Hyperledger Indy

Theory and Applications of Blockchain (CS61065) - Tutorial 3

HYPERLEDGER
INDY

Indy

Hyperledger Indy is an open-source, decentralized identity management platform for individuals and organizations to have complete control over their digital identities. It provides a secure and scalable infrastructure to manage and store decentralized identity information

Key Features

- Distributed ledger - built for decentralized identity

- DIDs (Decentralized Identifiers) without requiring any centralized resolution authority

- Verifiable Credentials in an interoperable format for exchange of digital identity attributes

- Zero Knowledge Proofs which prove that some or all of the data in a set of Claims is true without revealing any additional information

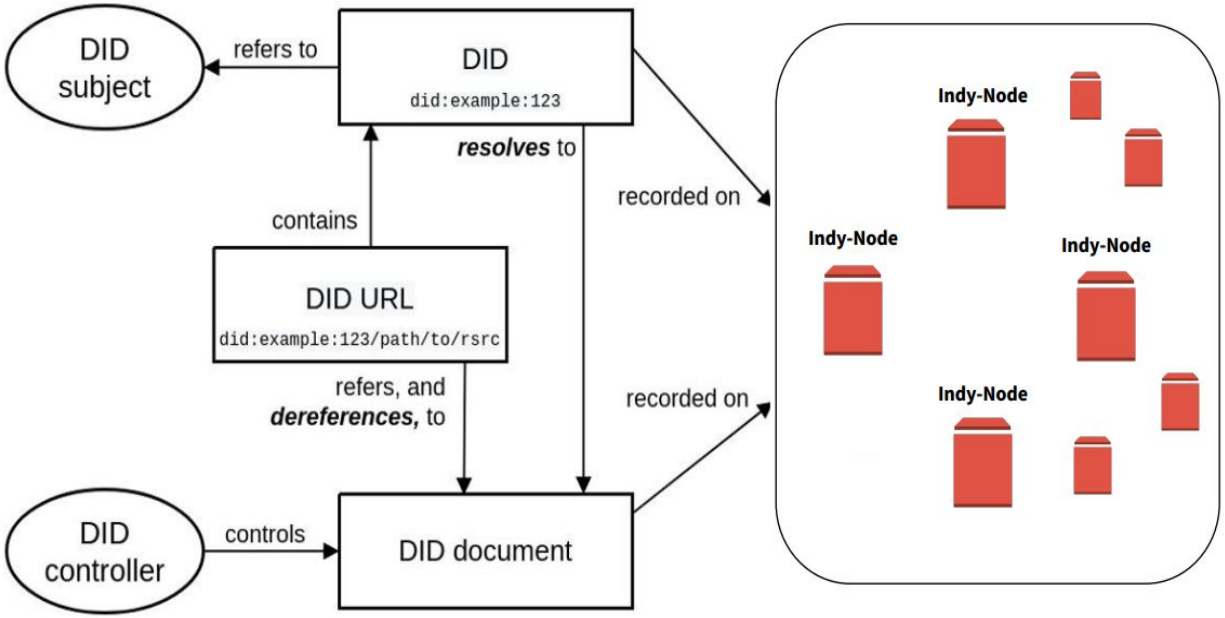
Indy Work Projects

Indy-Plenum:

- ❑ It is the ledger part
- ❑ Used for consensus in Indy
- ❑ https://github.com/Hyperledger/indy-plenum

