

Task 1:

Creating and deploying a simple, smart contract with cargo casper and cargo test

Installing rust:

```
gr33nr4bb1t@ubuntu:~/Downloads$ curl --proto '=https' --tlsv1.2 -sSf https://sh.rustup.rs | sh
info: downloading installer
```

Welcome to Rust!

This will download and install the official compiler for the Rust programming language, and its package manager, Cargo.

Rustup metadata and toolchains will be installed into the Rustup home directory, located at:

```
/home/gr33nr4bb1t/.rustup
```

This can be modified with the RUSTUP_HOME environment variable.

The Cargo home directory located at:

```
/home/gr33nr4bb1t/.cargo
```

This can be modified with the CARGO_HOME environment variable.

The **cargo**, **rustc**, **rustup** and other commands will be added to Cargo's bin directory, located at:

```
/home/gr33nr4bb1t/.cargo/bin
```

```
22.3 MiB / 22.3 MiB (100%) 842.0 KiB/s in 29s ETA: 0s
info: downloading component 'rustc'
51.0 MiB / 51.0 MiB (100%) 192.0 KiB/s in 1m 43s ETA: 0s
info: downloading component 'rustfmt'
3.7 MiB / 3.7 MiB (100%) 761.5 KiB/s in 5s ETA: 0s
info: installing component 'cargo'
info: installing component 'clippy'
info: installing component 'rust-docs'
17.0 MiB / 17.0 MiB (100%) 4.3 MiB/s in 3s ETA: 0s
info: installing component 'rust-std'
22.3 MiB / 22.3 MiB (100%) 10.5 MiB/s in 2s ETA: 0s
info: installing component 'rustc'
51.0 MiB / 51.0 MiB (100%) 11.1 MiB/s in 4s ETA: 0s
info: installing component 'rustfmt'
info: default toolchain set to 'stable-x86_64-unknown-linux-gnu'
```

```
stable-x86_64-unknown-linux-gnu installed - rustc 1.55.0 (c8dfcfe04 2021-09-06)
```

Rust is installed now. Great!

To get started you may need to restart your current shell.
This would reload your PATH environment variable to include
Cargo's bin directory (\$HOME/.cargo/bin).

To configure your current shell, run:
source \$HOME/.cargo/env

Restarting shell and checking version:

```
gr33nr4bb1t@ubuntu:~/Downloads$ rustup --version
rustup 1.24.3 (ce5817a94 2021-05-31)
info: This is the version for the rustup toolchain manager, not the rustc compiler.
info: The currently active `rustc` version is `rustc 1.55.0 (c8dfcfe04 2021-09-06)`
gr33nr4bb1t@ubuntu:~/Downloads$
```

Installing dependencies:

CMake

```
gr33nr4bb1t@ubuntu:~$ sudo apt-get install cmake
[sudo] password for gr33nr4bb1t:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  binutils binutils-common binutils-x86-64-linux-gnu cmake-data gcc gcc-9
  libasan5 libatomic1 libbinutils libc-dev-bin libc6-dev libcrypt-dev
  libctf-nobfd0 libctf0 libgcc-9-dev libitm1 libjsoncpp1 liblsan0 libquadmath0
  librhash0 libtsan0 libubsan1 linux-libc-dev make manpages-dev
Suggested packages:
  binutils-doc cmake-doc ninja-build gcc-multilib autoconf automake libtool
  flex bison gcc-doc gcc-9-multilib gcc-9-doc gcc-9-locales glibc-doc make-doc
The following NEW packages will be installed:
  binutils binutils-common binutils-x86-64-linux-gnu cmake cmake-data gcc
  gcc-9 libasan5 libatomic1 libbinutils libc-dev-bin libc6-dev libcrypt-dev
  libctf-nobfd0 libctf0 libgcc-9-dev libitm1 libjsoncpp1 liblsan0 libquadmath0
  librhash0 libtsan0 libubsan1 linux-libc-dev make manpages-dev
0 upgraded, 26 newly installed, 0 to remove and 3 not upgraded.
Need to get 28.9 MB of archives.
After this operation, 135 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
```

Checking version:

```
gr33nr4bb1t@ubuntu:~/Downloads$ cmake --version
cmake version 3.16.3

CMake suite maintained and supported by Kitware (kitware.com/cmake).
gr33nr4bb1t@ubuntu:~/Downloads$
```

Development Environment Setup

Installing the Casper Crates:

```
Compiling unicode-width v0.1.9
Compiling hashbrown v0.11.2
Compiling os_str_bytes v3.1.0
Compiling vec_map v0.8.2
Compiling strsim v0.10.0
Compiling termcolor v1.1.2
Compiling once_cell v1.8.0
Compiling proc-macro-error-attr v1.0.4
Compiling proc-macro-error v1.0.4
Compiling instant v0.1.10
Compiling lock_api v0.4.5
Compiling indexmap v1.7.0
Compiling textwrap v0.14.2
Compiling heck v0.3.3
Compiling signal-hook-registry v1.4.0
Compiling atty v0.2.14
Compiling mio v0.7.13
Compiling quote v1.0.9
Compiling parking_lot v0.11.2
Compiling signal-hook v0.1.17
Compiling crossterm v0.19.0
Compiling colour v0.6.0
Compiling clap_derive v3.0.0-beta.4
Compiling clap v3.0.0-beta.4
Compiling cargo-casper v1.3.3
  Finished release [optimized] target(s) in 3m 39s
Installing /home/gr33nr4bb1t/.cargo/bin/cargo-casper
  Installed package `cargo-casper v1.3.3` (executable `cargo-casper`)
gr33nr4bb1t@ubuntu:~/Downloads/casper-node/execution_engine_testing/cargo_casper$ █
```

```
gr33nr4bb1t@ubuntu:~/Downloads/casper-node/execution_engine_testing/cargo_casper$ cargo-casper --help
cargo-casper 1.3.3
```

A command line tool for creating a Wasm smart contract and tests for use on the Casper network.

USAGE:

```
cargo casper [FLAGS] <path>
cd <path>
make prepare
make test
```

ARGS:

```
<path>    Path to new folder for contract and tests
```

FLAGS:

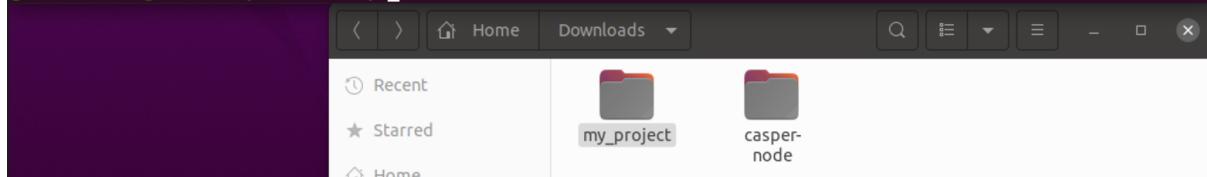
```
--erc20      Create a basic ERC-20 contract and tests
-h, --help     Print help information
-V, --version   Print version information
```

NOTE:

```
If no other flag is provided, a trivial example contract and tests are created
```

Creating a project and checking files:

```
gr33nr4bb1t@ubuntu:~/Downloads$ cargo casper my_project  
gr33nr4bb1t@ubuntu:~/Downloads$ ls  
casper-node  my_project  
gr33nr4bb1t@ubuntu:~/Downloads$
```



Opening the main.rs file, which is located in the contract/src folder.

