

TRACE4EU

KNOW YOYR CUSTOMER (KYC) TOOL

USE CASE

SOFTWARE SPECIFICATIONS

GOLDMAN SOLUTIONS & SERVICES

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Overview

The problem

Customers are required to share their KYC (Know Your Customer) documents, either as a first time or as an updated version, several times and to several banks or several institutions that are doing business with. Each bank is forced to repeat the verification process irrespectively of whether this process has already been performed by other banks.

Objective

The objective of this use case is to allow a customer to “**upload once use many times**” of his KYC documents. It also speeds up the KYC verification process on part of the banks or other institutions, since a bank will be able to rely on the verification results already performed by other banks on a customer’s KYC docs.

It **does not** provide a new process for KYC verification. This process remains the same as currently carried out by each bank or other institution.

Future enchancement will also allow a customer, using his EBSI KYC wallet, to securely **open a new bank account** by presenting to the bank a **proof of ownership of his KYC verified docs**.

Technical overview

Banks wishing to take part in the KYC domain, make a request to CBC (Central Bank of Cyprus) to be onboarded to EBSI and become authorized to create new documents in TnT service on behalf of their customers.

Customers and banks **encrypt** private data, stored in off-chain or on-chain, using **randomly** generated **AES 256 bits** encryption keys. These encryption keys are kept encrypted in EBSI wallets local storages created and used by customers and banks.

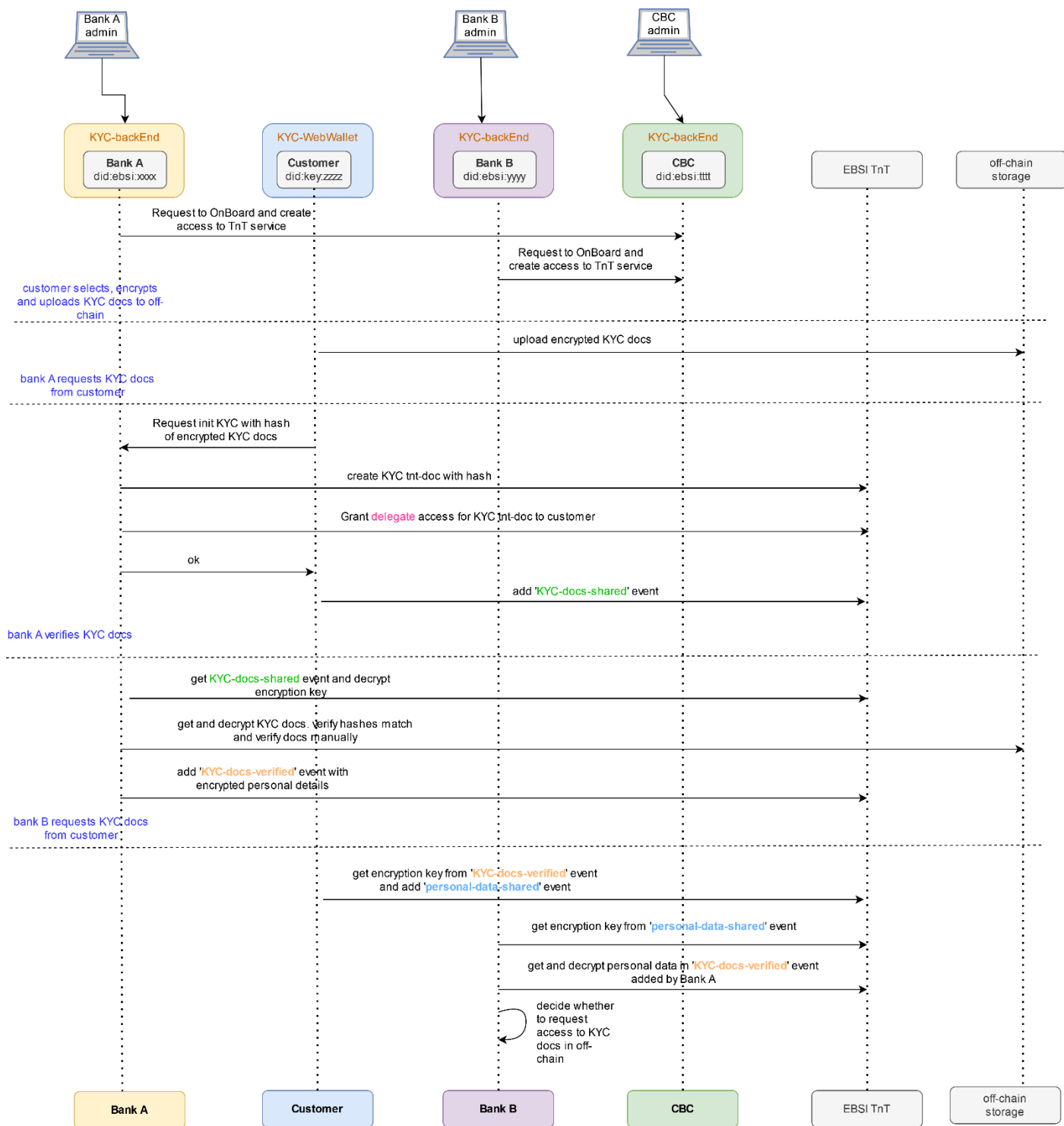
Encryption keys are shared via TnT events and after being encrypted using the public key of the recipient. More precisely, the encryption keys are encrypted using an AES 256 bits encryption key **derived** from the ES256 private key of the sender and the ES256 public key of the recipient.