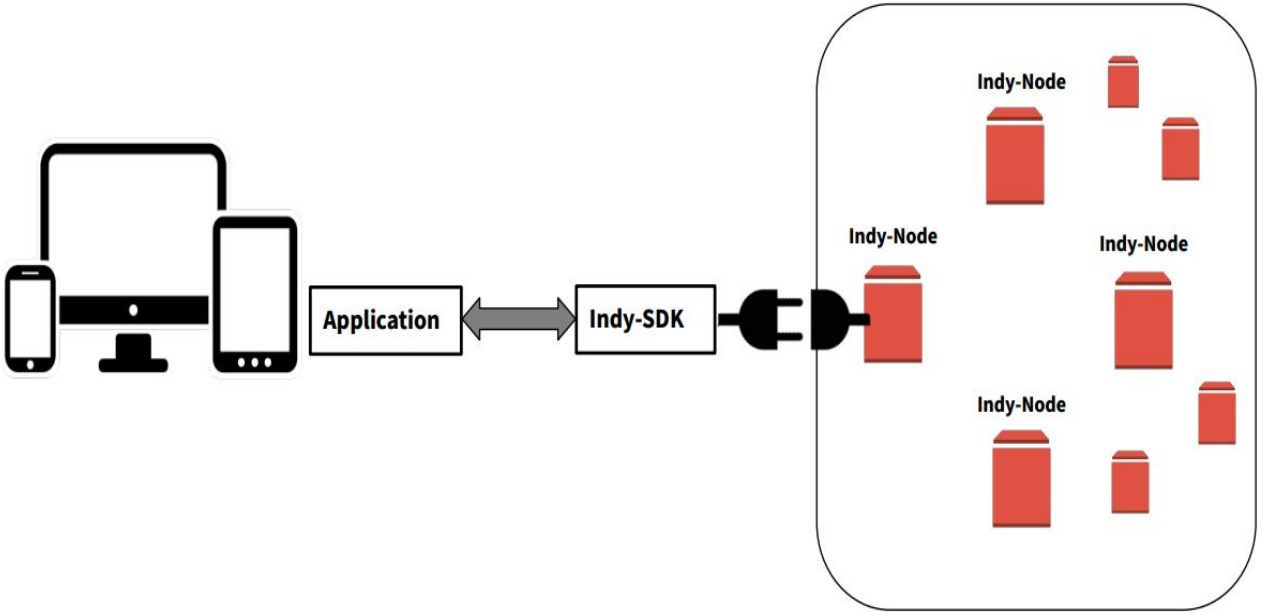
- Indy-Node:
  - ❑ This codebase embodies all the functionality to run nodes
  - ❑ It provide a self-sovereign identity ecosystem on top of the edger
  - ❑ https://github.com/Hyperledger/indy-node
- Indy-SDK
  - ❑ Provides services and interface to applications for interacting with Indy network
  - ❑ Indy- https://github.com/Hyperledger/indy-sdk

Indy and Decentralized Identities



* Courtesy: NPTEL Lecture Series

Indy Connectivity



* Courtesy: NPTEL Lecture Series

Indy Set Up using Indy SDK

Start Indy Pool using Indy SDK

Clone indy-sdk

```
git clone https://github.com/hyperledger/indy-sdk.git
cd indy-sdk
```

-

Indy Set Up

Build and run indy pool docker image

```
docker build -f ci/indy-pool.dockerfile -t indy_pool .
docker run -itd -p 9701-9708:9701-9708 indy_pool
```

Alternatively an easy way to start indy pool

- docker run -itd -p 9701-9708:9701-9708 mailtisen/indy_pool:latest

Also Installing Indy from Indy Node

Clone indy-node

git clone https://github.com/hyperledger/indy-node.git

Move to the directory indy-node/environment/docker/pool

./pool_start.sh [number of nodes in pool] [IP addresses of nodes] [number of clients] [port for the first node]

Eg.

./pool_start.sh 4 10.0.0.2,10.0.0.3,10.0.0.4,10.0.0.5 10 9701

Install SDK and Wrappers

Ubuntu based distributions (Ubuntu 18.04)
It is recommended to install the SDK packages with APT. (Not tested yet with Snap)

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sudo apt-key adv --keyserver keyserver.ubuntu.com --recv-keys CE7709D068DB5E88
(use other keyservers if ubuntu one is not available)

sudo add-apt-repository "deb https://repo.sovrin.org/sdk/deb (xenial|bionic) {release channel}"

Install SDK and Wrappers

sudo apt-get update

sudo apt-get install -y {library}

- {library} must be replaced with libindy, libnullpay, libvcx or indy-cli.
- (xenial|bionic) xenial for 16.04 and older Ubuntu and bionic for 18.04 Ubuntu.
- {release channel} must be replaced with master, rc or stable to define a corresponding release channel.