Checking functions:

A screenshot of a code editor displaying the 'main.rs' file. The file path is shown as '~ / Downloads / my_project / contract / src'. The code itself is a Rust script for a Casper contract. It includes imports for std::alloc::string::String, casper_contract::ContractApi, casper_types::ApiError, and casper_types::Key. It defines a custom error enum 'Error' with two variants: 'KeyAlreadyExists' (value 0) and 'KeyMismatch' (value 1). It implements the From<Error> trait for ApiError, mapping errors to u16 values. Finally, it defines a public extern C function 'call()' with a note about key management.

```
1 #![no_std]
2 #![no_main]
3
4 #![cfg(not(target_arch = "wasm32"))]
5 compile_error!("target arch should be wasm32: compile with '--target wasm32-unknown-unknown');
6
7 // We need to explicitly import the std alloc crate and `alloc::string::String` as we're in a
8 'no_std' environment.
9 extern crate alloc;
10
11 use alloc::string::String;
12
13 use casper_contract::{
14     contract_api::{runtime, storage},
15     unwrap_or_revert::UnwrapOrRevert,
16 };
17 use casper_types::{ApiError, Key};
18
19 const KEY_NAME: &str = "my-key-name";
20 const RUNTIME_ARG_NAME: &str = "message";
21
22 /// An error enum which can be converted to a `u16` so it can be returned as an
'ApiError::User'.
23 #[repr(u16)]
24 enum Error {
25     KeyAlreadyExists = 0,
26     KeyMismatch = 1,
27 }
28
29 impl From<Error> for ApiError {
30     fn from(error: Error) -> Self {
31         ApiError::User(error as u16)
32     }
33 }
34
35 #[no_mangle]
36 pub extern "C" fn call() {
37     // The key shouldn't already exist in the named keys.
```

Building the contract:

```
gr33nr4bb1t@ubuntu:~/Downloads/my_project/contract$ rustup install $(cat rust-toolchain)
cat: rust-toolchain: No such file or directory
error: error: The following required arguments were not provided:
        <toolchain>...
USAGE:
    rustup install [FLAGS] [OPTIONS] <toolchain>...

For more information try --help

gr33nr4bb1t@ubuntu:~/Downloads/my_project/contract$ cd ..
gr33nr4bb1t@ubuntu:~/Downloads/my_project$ rustup install $(cat rust-toolchain)
info: syncing channel updates for 'nightly-2021-06-17-x86_64-unknown-linux-gnu'

nightly-2021-06-17-x86_64-unknown-linux-gnu unchanged - rustc 1.55.0-nightly (a85f584ae 2021-06-16)

info: checking for self-updates
gr33nr4bb1t@ubuntu:~/Downloads/my_project$ rustup target add --toolchain $(cat rust-toolchain) wasm32-unknown-unknown
info: downloading component 'rust-std' for 'wasm32-unknown-unknown'
info: installing component 'rust-std' for 'wasm32-unknown-unknown'
  13.4 MiB / 13.4 MiB (100 %) 6.8 MiB/s in 1s ETA: 0s
gr33nr4bb1t@ubuntu:~/Downloads/my_project$ cargo build --release
error: could not find `Cargo.toml` in `/home/gr33nr4bb1t/Downloads/my_project` or any parent directory
gr33nr4bb1t@ubuntu:~/Downloads/my_project$ cd contract/
gr33nr4bb1t@ubuntu:~/Downloads/my_project/contract$ cargo build --release
  Updating crates.io index
  Downloaded opaque-debug v0.3.0
  Downloaded sha2 v0.9.8
  Downloaded rand v0.8.4
  Downloaded subtle v2.4.1
  Downloaded serde_derive v1.0.130
  Downloaded rand_core v0.5.1
  Downloaded synstructure v0.12.5
  Downloaded typenum v1.14.0
  Downloaded base16 v0.2.1
  Downloaded uint v0.9.1
  Downloaded rand_chacha v0.2.2
  Downloaded static_assertions v1.1.0
  Downloaded radium v0.3.0
  Downloaded blake2 v0.9.2
  Downloaded ryu v1.0.5
```

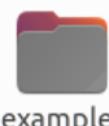
```
Compiling ecdsa v0.10.2
Compiling ed25519-dalek v1.0.1
Compiling k256 v0.7.3
Compiling casper-types v1.3.3
Compiling casper-contract v1.3.3
Compiling contract v0.1.0 (/home/gr33nr4bb1t/Downloads/my_project/contract)
  Finished release [optimized] target(s) in 1m 19s
gr33nr4bb1t@ubuntu:~/Downloads/my_project/contract$
```



build



deps



examples



incremental



contract.d



contract.wasm

Testing the sample project:

```
running 2 tests
test tests::should_store_hello_world ... FAILED
test tests::should_error_on_missing_runtime_arg - should panic ... FAILED

failures:

---- tests::should_store_hello_world stdout ----
thread 'tests::should_store_hello_world' panicked at 'Rust Wasm path /home/gr33nr4bb1t/.cargo/registry/src/target/wasm32-unknown-unknown/release does not exists', /home/gr33nr4bb1t/.cargo/registry/src/github.com-1ecc6299db9ec823/casper-engine-test-support-1.3.3/src/internal/utils.rs:49:5
note: run with `RUST_BACKTRACE=1` environment variable to display a backtrace

---- tests::should_error_on_missing_runtime_arg stdout ----
thread 'tests::should_error_on_missing_runtime_arg' panicked at 'Lazy instance has previously been poisoned', /home/gr33nr4bb1t/.cargo/registry/src/github.com-1ecc6299db9ec823/once_cell-1.8.0/src/lib.rs:1116:25
note: panic did not contain expected string
      panic message: `"\u{26a0}\u{fe0f} Lazy instance has previously been poisoned"`,
      expected substring: `"\u{26a0}\u{fe0f}ApiError::MissingArgument"`

failures:
    tests::should_error_on_missing_runtime_arg
    tests::should_store_hello_world

test result: FAILED. 0 passed; 2 failed; 0 ignored; 0 measured; 0 filtered out; finished in 0.06s

error: test failed, to rerun pass '--bin integration-tests'
gr33nr4bb1t@ubuntu:~/Downloads/my_project/tests$
```

Making second test

```
gr33nr4bb1t@ubuntu:~/Downloads/my_project/tests$ cd ..
gr33nr4bb1t@ubuntu:~/Downloads/my_project$ make test
cd contract && cargo build --release --target wasm32-unknown-unknown
  Finished release [optimized] target(s) in 0.27s
wasm-strip contract/target/wasm32-unknown-unknown/release/contract.wasm 2>/dev/null
| true
mkdir -p tests/wasm
cp contract/target/wasm32-unknown-unknown/release/contract.wasm tests/wasm
cd tests && cargo test
  Finished test [unoptimized + debuginfo] target(s) in 0.37s
  Running unittests (target/debug/deps/integration_tests-6e09cdee45cf0eea)

running 2 tests
test tests::should_error_on_missing_runtime_arg - should panic ... ok
test tests::should_store_hello_world ... ok

test result: ok. 2 passed; 0 failed; 0 ignored; 0 measured; 0 filtered out; finished
in 0.14s
```

Task 2:

Completing one of the existing tutorials for writing smart contracts

Account management and contract setup:

Because I've got many issues with the long path folder and NCTL network I decided to move everything to a folder inside /home directory.

Installing tools and preparing environment:

```
root@ubuntu:/home/Working_Directory# apt install pkg-config
Reading package lists... Done
Building dependency tree
Reading state information... Done
pkg-config is already the newest version (0.29.1-0ubuntu4).
0 upgraded, 0 newly installed, 0 to remove and 3 not upgraded.
root@ubuntu:/home/Working_Directory# apt install libssl-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
libssl-dev is already the newest version (1.1.1f-1ubuntu2.8).
0 upgraded, 0 newly installed, 0 to remove and 3 not upgraded.
root@ubuntu:/home/Working_Directory# sudo apt install build-essential
Reading package lists... Done
Building dependency tree
Reading state information... Done
build-essential is already the newest version (12.8ubuntu1.1).
0 upgraded, 0 newly installed, 0 to remove and 3 not upgraded.
root@ubuntu:/home/Working_Directory# gcc --version
gcc (Ubuntu 9.3.0-17ubuntu1~20.04) 9.3.0
Copyright (C) 2019 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

root@ubuntu:/home/Working_Directory# g++ --version
g++ (Ubuntu 9.3.0-17ubuntu1~20.04) 9.3.0
Copyright (C) 2019 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

root@ubuntu:/home/Working_Directory# ls
casper-node casper-node-launcher keys-manager kv-storage-contract
root@ubuntu:/home/Working_Directory# python3 -m venv env
root@ubuntu:/home/Working_Directory# python3 -m venv env
root@ubuntu:/home/Working_Directory# ls
casper-node casper-node-launcher env keys-manager kv-storage-contract
root@ubuntu:/home/Working_Directory# source env/bin/activate
(env) root@ubuntu:/home/Working_Directory# pip install --upgrade pip
Collecting pip
  Using cached pip-21.2.4-py3-none-any.whl (1.6 MB)
Installing collected packages: pip
  Attempting uninstall: pip
    Found existing installation: pip 20.0.2
    Uninstalling pip-20.0.2:
      Successfully uninstalled pip-20.0.2
Successfully installed pip-21.2.4
```

```
(env) root@ubuntu:/home/Working_Directory# pip install jq
Collecting jq
  Using cached jq-1.2.1-cp38-cp38-manylinux2010_x86_64.whl (581 kB)
Installing collected packages: jq
Successfully installed jq-1.2.1
(env) root@ubuntu:/home/Working_Directory# pip install supervisor
Collecting supervisor
  Using cached supervisor-4.2.2-py2.py3-none-any.whl (743 kB)
Installing collected packages: supervisor
Successfully installed supervisor-4.2.2
```

```
(env) root@ubuntu:/home/Working_Directory# pip install toml
Collecting toml
  Using cached toml-0.10.2-py2.py3-none-any.whl (16 kB)
Installing collected packages: toml
Successfully installed toml-0.10.2
```