Customers can delete their encrypted KYC docs they uploaded to off-chain storage at any time.

User Flow

Below is the description of the steps and a flow diagram (see next page) of our suggested solution which is based on EBSI’s TnT service.

1. Banks wishing to take part in the KYC domain, make a request to CBC (Central Bank of Cyprus) to be onboarded and be allowed to create new documents in TnT service.
2. Customer A creates a web wallet, if doesn't have one, and chooses the wallet's option to upload his KYC docs to off-chain storage. Wallet pop-ups a file selection window and lets the user select the docs he wishes to upload from his local drive. Once selected, wallet **encrypts the docs with a random encryption key**, and uploads them to off-chain storage.
3. Bank A makes an out-of-band request to customer A to share his KYC docs. Customer A chooses the wallet's option to share his KYC docs to Bank A. Wallet pop-ups a list of docs uploaded to off-chain storage and, after selecting one, wallet creates a hash of the encrypted docs and makes a request to Bank A's API to initiate the KYC docs sharing process passing the hash to the API.
4. Bank A's API makes a request to TnT to create a **new KYC tnt-document** for customer A using the encrypted docs hash.
5. Bank A grants delegate access for the newly created TnT document to customer A's **did:key** and returns a successful response to wallet.
6. Wallet updates the TnT document adding a **KYC-docs-shared** event for Bank A. The **KYC-docs-shared** event contains the KYC docs off-chain location url and the **customer's random encryption key** encrypted with bank's A public key.
7. Bank A's employee uses a web gui interface to get the encryption key from the **KYC-docs-shared** event and decrypt the customer's docs from the off-chain storage. He verifies that the hash of decrypted docs matches the TnT-id, manually validates the docs as of today and sends a request to TnT to update the document (writes a new event) with the verified customer's details (name, id, address, etc) **encrypted using a random encryption key**. The encryption key is also added to the event **encrypted using the customer's public key** (**KYC-docs-verified** event).
8. Bank B makes an out-of-band request to customer A to share his KYC docs. Customer A uses his wallet to update the TnT document (writes a new event) with the encryption key used by Bank A to encrypt his verified personal data **encrypted with Bank B's public key** (**Personal-data-shared** event).
9. Bank B's employee uses a web gui interface to get the encryption key from the TnT **Personal-data-shared** event and decrypt the customer's verified details included in the event **KYC-docs-verified** added by Bank A.
Bank B's employee may decide to trust Bank A's verified details or ask the customer to grant him access to the original uploaded to off-chain KYC docs. In the second case, the customer will need to add a **KYC-docs-shared** event for bank B and grant write access to bank B in case bank B needs to add its own **KYC-docs-verified** event.



Schemas

KYC TnT document

created by a bank following a request by customer to initiate KYC sharing.
in the request customer specifies his did:key and a hash of his **encrypted** KYC docs
Following tnt-doc creation, bank gives **delegate** permission to did:key

```
{
  from: bank's ethereum address
  documentHash: hash of encrypted KYC docs
  documentMetadata: "KYC doc created by Bank A"
  didEbsiCreator: bank's did:ebsi
}
```

Grant delegate permission to customer's did:key

```
{
  From: bank's Ethereum address
  documentHash: hash of encrypted KYC docs = document id
  grantedByAccount: UTF-8 of bank's did:ebsi
  subjectAccount: secp256kl public key of did:key
  grantedByAccType: 0 for did:ebsi
  subjectAccType: 1 for did:key
  permission: 0 for delegate
}
```

KYC TnT events

KYC-docs-shared event –
added by customer for a bank that requested access to his encrypted data in off-chain

```
{
  from: customer's ethereum address
  documentHash: document-id created by bank
  externalHash: hash of string "KYC docs shared to Bank X"
  sender: secp256kl public key of customer's did:key
  metadata: KYC-docs-shared-metadata
}
```

KYC-docs-shared-metadata

```
{
  event-type: 'KYC-docs-shared'
  sharedForName: 'bank X'
  sharedForDID: bank X DID
  off-chain-url: url of encrypted docs in off-chain
  EncryptedEncryptionKey: customer's random secret key encrypted with bank's X public key
}
```

Note: if bank X has no access to the TnT doc (it is not the creator of the TnT doc), customer must also provide write access to the bank so that bank X can also add a **KYC-docs-verified** event.