Please see the "Release channels" section in the Hyperledger Indy documentation for more details.

Install SDK and Wrappers

Install Python3 Wrapper Library

```
pip install python3-indy
```

Alternatively

```
sudo apt install python3-pip
pip3 install python3-indy
```

Connect To Indy Pool → Find path to genesis txn

Default pool genesis txn:

{"reqSignature":{},"txn":{"data":{"data":{"alias":"Node1","blskey":"4N8aUNHSgjQVgkpm8nhNEfDf6txHznoYREg9kirmJrkivgL4oSEimFF6nsQ6M41QvhM2Z33nves5vfSn9n1UwNFJBYtWVnHYMATn76vLuL3zU88KyeAYcHfsih3He6UHcXDxcaecHVz6jhCYz1P2UZn2bDVruL5wXpehgBfBaLKm3Ba","blskey_pop":"RahHY¿CvoNCtPTrVtP7nMC5eTYrsUA8WjXbdhNc8debh1agE9bGiJxWBXYNFbnJXoXhWFMvyqhqhRoq737YQemH5ik9oL7R4NTTCz2LEZhkgLJzB3QRQqJyBNyv7acbdHrAT8nQ9UkLbaVL9NBpnWXBTw4LEMePaSHEw66RzPNdAX1","client_ip":"127.0.0.1","client_port":9702,"node_ip":"127.0.0.1","node_port":9701,"services":["VALIDATOR"]},"dest":"Gw6pDLhcBcoQesN72qfotTgFa7cbuqZpkX3Xo6pLhPhv"},"metadata":{"from":"Th7MpTaRZVRYnPiabds81Y"},"type":"0"},"txnMetadata":{"seqNo":1,"txnId":"fea82e10e894419fe2bea7d96296a6d46f50f93f9eeda954ec461b2ed2950b62"},"ver":"1"}

Connect To Indy Pool

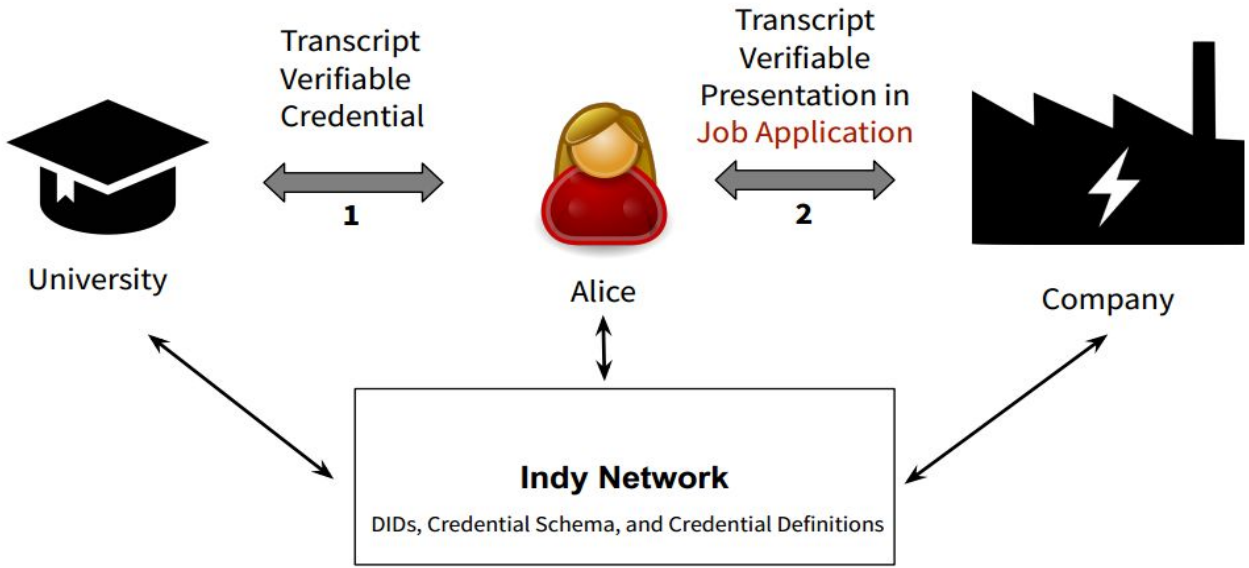
Default pool genesis txn:

{"reqSignature":{},"txn":{"data":{"data":{"alias":"Node2","blskey":"37rAPpXVoxzKhz7d9gkUe52XuXryuLXoM6P6LbWDB7LSbG62Lsb33sfG7zqS8TK1MXwuCHj1FKNzVpsnafmqLG1vXN88rt38mNFs9TENzm4QHdBzsvCuoBnPH7rpYYDo9DZNJePaDvRvqJKByCabubJz3XXKbEeshzpz4Ma5QYpJqjk","blskey_pop":"Qr658mWZ2YC8JXGXwMDQTzuZCWF7NK9EwxphGmcBvCh6ybUuLxbG65nsX4JvD4SPNtkJ2w9ug1yLTj6fgmuDg41TgECXjLCij3RMsV8CwewBVgVN67wsA45DFWvqvLtu4rjNnE9JbdFTc1Z4WCPA3Xan44K1HoHAq9EVeaRYs8zoF5","client_ip":"127.0.0.1","client_port":9704,"node_ip":"127.0.0.1","node_port":9703,"services":["VALIDATOR"]},"dest":"8ECVSk179mjsjKRLWiQtssMLgp6EPhWXtaYyStWPSGAb"},"metadata":{"from":"EbP4aYNeTHL6q385GuVpRV"},"type":"0"},"txnMetadata":{"seqNo":2,"txnId":"1ac8aece2a18ced660fef8694b61aac3af08ba875ce3026a160acbc3a3af35fc"},"ver":"1"}

{"reqSignature":{},"txn":{"data":{"data":{"alias":"Node3","blskey":"3WFpdbg7C5cnLYZwFZevJqhubkFALBfCBBok15GdrKMUhUjGsk3jV6QKj6MZgEubF7oqCafxNdkm7eswgA4sdKTRc82tLGzZBd6vNqU8dupzup6uYUf32KTHTPQbuUM8Yk4QFXjEf2Usu2TJcNkdgpyeUSX42u5LqdDDpNSWUK5deC5","blskey_pop":"QwDeb2CkNSx6r8QC8vGQK3GRv7Yndn84TGNijX8YXHPiagXajyfTjoR87rXUu4G4QLk2cF8NNyqWiYMus1623dELWwx57rLCFqGh7N4ZRbGDRP4fnVcaKg1BcUxQ866Ven4gw8y4N56S5HzxXNBZtLYmhGHvDtk6PFkFwCvxYrNYjh","client_ip":"127.0.0.1","client_port":9706,"node_ip":"127.0.0.1","node_port":9705,"services":["VALIDATOR"]},"dest":"DKVxG2fXXTU8yT5N7hGEbXB3dfdAnYv1JczDUHpmDxya"},"metadata":{"from":"4cU41vWW82ArfxJxHkzXPG"},"type":"0"},"txnMetadata":{"seqNo":3,"txnId":"7e9f355dffa78ed24668f0e0e369fd8c224076571c51e2ea8be5f26479edebe4"},"ver":"1"}