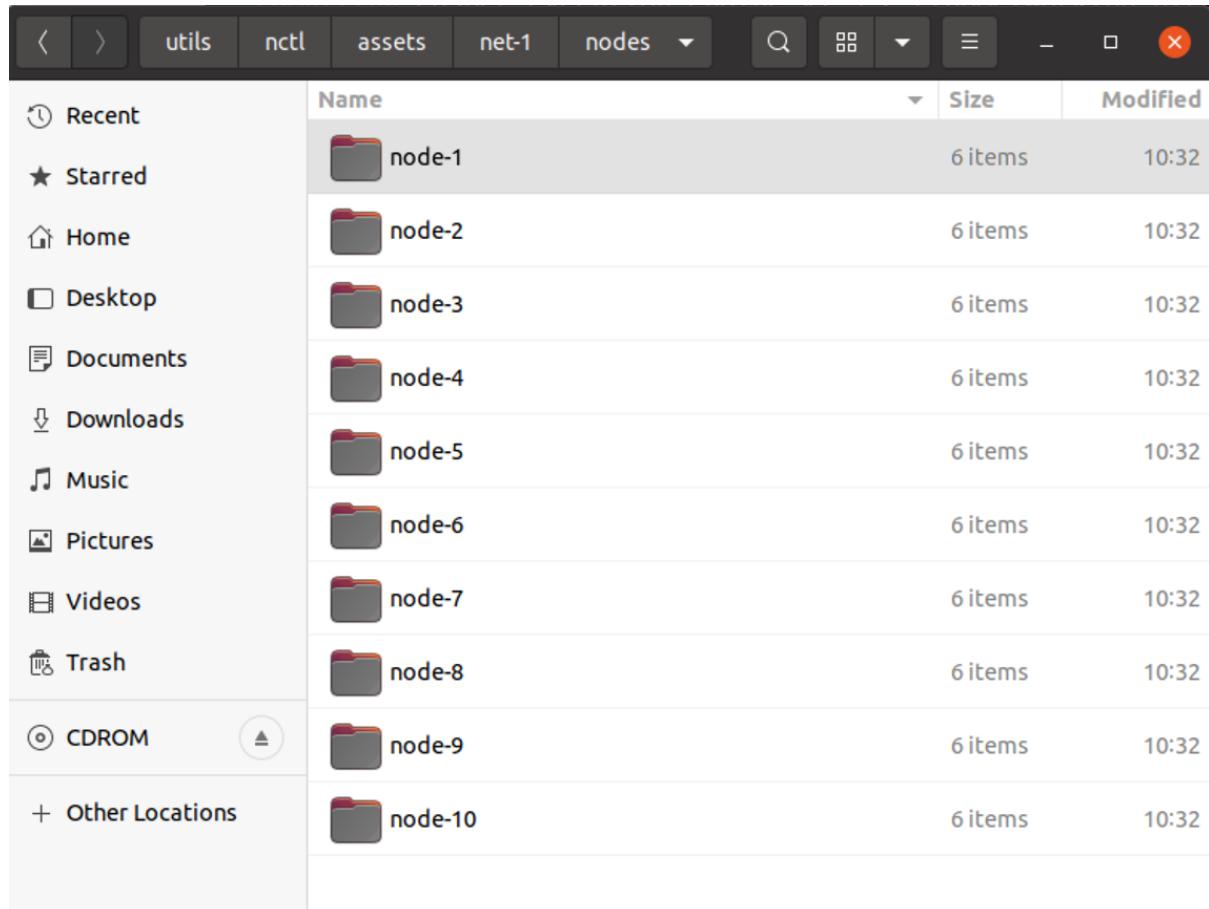
Setting up a network:

```
(env) root@ubuntu:/home/Working_Directory# ls
casper-node  casper-node-launcher  env  keys-manager  kv-storage-contract
(env) root@ubuntu:/home/Working_Directory# source casper-node/utils/nctl/activate
(env) root@ubuntu:/home/Working_Directory# nctl-compile
  Compiling proc-macro2 v1.0.28
  Compiling unicode-xid v0.2.2
  Compiling syn v1.0.74
  Compiling libc v0.2.98
  Compiling version_check v0.9.3
  Compiling autocfg v1.0.1
  Compiling serde_derive v1.0.126
  Compiling serde v1.0.126
  Compiling cfg-if v1.0.0
  Compiling typenum v1.13.0
  Compiling memchr v2.4.0
  Compiling log v0.4.14
  Compiling cc v1.0.69
  Compiling pin-project-lite v0.2.7
  Compiling futures-core v0.3.16
  Compiling futures-io v0.3.16

  Compiling pwasm-utils v0.16.0
  Compiling version-sync v0.9.2
  Compiling ecdsa v0.10.2
  Compiling ed25519-dalek v1.0.1
  Compiling rusty-fork v0.3.0
  Compiling k256 v0.7.3
  Compiling proptest v1.0.0
  Compiling casper-types v1.3.2 (/home/Working_Directory/casper-node/types)
  Compiling casper-contract v1.3.2 (/home/Working_Directory/casper-node/smart_
contracts/contract)
  Compiling casper-execution-engine v1.3.2 (/home/Working_Directory/casper-nod
e/execution_engine)
  Compiling casper-engine-test-support v1.3.2 (/home/Working_Directory/casper-
node/execution_engine_testing/test_support)
  Compiling global-state-update-gen v0.1.0 (/home/Working_Directory/casper-nod
e/utils/global-state-update-gen)
  Finished release [optimized] target(s) in 5m 51s
```

Running NCTL Network:

```
(env) root@ubuntu:/home/Working_Directory# nctl-assets-setup && nctl-start
2021-09-22T10:32:19.678486 [INFO] [71704] NCTL :: asset setup begins ... please
wait
2021-09-22T10:32:19.680310 [INFO] [71704] NCTL :: ... setting directories
2021-09-22T10:32:19.877437 [INFO] [71704] NCTL :: ... setting binaries
2021-09-22T10:32:21.016839 [INFO] [71704] NCTL :: ... setting cryptographic key
s
2021-09-22T10:32:21.150379 [INFO] [71704] NCTL :: ... setting daemon config
2021-09-22T10:32:21.354886 [INFO] [71704] NCTL :: ... setting chainspec.toml
2021-09-22T10:32:21.426038 [INFO] [71704] NCTL :: ... setting accounts.toml
2021-09-22T10:32:21.543942 [INFO] [71704] NCTL :: ... setting node configs
2021-09-22T10:32:22.421855 [INFO] [71704] NCTL :: asset setup complete
2021-09-22T10:32:22.429107 [INFO] [71704] NCTL :: starting node(s) begins ... p
lease wait
2021-09-22T10:32:22.434205 [INFO] [71704] NCTL :: ... starting supervisord
2021-09-22T10:32:24.721048 [INFO] [71704] NCTL :: ... starting nodes: genesis b
ootstraps
2021-09-22T10:32:25.923753 [INFO] [71704] NCTL :: ... starting nodes: genesis n
on-bootstraps
2021-09-22T10:32:27.109086 [INFO] [71704] NCTL :: starting node(s) complete
validators-1:casper-net-1-node-1      RUNNING   pid 118660, uptime 0:00:04
validators-1:casper-net-1-node-2      RUNNING   pid 118661, uptime 0:00:04
validators-1:casper-net-1-node-3      RUNNING   pid 118662, uptime 0:00:04
validators-2:casper-net-1-node-4      RUNNING   pid 118687, uptime 0:00:02
validators-2:casper-net-1-node-5      RUNNING   pid 118688, uptime 0:00:02
validators-3:casper-net-1-node-10    STOPPED  Not started
validators-3:casper-net-1-node-6      STOPPED  Not started
validators-3:casper-net-1-node-7      STOPPED  Not started
validators-3:casper-net-1-node-8      STOPPED  Not started
validators-3:casper-net-1-node-9      STOPPED  Not started
```



