet" let
( testnet_contract_id , status_msg )
=
{ let worker =
workspaces :: testnet ( ) . await ? ; let contract_id :
AccountId
=
TESTNET_PREDEPLOYED_CONTRACT_ID . parse ( ) . map_err ( anyhow :: Error :: msg ) ? ; let
mut state_items = worker . view_state ( & contract_id ,
None ) . await ? ; let state = state_items . remove ( b"STATE" . as_slice ( ) ) . unwrap ( ) ; let status_msg =
StatusMessage :: try_from_slice ( & state ) ? ; ( contract_id , status_msg ) } ; info! ( target :
"spooning" ,
"Testnet: {:?}" , status_msg ) ; // Create our sandboxed environment and grab a worker to do stuff in it: let worker =
workspaces :: sandbox ( ) . await ? ; // Deploy with the following status_message state: sandbox_contract_id => "hello from
sandbox" let sandbox_contract =
deploy_status_contract ( & worker ,
"hello from sandbox" ) . await ? ; // Patch our testnet STATE into our local sandbox: worker . patch_state ( sandbox_contract
. id ( ) , "STATE" . as_bytes ( ) , & status_msg . try_to_vec ( ) ? , ) . await ? ; // Now grab the state to see that it has indeed
been patched: let status :
String

```

```
= sandbox_contract . view ( & worker , "get_status" , serde_json :: json! ( { "account_id" : testnet_contract_id , } ) . to_string (
) . into_bytes ( ) , ) . await ? . json ( ) ? ; info! ( target :
```

```
"spooning" ,
```

```
"New status patched: {:?}" , status ) ; assert_eq! ( & status ,
```

"hello from testnet" ) ; As an alternative to patchState , you can stop the node, dump state at genesis, edit the genesis, and restart the node. This approach is more complex to do and also cannot be performed without restarting the node.

## Time Traveling

workspaces offers support for forwarding the state of the blockchain to the future. This means contracts which require time sensitive data do not need to sit and wait the same amount of time for blocks on the sandbox to be produced. We can simply just call worker.fast\_forward to get us further in time:

- JavaScript
- Rust

tests/08.fast-forward.ava.ts loading ... [See full example on GitHub](#)

## [tokio::test]

```
async
```

```
fn
```

```
test_contract ( )
```

```
->
```

```
anyhow :: Result < ( )
```

```
{ let worker =
```

```
workspaces :: sandbox ( ) . await ? ; let contract = worker . dev_deploy ( WASM_BYTES ) ; let blocks_to_advance =
```

```
10000 ; worker . fast_forward ( blocks_to_advance ) ; // Now, "do_something_with_time" will be in the future and can act on
future time-related state. contract . call ( & worker ,
```

```
"do_something_with_time" ) . transact ( ) . await ? ; See the full example on Github.
```

## Using Testnet

NEAR Workspaces is set up so that you can write tests once and run them against a local Sandbox node (the default behavior) or against [NEAR TestNet](#) . Some reasons this might be helpful:

- Gives higher confidence that your contracts work as expected
- You can test against deployed testnet contracts
- If something seems off in Sandbox mode, you can compare it to testnet

tip In order to use Workspaces in testnet mode you will need to have a testnet account. You can create one [here](#) . You can switch to testnet mode in three ways.

1. When creating Worker set network to testnet
2. and pass your master account:
3. JavaScript
4. Rust

```
const worker =
```

```
await
```

```
Worker . init ( { network :
```

```
'testnet' , testnetMasterAccountId :
```

```
" , } )
```

## [tokio::main]

```
// or whatever runtime we want async
```

```
fn
```

```
main ( )
```

```
->
```

```
anyhow :: Result < ( )
```

```
{ // Create a sandboxed environment. // NOTE: Each call will create a new sandboxed environment let worker =
```

```
workspaces :: sandbox ( ) . await ? ; // or for testnet: let worker =
```

```
workspaces :: testnet ( ) . await ? ; } 1. Set the NEAR_WORKSPACES_NETWORK 2.
```

```
and TESTNET_MASTER_ACCOUNT_ID 3. environment variables when running your tests:
```

- JavaScript

NEAR\_WORKSPACES\_NETWORK=testnet TESTNET\_MASTER\_ACCOUNT\_ID= node test.js If you set this environment variables and pass{network: 'testnet', testnetMasterAccountId: } to Worker.init , the config object takes precedence. 1. If using near-workspaces 2. with AVA, you can use a custom config file. Other test runners allow similar config files; adjust the following instructions for your situation.

- JavaScript

Create a file in the same directory as your package.json called ava.testnet.config.cjs with the following contents:

```
module . exports
```

```
=
```

```
{ ... require ( 'near-workspaces/ava.testnet.config.cjs' ) , ... require ( './ava.config.cjs' ) , } ; module . exports .  
environmentVariables
```

```
=
```

```
{ TESTNET_MASTER_ACCOUNT_ID :
```

```
" , } ; The near-workspaces/ava.testnet.config.cjs import sets the NEAR_WORKSPACES_NETWORK environment variable  
for you. A benefit of this approach is that you can then easily ignore files that should only run in Sandbox mode.
```

Now you'll also want to add a test:testnet script to your package.json 'scripts' section:

```
"scripts": { "test": "ava" , + "test:testnet": "ava --config ./ava.testnet.config.cjs" }
```

## Additional Media

### Test Driven Design Using Workspaces and AVA

The video below walks through how to apply TDD with Workspaces and AVA for a simple contract [Edit this page](#) Last updated on Feb 28, 2024 by Damián Parrino Was this page helpful? Yes No

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