{"reqSignature":{},"txn":{"data":{"data":{"alias":"Node4","blskey":"2zN3bHM1m4rLz54MJHYSwvqzPchYp8jkHswveCLAEJVcX6Mm1wHQD1SkPYMzUDTZvWvhuE6VNAkK3KxVeEmsanSmvjVkReDeBEMxeDaayjcZjFGPydyey1qxBHmTvAnBKoPydvuTAqx5f7YNNRAdeLmUi99gERUU7TD8KfAa6MpQ9bw","blskey_pop":"RPLagxaR5xdimFzwmzYnz4ZhWtYQEj8iR5ZU53T2gitPCyCHQneUn2Huc4oeLd2B2HzkGnjAff4hWTJT6C7qHYB1Mv2wU5iHHGFWkhnTX9WsEAbunJCV2qcaXScKj4tTfvdDKfLiVuU2av6hbsMztirRze7LvYBkRHV3tGwyCptsrP","client_ip":"127.0.0.1","client_port":9708,"node_ip":"127.0.0.1","node_port":9707,"services":["VALIDATOR"]},"dest":"4PS3EDQ3dW1tci1Bp6543CfuuebjFrg36kLAUcskGfaA"},"metadata":{"from":"TWwCRQRZ2ZHMJFn9TzLp7W"},"type":"0"},"txnMetadata":{"seqNo":4,"txnId":"aa5e817d7cc626170eca175822029339a444eb0ee8f0bd20d3b0b76e566fb008"},"ver":"1"}

Demo Scenario



Indy Roles

STEWARDS

Steward can onboard new actors in the system and assigns role to them.

Trust Anchor(TA)

TA's are the link between User and Stewards. TA can be banks, universities, hospitals, service providers, insurance companies. TA's are endorsers onboarded by Stewards.

Indy Credential Workflow

Indy Credential Workflow

- Getting the ownership for Steward's DID

- Register DID for Government, University and Company
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- Register Credential Schema
  - Government creates transcript schema for university.

- Create Credential Definition
  - University creates a credential definition.

Indy Credential Workflow

Indy Credential Workflow

- Issue Credential
  - University issues transcript credential to Alice.

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- Verifiable Presentation
  - Alice sends Verifiable Presentation to Company.

- Validate Presentation
  - Company validates Alice's claims from the presentation.

Indy Demo Code Snippet

```
import asyncio
import json
import time

from indy import pool, wallet, did, ledger, anoncreds, blob_storage
from indy.error import ErrorCode, IndyError
from indy.pairwise import get_pairwise

async def run():

        pool_ = {
        'name': 'pool1'
        }
        print("Open Pool Ledger: {}".format(pool_['name']))
        pool_['genesis_txn_path'] = "pool1.txn"
        pool_['config'] = json.dumps({"genesis_txn": str(pool_['genesis_txn_path'])})

        print(pool_)

        # Set protocol version 2 to work with Indy Node 1.4
        await pool.set_protocol_version(2)

        try:
        await pool.create_pool_ledger_config(pool_['name'], pool_['config'])
        except IndyError as ex:
        if ex.error_code == ErrorCode.PoolLedgerConfigAlreadyExistsError:
        pass
        pool_['handle'] = await pool.open_pool_ledger(pool_['name'], None)

        print(pool_['handle'])
        #               ------------------------------------------------------------------------
        #  Accessing a steward.

        steward = {
        'name': "Sovrin Steward"
```

References

- Indy Walkthrough:
  https://github.com/hyperledger/indy-sdk/blob/master/docs/getting-started/indy-walkthrough.md

- Indy Walkthrough Python Code:
  https://github.com/hyperledger/indy-sdk/blob/master/samples/python/src/getting_started.py

  Sample code in other languages:
  https://github.com/hyperledger/indy-sdk/tree/master/samples

- Indy-node: https://github.com/hyperledger/indy-node
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- Indy-sdk: https://github.com/hyperledger/indy-sdk

- Indy-plenum: https://github.com/hyperledger/indy-plenum

*Most of the explanation and codes are taken from previous NPTEL Lectures and slides. Please refer to them for further details.