Checking the faucet account details:

```
2021-09-22T11:19:45.293996 [INFO] [71704] NCTL :: faucet on-chain account : see below
{
  "api_version": "1.0.0",
  "merkle_proof": "[2092 hex chars]",
  "stored_value": {
    "Account": {
      "account_hash": "account-hash-efc82f0b47728dd59c1db9416fc14b6dd7ee225b6731fd7f1975815f30d702f9",
      "action_thresholds": {
        "deployment": 1,
        "key_management": 1
      },
      "associated_keys": [
        {
          "account_hash": "account-hash-efc82f0b47728dd59c1db9416fc14b6dd7ee225b6731fd7f1975815f30d702f9",
          "weight": 1
        }
      ],
      "main_purse": "uref-97029257b0ef629c6d904f82e0986bd3f4bb52e9bf72fe2f1e4a923075bb4b8f-007",
      "named_keys": []
    }
  }
}
(env) root@ubuntu:/home/Working_Directory#
```

Setting up the client:

```
(env) root@ubuntu:/home/Working_Directory/keys-manager/client# cat << EOF > .env
v
> BASE_KEY_PATH=/home/Working_Directory/casper-node/utils/nctl/assets/net-1/faucet/
> NODE_URL=http://localhost:11101/rpc
> EOF
(env) root@ubuntu:/home/Working_Directory/keys-manager/client# cat .env
BASE_KEY_PATH=/home/Working_Directory/casper-node/utils/nctl/assets/net-1/faucet/
NODE_URL=http://localhost:11101/rpc
(env) root@ubuntu:/home/Working_Directory/keys-manager/client# npm install
```

```
audited 161 packages in 2.155s

15 packages are looking for funding
  run `npm fund` for details

found 0 vulnerabilities
```

```
(env) root@ubuntu:/home/Working_Directory/keys-manager/client# npm run start:atomic

> keys-manager@1.0.0 start:atomic /home/Working_Directory/keys-manager/client
> node -r dotenv/config ./src/scenario-atomic.js

secp256k1 unavailable, reverting to browser version

0.1 Fund main account.

Signed by: account-hash-efc82f0b47728dd59c1db9416fc14b6dd7ee225b6731fd7f1975815
f30d702f9
Deploy hash: 620aa706221318dd7affcb0413686c27202c8ea2f95d2e4814faff28309d474f
Deploy result:
{ deploy:
  { hash:
    '620aa706221318dd7affcb0413686c27202c8ea2f95d2e4814faff28309d474f',
    header:
      { account:
        '01a128ffb6b8b0cddd9c9f0dd563a0229e30a39ef5e405712c4804c8fb4a009e4',
        timestamp: '2021-09-23T12:19:02.936Z',
        ttl: '30m',
        gas_price: 1,
        body_hash:
          'bcee9abd36ea4bf394b2a16fb64a5a00dbe97456e29be4759d98c24056086eb7',
        dependencies: [],
        chain_name: 'casper-net-1' },
      payment: { ModuleBytes: [Object] },
      session: { Transfer: [Object] },
      approvals: [ [Object] ] } }
```

```
[x] Current state of the account:
{ _accountHash:
  'account-hash-1add07c00aa02c1d67e78a8c227326bb2193a214245df5b6004ecc891bc98b
78',
  namedKeys: [],
  mainPurse:
    'uref-4e2df4988d8cb4a21e0cda31a2ee8f79ec110f8901c03c247148ac7340e26d17-007',
  associatedKeys:
    [ { accountHash:
      'account-hash-1add07c00aa02c1d67e78a8c227326bb2193a214245df5b6004ecc891
bc98b78',
      weight: 1 } ],
  actionThresholds: { deployment: 1, keyManagement: 1 } }

[x]0.2 Install Keys Manager contract
Signed by: account-hash-1add07c00aa02c1d67e78a8c227326bb2193a214245df5b6004ecc8
91bc98b78
Deploy hash: 46f2d5eb071dc6a1fb872214eb9dbd38e765908b81e5271107f70f232bea909f
Deploy result:
{ deploy:
  { hash:
    '46f2d5eb071dc6a1fb872214eb9dbd38e765908b81e5271107f70f232bea909f',
    header:
      { account:
        '0202d92417b2072de8765a0ff3460dd331782615e3d52b16615b11413ac34015be4f' }}
```

1. Set faucet's weight to 3

```
Signed by: account-hash-1add07c00aa02c1d67e78a8c227326bb2193a214245df5b6004ecc8  
91bc98b78  
Deploy hash: d84a9ea8c6852c63323b547972bc0aace1e4c9a2ab2e2a95ea88f02089e67eb5  
Deploy result:  
{ deploy:  
  { hash:  
    'd84a9ea8c6852c63323b547972bc0aace1e4c9a2ab2e2a95ea88f02089e67eb5' ,  
     header:  
      { account:  
        '0202d92417b2072de8765a0ff3460dd331782615e3d52b16615b11413ac34015be4f'  
,  
         timestamp: '2021-09-23T12:21:14.999Z' ,  
         ttl: '30m' ,  
         gas_price: 1,  
         body_hash:  
           'ba00dce80a1c1636ebcd6e49bbb8bd8d80373888311f1b87e3cd9c00196fa9b0' ,  
         dependencies: [],  
         chain_name: 'casper-net-1' },  
       payment: { ModuleBytes: [Object] } ,  
       session: { StoredContractByName: [Object] } ,  
       approvals: [ [Object] ] } }
```

[x] Current state of the account:

```
{ _accountHash:  
  'account-hash-1add07c00aa02c1d67e78a8c227326bb2193a214245df5b6004ecc891bc98b  
78' ,  
  namedKeys:  
  [ { name: 'keys_manager' ,  
    key:  
      'hash-21d1d4e2b0f40e8aed5a310477ee23c68bf37916bba27d21d1912a69eccfbc87'  
},  
  { name: 'keys_manager_hash' ,  
    key:  
      'uref-5ac009dd95d02a0fd372ba97a71fbc9387683bb028bcf9f107fecfdf561af56-  
007' } ],  
  mainPurse:  
  'uref-4e2df4988d8cb4a21e0cda31a2ee8f79ec110f8901c03c247148ac7340e26d17-007' ,  
  associatedKeys:  
  [ { accountHash:  
    'account-hash-1add07c00aa02c1d67e78a8c227326bb2193a214245df5b6004ecc891  
bc98b78' ,  
    weight: 3 } ],  
  actionThresholds: { deployment: 2 , keyManagement: 3 } }
```

Task 3:

Demonstrating key management concepts by modifying the client in the Multi-Signature tutorial to address one of the additional scenarios

Scenario One:

The screenshot shows the VS Code interface with the following details:

- EXPLORER:** Shows the project structure under "KEYS-MANAGER".
- PACKAGE.JSON:** Opened in the editor.
- SCENARIO-ONE.JS:** Opened in the editor, showing the code for the scenario.

The code in scenario-one.js is as follows:

```
// Key Management Threshold should be set to 2.
18 let masterKey = keyManager.randomMasterKey();
19 let mainAccount = masterKey.deriveIndex(1);
20 let firstAccount = masterKey.deriveIndex(2);
21
22 console.log("\n0.1 Fund main account.\n");
23 await keyManager.fundAccount(mainAccount);
24 await keyManager.printAccount(mainAccount);
25
26 console.log("\n[x]0.2 Install Keys Manager contract");
27 deploy = keyManager.keys.buildContractInstallDeploy(mainAccount);
28 await keyManager.sendDeploy(deploy, [mainAccount]);
29 await keyManager.printAccount(mainAccount);
30
31 // 1. Adding first new key with weight 1
32 console.log("\n1. Add first new key with weight 1.\n");
33 deploy = keyManager.keys.setKeyWeightDeploy(mainAccount, firstAccount, 1);
34 await keyManager.sendDeploy(deploy, [mainAccount]);
35 await keyManager.printAccount(mainAccount);
36
37 // 2. Setting mainAccount's weight to a value of 2
38 console.log("\n2. Set faucet's weight to 2\n");
39 deploy = keyManager.keys.setKeyWeightDeploy(mainAccount, mainAccount, 2);
40 await keyManager.sendDeploy(deploy, [mainAccount]);
41 await keyManager.printAccount(mainAccount);
42
43 // 3. Setting Keys Management Threshold - 2
44 console.log("\n3. Set Keys Management Threshold to 2\n");
45 deploy = keyManager.keys.setKeyManagementThresholdDeploy(mainAccount, 2);
46 await keyManager.sendDeploy(deploy, [mainAccount]);
47 await keyManager.printAccount(mainAccount);
48
49
50
51
52 })();
```

Client output:

```
(env) root@ubuntu:/home/Working_Directory/keys-manager/client# npm run start:scenario-one

> keys-manager@1.0.0 start:scenario-one /home/Working_Directory/keys-manager/client
> node -r dotenv/config ./src/scenario-one.js

secp256k1 unavailable, reverting to browser version

0.1 Fund main account.

Signed by: account-hash-20d64d3dd6936347365b3d9bb1f2f6c408a5ab078b300354af8b298
089bcde4d
Deploy hash: d5b922038c21dd02ff01173314b555595542cb87b644fc52553711e6ea284882
Deploy result:
```

0.1 Fund main account.

```
Signed by: account-hash-20d64d3dd6936347365b3d9bb1f2f6c408a5ab078b300354af8b298
089bcde4d
Deploy hash: d5b922038c21dd02ff01173314b555595542cb87b644fc52553711e6ea284882
Deploy result:
{ deploy:
  { hash:
    'd5b922038c21dd02ff01173314b555595542cb87b644fc52553711e6ea284882',
    header:
      { account:
        '01b9146bd8e04bb7f2fec4ed0fe8312c0e0d1f283e3bbf99daeee900ace1eb16fb',
        timestamp: '2021-09-23T22:44:12.181Z',
        ttl: '30m',
        gas_price: 1,
        body_hash:
          'ce42af884d0d194c13ddd0e9998c9d1289f284a1b4039482681089fa973bb2ac',
        dependencies: [],
        chain_name: 'casper-net-1' },
      payment: { ModuleBytes: [Object] },
      session: { Transfer: [Object] },
      approvals: [ [Object] ] }
```

[x] Current state of the account:

```
{ _accountHash:
  'account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e9bd3d15
ea',
  namedKeys: [],
  mainPurse:
    'uref-d2d1abf0b2220e158c9cfa163fd62584de2189c35cd4ee0dd3d59580116d9d67-007',
  associatedKeys:
    [ { accountHash:
      'account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e9b
d3d15ea',
      weight: 1 } ],
  actionThresholds: { deployment: 1, keyManagement: 1 } }
```

[x]0.2 Install Keys Manager contract

```
Signed by: account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e
9bd3d15ea
Deploy hash: 9500189cee3c55a33aef20d86fa6e2d47a5edb79561fa1a0ce5c8601170af86a
Deploy result:
{ deploy:
  { hash:
    '9500189cee3c55a33aef20d86fa6e2d47a5edb79561fa1a0ce5c8601170af86a',
    header:
      { account:
        '020371c968c7b61f7c109d3e58ad85a92265631ac6bc2e996366e8ead3825e1a340d'
      },
      timestamp: '2021-09-23T22:45:15.767Z',
      ttl: '30m',
      gas_price: 1,
      body_hash:
        'f6e9590ac687f075a2e41da60f2ff56e4b0e6ef5b9b642f64c4961ddd8b2d92c',
      dependencies: [],
      chain_name: 'casper-net-1' },
    payment: { ModuleBytes: [Object] },
    session: { ModuleBytes: [Object] },
    approvals: [ [Object] ] }
```

```
[x] Current state of the account:
{
  _accountHash:
    'account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e9bd3d15ea',
  namedKeys:
    [ { name: 'keys_manager' ,
        key:
          'hash-b50258b0d972a8b15ceb6b642a2e46bc147ba8bff40e2482e33b8552b577e31b' },
      { name: 'keys_manager_hash' ,
        key:
          'uref-90d47170d6ec1fd81b11a75431f1afdf1953ee21624362732e611f0df742701a-007' } ],
  mainPurse:
    'uref-d2d1abf0b2220e158c9cfa163fd62584de2189c35cd4ee0dd3d59580116d9d67-007',
  associatedKeys:
    [ { accountHash:
        'account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e9bd3d15ea',
        weight: 1 } ],
  actionThresholds: { deployment: 1, keyManagement: 1 } }
```

1. Add first new key with weight 1.

```
Signed by: account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e9bd3d15ea
Deploy hash: 586c26d63504372ca53df55af52c2b2d7936bbe6327b5edd638091cdcf8e5239
Deploy result:
{ deploy:
  { hash:
    '586c26d63504372ca53df55af52c2b2d7936bbe6327b5edd638091cdcf8e5239' ,
    header:
      { account:
        '020371c968c7b61f7c109d3e58ad85a92265631ac6bc2e996366e8ead3825e1a340d' ,
          timestamp: '2021-09-24T13:19:36.255Z' ,
          ttl: '30m' ,
          gas_price: 1 ,
          body_hash:
            '44691d971968b20e7c6c0411f737dd1aa71127d2f7da5d10828b0bde0c4edd38' ,
          dependencies: [] ,
          chain_name: 'casper-net-1' } ,
        payment: { ModuleBytes: [Object] } ,
        session: { StoredContractByName: [Object] } ,
        approvals: [ [Object] ] } }
```

```
[x] Current state of the account:
{
  _accountHash:
    'account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e9bd3d15
  ea',
  namedKeys:
    [ { name: 'keys_manager' ,
        key:
          'hash-b50258b0d972a8b15ceb6b642a2e46bc147ba8bff40e2482e33b8552b577e31b'
    },
      { name: 'keys_manager_hash' ,
        key:
          'uref-90d47170d6ec1fd81b11a75431f1afdf1953ee21624362732e611f0df742701a-
        007' } ],
  mainPurse:
    'uref-d2d1abf0b2220e158c9cfa163fd62584de2189c35cd4ee0dd3d59580116d9d67-007',
  associatedKeys:
    [ { accountHash:
        'account-hash-4231905e081436a239898b77b34059f3cb8d8233048f8789fed54fe5b
      3600012',
        weight: 1 },
      { accountHash:
        'account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e9b
      d3d15ea',
        weight: 1 } ],
  actionThresholds: { deployment: 1 , keyManagement: 1 } }
}
```

2. Set faucet's weight to 2

```
Signed by: account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e
9bd3d15ea
Deploy hash: 05e7817d75d758b1a77f939089a9e6e61e360705a84376ff89c43fb774312934
Deploy result:
{ deploy:
  { hash:
      '05e7817d75d758b1a77f939089a9e6e61e360705a84376ff89c43fb774312934' ,
    header:
      { account:
          '020371c968c7b61f7c109d3e58ad85a92265631ac6bc2e996366e8ead3825e1a340d'
      ,
        timestamp: '2021-09-24T13:20:52.840Z' ,
        ttl: '30m' ,
        gas_price: 1 ,
        body_hash:
          'aa59856fa57866f7cf93f58d4dd529c4a3e55a302df44b50ddf7dce45bc9dd1' ,
        dependencies: [] ,
        chain_name: 'casper-net-1' },
      payment: { ModuleBytes: [Object] } ,
      session: { StoredContractByName: [Object] } ,
      approvals: [ [Object] ] } }
```

```
[x] Current state of the account:
{
  _accountHash:
    'account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e9bd3d15ea',
  namedKeys:
    [ { name: 'keys_manager' ,
        key:
          'hash-b50258b0d972a8b15ceb6b642a2e46bc147ba8bff40e2482e33b8552b577e31b' },
      { name: 'keys_manager_hash' ,
        key:
          'uref-90d47170d6ec1fd81b11a75431f1afdf1953ee21624362732e611f0df742701a-007' } ],
  mainPurse:
    'uref-d2d1abf0b2220e158c9cfa163fd62584de2189c35cd4ee0dd3d59580116d9d67-007',
  associatedKeys:
    [ { accountHash:
        'account-hash-4231905e081436a239898b77b34059f3cb8d8233048f8789fed54fe5b3600012' ,
        weight: 1 },
      { accountHash:
        'account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e9bd3d15ea' ,
        weight: 2 } ],
  actionThresholds: { deployment: 1, keyManagement: 1 } }
}
```

3. Set Keys Management Threshold to 2

```
Signed by: account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e9bd3d15ea
Deploy hash: 33bca211d6da31782912c48f97ed72785f4fa43d87cec8af5a44b4f9645f54b4
Deploy result:
{ deploy:
  { hash:
    '33bca211d6da31782912c48f97ed72785f4fa43d87cec8af5a44b4f9645f54b4' ,
    header:
      { account:
        '020371c968c7b61f7c109d3e58ad85a92265631ac6bc2e996366e8ead3825e1a340d' ,
        timestamp: '2021-09-24T13:22:06.478Z' ,
        ttl: '30m' ,
        gas_price: 1 ,
        body_hash:
          '9357475174b44041d5a89a9091cded242fedc567af82c7fa920d5ec13d5c7f74' ,
        dependencies: [] ,
        chain_name: 'casper-net-1' } ,
      payment: { ModuleBytes: [Object] } ,
      session: { StoredContractByName: [Object] } ,
      approvals: [ [Object] ] } }
```

```
[x] Current state of the account:  
{ _accountHash:  
  'account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e9bd3d15  
ea',  
  namedKeys:  
  [ { name: 'keys_manager',  
      key:  
        'hash-b50258b0d972a8b15ceb6b642a2e46bc147ba8bff40e2482e33b8552b577e31b'  
    },  
    { name: 'keys_manager_hash',  
      key:  
        'uref-90d47170d6ec1fd81b11a75431f1afdf1953ee21624362732e611f0df742701a-  
007' } ],  
  mainPurse:  
  'uref-d2d1abf0b2220e158c9cfa163fd62584de2189c35cd4ee0dd3d59580116d9d67-007',  
  associatedKeys:  
  [ { accountHash:  
      'account-hash-4231905e081436a239898b77b34059f3cb8d8233048f8789fed54fe5b  
3600012',  
      weight: 1 },  
    { accountHash:  
      'account-hash-f67f6cb9d0b6046c9278546f1849ef8b2dc8a7150e7ff7b797a487e9b  
d3d15ea',  
      weight: 2 } ],  
  actionThresholds: { deployment: 1, keyManagement: 2 } } }  
(env) root@ubuntu:/home/Working_Directory/keys-manager/client#
```

Task 4

Learning how to transfer tokens to an account on the Casper Testnet

Installing casper-client:

```
gr33nr4bb1t@ubuntu:~/Working_directory/casper-node$ rustup toolchain install nig
htly
info: syncing channel updates for 'nightly-x86_64-unknown-linux-gnu'

nightly-x86_64-unknown-linux-gnu unchanged - rustc 1.57.0-nightly (2b862bed9 2
021-09-23)

info: checking for self-updates
gr33nr4bb1t@ubuntu:~/Working_directory/casper-node$ cargo +nightly-2021-06-17 in
stall casper-client --locked
  Updating crates.io index
  Installing casper-client v1.3.2
warning: package `aes-soft v0.5.0` in Cargo.lock is yanked in registry `crates.i
o`, consider running without --locked
  Compiling proc-macro2 v1.0.28
  Compiling unicode-xid v0.2.2
  Compiling syn v1.0.74
  Compiling libc v0.2.98
  Compiling version_check v0.9.3
  Compiling autocfg v1.0.1
  Compiling serde_derive v1.0.127
  Compiling serde v1.0.127
  Compiling cfg-if v1.0.0
  Compiling log v0.4.14
  Compiling memchr v2.4.0
  Compiling typenum v1.13.0
  Compiling pin-project-lite v0.2.7
  Compiling futures-core v0.3.16
```

Checking version:

```
gr33nr4bb1t@ubuntu:~/Working_directory/casper-node$ casper-client --help
Casper client 1.3.2
A client for interacting with the Casper network

USAGE:
  casper-client [SUBCOMMAND]

FLAGS:
  -h, --help
      Prints help information

  -V, --version
      Prints version information
```

Registering and generating keys:

```
gr33nr4bb1t@ubuntu:/home/Working_Directory/casper-node/keys_gr33n_r4bb1t$ ls  
gr33n_r4bb1t_public_key_hex.txt  gr33n_r4bb1t_secret_key.pem  
gr33n_r4bb1t_public_key.pem
```

Signing to Casper testing network and opening Faucet:

The screenshot shows the CSPR.live dashboard. At the top, there are navigation links: Home, Blocks, Deployments, Validators, Tools (with a dropdown menu), Wallet (with a dropdown menu), and a user profile section. Below the navigation, there are summary statistics: Latest Block Height (209,951), Active Validators (100), Total Stake Bonded (5,263,559), and Circulating Supply (4,919,966). A search bar at the top right contains placeholder text: "Search public key, deploy hash or block hash". A red-bordered modal window titled "Faucet" is open, showing the text "Connected Peers". The main content area is titled "Account" and displays account details: Public Key (020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51), Account Hash (48bb5e94c43e1f75ef95cd75e23a126b11874a8eaef737ce90a3935006c9707e), Liquid Account Balance (0.00000 CSPR (\$0.00)), Delegated Account Balance (0.00000 CSPR (\$0.00)), and Total Rewards Received (0.00000 CSPR (\$0.00)). There is a "Show raw data" button. Below this is a table header with columns: Deployments (blue button), Delegations, Staking Rewards, and Transfers. The table has columns: Deploy Hash, Block Hash, Age (with a dropdown arrow), Type, Amount, Cost (with a dropdown arrow), and Status.

Requesting tokens

The screenshot shows the CSPR.live homepage with a dark blue header. On the right side of the header, there is a dropdown menu with the following items: Tools (with a downward arrow), Wallet (with a downward arrow), EN (selected), and a public key address: 02034...25e51 (with a downward arrow). A red rectangular box highlights the "Faucet" option under the Tools menu. Below the header, there are four status indicators: LATEST BLOCK HEIGHT (209,956), ACTIVE VALIDATORS (100), TOTAL STAKE BONDED (5,263,559), and CIRCULATING SUPPLY (4,919,966). The main content area has a light gray background and features a section titled "Faucet". It contains a "Public Key" field with the value 020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d1... followed by a copy icon. A prominent red button labeled "Request tokens" is centered below the public key field. At the bottom of the faucet section, there is a heading "Recent faucet requests" followed by a table with one row of data. The table has columns for Deploy Hash, Age, Public Key, and Status. The Deploy Hash is 14c8e627099df51a67140e6ad3e0..., the Age is 2 minutes ago, the Public Key is 020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d1..., and the Status is marked with a green checkmark and a red arrow icon.

Deploy Hash	Age	Public Key	Status
14c8e627099df51a67140e6ad3e0...	2 minutes ago	020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d1...	✓ ➔

The screenshot shows the CSPR.live homepage again, with the same header and status indicators. Below the header, there is a search bar with the placeholder "Search by account public key, deploy hash or block hash" and a magnifying glass icon. A red rectangular box highlights the "Faucet" link in the top left corner of the main content area. The main content area now displays a detailed view of a recent faucet request. The title is "Deploy 14c8e...2d7f3". The request details are listed in a table:

Timestamp	Sep 26, 2021, 10:42:56 AM
Deploy Hash	14c8e627099df51a67140e6ad3e02fc caee53334c2fc6461d1c70e4aeb12d7f3
Block Hash	ccf5993f58c0fefdb7c31ab6d4507afacd46cff24d3d3eb861cc159a3422d231
Public Key	018afa98ca4be12d613617f7339a2d576950a2f9a92102ca4d6508ee31b54d2c02
Cost	0.16851 CSPR
Status	✓ Success

At the bottom of the table, there are two buttons: "Raw Data" and "Show raw data".

Checking balance:

The screenshot shows the CSPR.live dashboard. At the top, there are statistics: LATEST BLOCK HEIGHT (209,961), ACTIVE VALIDATORS (100), TOTAL STAKE BONDED (5,263,559), and CIRCULATING SUPPLY (4,919,966). Below this is a search bar and a navigation menu with links for Home, Blocks, Deploys, Validators, Tools, Wallet, EN, and a user account. The main section is titled "Account" and displays the following data:

Public Key	020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51
Account Hash	48bb5e94c43e1f75ef95cd75e23a126b11874a8eaef737ce90a3935006c9707e
Liquid Account Balance	1,000.00000 CSPR (\$84.28)
Delegated Account Balance	0.00000 CSPR (\$0.00)
Total Rewards Received	0.00000 CSPR (\$0.00)
Raw Data	Show raw data

Obtaining a global state root hash:

```
gr33nr4bb1t@ubuntu:/home/Working_Directory/casper-node$ casper-client get-state-root-hash --id 1 --node-address http://46.4.119.180:7777
{
  "id": 1,
  "jsonrpc": "2.0",
  "result": {
    "api_version": "1.3.4",
    "state_root_hash": "3bf5a04cdc2c6a40e472e69ffdc185825162011e57fc72461ad5c8f85499c65b"
  }
}
```

Querying an Account:

```
gr33nr4bb1t@ubuntu:/home/Working_Directory/casper-node$ casper-client query-state \
>   --id 4 \
>   --node-address http://46.4.119.180:7777 \
>   --state-root-hash 3bf5a04cdc2c6a40e472e69ffdc185825162011e57fc72461ad5c8f8 \
5499c65b \
>   --key 020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51 \
{
  "id": 4,
  "jsonrpc": "2.0",
  "result": {
    "api_version": "1.3.4",
    "merkle_proof": "[19988 hex chars]",
    "stored_value": {
      "Account": {
        "account_hash": "account-hash-48bb5e94c43e1f75ef95cd75e23a126b11874a8eaef737ce90a3935006c9707e",
        "action_thresholds": {
          "deployment": 1,
          "key_management": 1
        },
        "associated_keys": [
          {
            "account_hash": "account-hash-48bb5e94c43e1f75ef95cd75e23a126b11874a8eaef737ce90a3935006c9707e",
            "weight": 1
          }
        ],
        "main_purse": "uref-80b5327356ac6a0f3db35358ee10e1ad8f030a2bd5de6065d8e85e8596f4fa1d-007",
        "named_keys": []
      }
    }
  }
}
```

Checking balance from casper-client:

```
gr33nr4bb1t@ubuntu:/home/Working_Directory/casper-node$ casper-client get-balance \
> --id 6 \
> --node-address http://46.4.119.180:7777 \
> --state-root-hash 3bf5a04cdc2c6a40e472e69ffdc185825162011e57fc72461ad5c8f85499c65b \
>     --purse-uref uref-80b5327356ac6a0f3db35358ee10e1ad8f030a2bd5de6065d8e85e8596f4fa
1d-007
{
  "id": 6,
  "jsonrpc": "2.0",
  "result": {
    "api_version": "1.3.4",
    "balance_value": "1000000000000000",
    "merkle_proof": "[20398 hex chars]"
  }
}
gr33nr4bb1t@ubuntu:/home/Working_Directory/casper-node$
```

Making a transfer via casper-client:

```
gr33nr4bb1t@ubuntu:/home/Working_Directory/casper-node$ casper-client transfer --trans
fer-id 123456789012345 --node-address http://46.4.119.180:7777 --amount 25000000000 --s
ecret-key /home/Working_Directory/casper-node/keys_gr33n_r4bb1t/gr33n_r4bb1t_secret_ke
y.pem --chain-name casper-test --target-account 01b341a3c8409d69da65c59959f8927ca1350f
60bdfb807dc5550b59cc1141858b --payment-amount 2500000000
{
  "id": -4557188124512624944,
  "jsonrpc": "2.0",
  "result": {
    "api_version": "1.3.4",
    "deploy_hash": "472a7caffd66e12dddc7927249382dbbf1537460bec8cf881b4e2fea9ecdce6a"
  }
}
```

Checking balance (updating root-hash, query-state and get-balance request)

```
gr33nr4bb1t@ubuntu:/home/Working_Directory/casper-node$ casper-client get-balance \
> --id 6 \
> --node-address http://46.4.119.180:7777 \
> --state-root-hash 7061a0f090a847e370b354841c6e79434d71ce40d5a6995a1360b6a5dc4c8d25 \
>     --purse-uref uref-80b5327356ac6a0f3db35358ee10e1ad8f030a2bd5de6065d8e85e8596f4fa
1d-007
{
  "id": 6,
  "jsonrpc": "2.0",
  "result": {
    "api_version": "1.3.4",
    "balance_value": "997499990000",
    "merkle_proof": "[20398 hex chars]"
  }
}
```

Checking deploy status:

```
gr33nr4bb1t@ubuntu:/home/Working_Directory/casper-node$ casper-client get-deploy --node-address http://46.4.119.180:7777 472a7caffd66e12dddc7927249382dbbf1537460bec8cf881b4e2fea9ecdce6a
{
  "id": 4298780152891164351,
  "jsonrpc": "2.0",
  "result": {
    "api_version": "1.3.4",
    "deploy": {
      "approvals": [
        {
          "signature": "[130 hex chars]",
          "signer": "020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51"
        }
      ],
      "hash": "472a7caffd66e12dddc7927249382dbbf1537460bec8cf881b4e2fea9ecdce6a",
      "header": {
        "account": "020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51",
        "body_hash": "125dbacd221b36779751ed4ff3be389eb9657c59a3b4dd09a444942f69b0a572",
        "chain_name": "casper-test",
        "dependencies": [],
        "gas_price": 1,
        "timestamp": "2021-09-26T18:09:07.407Z",
        "ttl": "30m"
      },
      "payment": {
        "ModuleBytes": {
          "args": [
            [
              "amount",
              {
                "bytes": "0400f90295",
                "cl_type": "U512",
                "parsed": "2500000000"
              }
            ]
          ],
          "module_bytes": ""
        }
      },
      "session": {
        "Transfer": {
          "args": [
            [
              "amount",
              {
                "bytes": "0400f90295",
                "cl_type": "U512",
                "parsed": "2500000000"
              }
            ]
          ],
          "module_bytes": ""
        }
      }
    }
  }
}
```

Checking deploy status at testnet.cspr.live:

Deploy 472a7...dce6a

Timestamp	Sep 26, 2021, 11:09:07 AM
Deploy Hash	472a7caffd66e12ddc7927249382dbbf1537460bec8cf881b4e2fea9ecdce6a
Block Hash	66960ad4582c7b3b916bcf0fb68a549cfffe1f63c1ec90beb7d1beba66d6759
Public Key	020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51
Cost	0.00001 CSPR
Status	Success
Raw Data	Show raw data

Transfers

Deploy Hash	Age	From (Account Hash)	To (Account Hash)	Transfer ID	Amount
472a7caffd6...	2 minutes ago	48bb5e94c43...	05732a56f79...	123456789012345	2.50000 CSPR

1 total rows First < Page 1 of 1 > Last

Checking balance:

Account

Public Key	020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51
Account Hash	48bb5e94c43e1f75ef95cd75e23a126b11874a8eaef737ce90a3935006c9707e
Liquid Account Balance	997.49999 CSPR (\$83.79)
Delegated Account Balance	0.00000 CSPR (\$0.00)
Total Rewards Received	0.00000 CSPR (\$0.00)
Raw Data	Show raw data

Deploys

Deploy Hash	Block Hash	Age	Type	Amount	Cost	Status
472a7caffd66e12ddc792724938...	66960ad4582c7b3b916bcf0fb68a...	2 minutes ago	Transfer	2.50000 CSPR	0.00001 CSPR	Success

Task 5

Learning how to Delegate and Undelegate on the Casper Testnet.

Delegating tokens via casper-client:

```
gr33nr4bb1t@ubuntu:/home/Working_Directory/casper-node/keys_gr33n_r4bb1t$ casper-client put-deploy \
> --node-address http://46.4.119.180:7777/rpc \
> --chain-name casper-test \
> --session-path /home/Working_Directory/casper-node/target/wasm32-unknown-unknown/release/delegate.wasm \
> --payment-amount 25550000000 \
> --session-arg "validator:public_key='017d96b9a63abcb61c870a4f55187a0a7ac24096bdb5fc585c12a686a4d892009e'" \
> --session-arg "amount:u512='25550000000'" \
> --session-arg "delegator:public_key='020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51'" \
> --secret-key /home/Working_Directory/casper-node/keys_gr33n_r4bb1t/gr33n_r4bb1t_secret_key.pem
{
  "id": 3245820397483492837,
  "jsonrpc": "2.0",
  "result": {
    "api_version": "1.3.4",
    "deploy_hash": "8d147e6ed40a940b90f138b1f3a473ea760aed292165258b93a92f6ba668830c"
  }
}
```

Deploy info:

Deploy 8d147...8830c	
Timestamp	Sep 26, 2021, 12:54:39 PM
Deploy Hash	8d147e6ed40a940b90f138b1f3a473ea760aed292165258b93a92f6ba668830c
Block Hash	4b1dba25ab845750d2f2f9e671648a5a8d2ae5ad7e4bea1ddd8314587a68da75
Public Key	020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51
Cost	2.99728 CSPR
Status	Success
Raw Data	<a>Show raw data

Transfers

Deploy Hash	Age	From (Account Hash)	To (Account Hash)	Transfer ID	Amount
8d147e6ed40...	8 minutes ago	48bb5e94c43...	6174cf2e6f8...		25.55000 CSPR
1 total rows					

Delegating tokens via casper-client:

```
gr33nr4bb1t@ubuntu:/home/Working_Directory/casper-node/keys_gr33n_r4bb1t$ casper-client put-deploy \
> --node-address http://46.4.119.180:7777/rpc \
> --chain-name casper-test \
> --session-path /home/Working_Directory/casper-node/target/wasm32-unknown-unknown/release/undelegate.wasm \
> --payment-amount 25550000000 \
> --session-arg "validator:public_key='017d96b9a63abcb61c870a4f55187a0a7ac24096bdb5fc585c12a686a4d892009e'" \
> --session-arg "amount:u512='25550000000'" \
> --session-arg "delegator:public_key='020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51'" \
> --secret-key /home/Working_Directory/casper-node/keys_gr33n_r4bb1t/gr33n_r4bb1t_secret_key.pem
{
  "id": 5575507255636953048,
  "jsonrpc": "2.0",
  "result": {
    "api_version": "1.3.4",
    "deploy_hash": "e6ccd230f3edd6a4707e9822178ff2c1ad6a9168e690e8f7211dab8cb5ea648"
  }
}
```

Deploy info:

Deploy e6ccd...ea648

Timestamp	Sep 26, 2021, 1:08:48 PM
Deploy Hash	e6ccd230f3edd6a4707e9822178ff2c1ad6a9168e690e8f7211dab8cb5ea648
Block Hash	ee9d2b3b1ed9ca56b484802faf9cae36f323729f4c61f039a286513f31fe65b9
Public Key	020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51
Cost	0.49734 CSPR
Status	Success
Raw Data	Show raw data

Delegating tokens on testnet.cspr.live



Delegation details

Account	Balance
020343918f7a7a7867e7a71671e9...	913.34999 CSPR

Validator

 017d96b9a63abcb61c870a...	<input type="checkbox"/>	10.00%	792,076 CSPR (95.58%)
---	--------------------------	--------	-----------------------

Amount

700	<input type="button" value="▼"/>	CSPR
-----	----------------------------------	------

Delegate max

Transaction fee	2.50001 CSPR
	\$0.21658837

By using CSPR.live, you acknowledge that you have read, understood and accepted our [Terms of Service](#).



Confirm delegation

Account	Balance
020343918f7a7a7867e7a71671e9... Copy	913.34999 CSPR

Validator			
017d96b9a63abcb61c870a... Copy	10.00%	792,925 CSPR (95.58%)	

You'll delegate **700.00000 CSPR
\$61.2031**

Transaction fee **2.50001 CSPR
\$0.21858337**

Total **702.50001 CSPR
\$61.42168337**

Please note

There is a 1 era delay before your funds are staked. Once they are staked, you will need to undelegate in order to have them become liquid again. There is a 7 era delay to undelegate. Era duration is approximately 120 minutes.



Sign delegation

Deploy hash

af700dcf6098de7403c5e82eed534ba2b9a0c76e11c0bd46921fa14440d6aa8e [Copy](#)

Validator public key

017d96b9a63abcb61c870a4f55187a0a7ac24096bdb5fc585c12a686a4d892009e [Copy](#)

Validator account hash

21eaea584903e79365bcb1f7607179cc118807033c8919cff7489a91c3a822d1 [Copy](#)

Delegate Amount

700,000,000,000 [Copy](#)

motes

Click the **Sign with Casper Signer** button.

⚠ Please note

Before confirming your transaction on the Casper Signer, make sure the values displayed on the Casper Signer match the values displayed above.

Deployed hash for checking:

<https://testnet.cspr.live/deploy/af700dcf6098de7403c5e82eed534ba2b9a0c76e11c0bd46921fa14440d6aa8e>

CONNECTED

Signature Request

Signing Key	020343...425e51
Account	020343...425e51
Deploy Hash	af700d...d6aa8e
Timestamp	27/09/2021, 00:37:59
Chain Name	casper-test
Transaction Fee	2 500 010 000 motes
Deploy Type	Contract Call
Contract Arguments	▼

CANCEL **SIGN**

- Delegation details
- Confirm
- Sign
- Done

Delegation completed!

Account	Balance
020343918f7a7a7867e7a71671e9...	913.34999 CSPR

Validator

017d96b9a63abcb61c870a...		10.00%	792,925 CSPR (95.58%)
---------------------------	--	--------	-----------------------

Amount delegated	700.00000 CSPR
	\$61.1751
Transaction fee	2.50001 CSPR
	\$0.21848337
Total	702.50001 CSPR
	\$61.39358337

Deploy hash: af700dcf609...

Successfully Sent

After inclusion in a new block, you can review the [Deploy Details](#)

[Make another delegation](#)

[Back to home](#)

Account

Public Key	020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51
Account Hash	48bb5e94c43e1f75ef95cd75e23a126b11874a8eaef737ce90a3935006c9707e
Liquid Account Balance	210.84998 CSPR (\$18.39)
Delegated Account Balance	700.00000 CSPR (\$61.07)
Total Rewards Received	0.00000 CSPR (\$0.00)
Raw Data	Show raw data

Deploys	Delegations	Staking Rewards	Transfers
Validator	Amount	Actions	
017d96b9a63abcb61c870a4f55...	700.00000 CSPR)	Undelegate Delegate	

Undelegating tokens on testnet.cspr.live:



Undelegation details

Account	Balance
020343918f7a7a7867e7a71671e9...	210.84998 CSPR

Validator

 017d96b9a63abcb61c870a4f5...	10.00%	700.000000000 CSPR
--	--------	--------------------

Amount

700 CSPR

Undelegate max

Transaction fee **0.00001 CSPR
\$0.00000087**

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Next



Confirm undelegation

Account	Balance
020343918f7a7a7867e7a71671e9... Copy	210.84998 CSPR

Validator			
 017d96b9a63abcb61c870a... Copy	10.00%	793,625	CSPR (95.50%)

You'll undelegate	700.00000 CSPR \$60.7908
-------------------	-----------------------------

Transaction fee	0.00001 CSPR \$0.00000087
-----------------	------------------------------

Please note

There is a 1 era delay before your funds are staked. Once they are staked, you will need to undelegate in order to have them become liquid again. There is a 7 era delay to undelegate. Era duration is approximately 120 minutes.

By using CSPR.live, you acknowledge that you have read, understood and accepted our [Terms of Service](#).

Deploy hash12155b657c3c2cfbff6aff64c2faba4b9535b643f677a200fdfa88502bfe3517 **Validator public key**017d96b9a63abcb61c870a4f55187a0a7ac24096bdb5fc585c12a686a4d892009e **Validator account hash**21eaee584903e79365bcb1f7607179cc118807033c8919cff7489a91c3a822d1 **Undelegate Amount**700,000,000,000 

motes

Click the **Sign with Casper Signer** button.

 **Please note**

Before confirming your transaction on the Casper Signer, make sure the values displayed on the Casper Signer match the values displayed above.

CSPR.live never accesses, saves, stores, or transmits your secret key. You need to sign each transaction in order to send it to the Casper Network.

By using CSPR.live, you acknowledge that you have read, understood and accepted our [Terms of Service](#).

Sign with Casper Signer**Deployed hash for checking:**<https://testnet.cspr.live/deploy/12155b657c3c2cfbff6aff64c2faba4b9535b643f677a200fdfa88502bfe3517>

CONNECTED

Signature Request

Signing Key	020343...425e51
Account	020343...425e51
Deploy Hash	12155b...fe3517
Timestamp	27/09/2021, 00:54:58
Chain Name	casper-test
Transaction Fee	10 000 motes
Deploy Type	Contract Call
Contract Arguments	▼
CANCEL	SIGN

Undelegation details Confirm Sign Done

Undelegation completed!

Account	Balance
020343918f7a7a7867e7a71671e9...	210.84998 CSPR

Validator

017d96b9a63abcb61c870a...	10.00%	793,625 CSPR (95.50%)
---------------------------	--------	-----------------------

Amount undelegated	700.00000 CSPR \$60.7908
Transaction fee	0.00001 CSPR \$0.00000087
Deploy hash: 12155b657c3...	Successfully Sent ✓

After inclusion in a new block, you can review the [Deploy Details](#)

[Make another undelegation](#) [Back to home](#)

Account

Public Key	020343918f7a7a7867e7a71671e9006974da751660d09775e88d66d15393a2425e51		
Account Hash	48bb5e94c43e1f75ef95cd75e23a126b11874a8eaef737ce90a3935006c9707e		
Liquid Account Balance	210.84997 CSPR (\$17.89)		
Delegated Account Balance	0.00000 CSPR (\$0.00)		
Total Rewards Received	0.00000 CSPR (\$0.00)		
Raw Data	Show raw data		
Deploys	Delegations	Staking Rewards	Transfers

Deploy Hash	Block Hash	Age	Type	Amount	Cost	Status
12155b657c3c2cfbff6aff64c2fa...	de36c259ab4a2b87ec9a0fa509ae...	11 minutes ago	Contract Call	-	0.00001 CSPR	✓

Done!
Mission completed ;-)