KYC-docs-verified event –
added by bank X

```
{
  from: bank's ethereum address
  documentHash: document-id created by bank
  externalHash: hash of string "KYC docs verified by Bank X"
  sender: UTF-8 of bank's X did:ebis
  metadata: docs-verified-metadata
}
```

docs-verified-metadata

```
{
  event_type: "KYC-docs-verified"
  verifiedBy: "Bank X"
  EncryptedEncryptionKey: bank's X random secret key encrypted with customer's public key
  //personalData encrypted using bank X's random encryption key
  EncryptedPersonalData: {
    firstName:
    LastName:
    Id:
    Address:
    Salary:
    ...
  }
}
```

Personal-data-shared event –
added by customer for a '**KYC-docs-verified**' by Bank X event for bank Y to see.

```
{
  from: customer's ethereum address
  documentHash: document-id created by bank
  externalHash: hash of string "personal data shared to bank Y"
  sender: secp256kl public key of customer's did:key
  metadata: personal-data-shared-metadata
}
```

personal-data-shared-metadata

```
{
  event-type: 'personal-data-shared'
  from: customer's did
  verifiedBy: "bank X"
  sharedForName: "bank Y"
  sharedForDID: bankY DID
  docsVerifiedEvent: eventid of KYC_docs_verified event added by bank X,
  encryptedEncryptionKey: bank's X random secret key encrypted with bank's Y public key
}
```

}

KYC BackEnd APIs

The KYC Back-end module is available for installation by both the Banks and the CBC.
A customizable environment variable determines its operation mode, BANK or CBC.

If operated by the CBC, banks can use CBC's APIs to request onBoarding to EBSI and granted write access to TnT EBSI service.

If operated by a Bank, customers can use the bank's APIs to share their KYC docs to the bank and the bank employee to verify the customer's docs.

Publicly exposed APIs

GET /getOnBoard?walletDID=bankDID

Offered by CBC module.

Called by a bank's backend module (bank's ent wallet) to initiate the issuance of **VerifiableAuthorisationToOnboard** vc from CBC. A pre-authorized credential offer will be returned. The bank admin must present the pin provided by the CBC admin.
It is assumed that CBC's DID is already registered in TIR as a Trusted Issuer.
Banks can use this vc to register their DID in EBSI DIR.

POST /token

Urlencoded request:

```
{
  grant_type: 'urn:ietf:params:oauth:grant-type:pre-authorized_code'
  pre-authorized_code: pre-authorized_code from get_license_vc
  user_pin: the provided pin
}
```

Finds an entry in banks db with pin and walletdid (in pre-authorised_code)
Generates access_token

Updates entry in db with access_token

```
returns
{
  access_token:
  token_type:
  id_token:
  c_nonce:
}
```

POST /credential

Bearer: **access_token** from above

```
raw request:
{
  types: [ "VerifiableCredential",
           "VerifiableAttestation",
           "VerifiableAuthorisationToOnboard"],
  format: 'jwt_vc',
  proof : {
    proof_type: 'jwt',
    jwt: c_nonce signed by wallet
  }
}
```

Validates the submitted proof and access_token, checks existence of access_token in banks db and issues a VerifiableAuthorisationToOnboard vc

```
returns
{
  format: 'jwt_vc',
  credential: jwtvc
}
```

GET /getTnTaccess?walletDID=bankDID&bankName=name&bankUrl=url

Offered by CBC module.

Note: The CBC's ethereum address must be in **TnT allowed list** to be able to authorize others for TnT create access (EBSI support has to do this):

Called by a bank's backend module (bank's ent wallet) to request TnT create access. The bank's onBoarding process must have been completed first.

CBC checks if DID is already authorized for TnT create. If yes, it skips the next step.

CBC checks if the bank's DID is in banks db and that it is registered in DIR and then authorises DID for TnT create.

==> run issueVcOnboard **CBCdid**

<self-issued-vcToOnboard>

==> resAuthTNT: authorisation auth tnt_authorise_presentation ES256 <self-issued-vcToOnboard>

==> using token resAuthTNT.access_token

==>tnt authoriseDid **CBC_DID bank_DID** true

Lastly, Updates the banks db with the bank's name and bank's backend module Url using bankDID

Note: EBSI support refused to white list the CBC's DID. This means that proving authorization for TnT create access to the banks will have to be performed manually, by opening a request to EBSI support.

Get /banks

Offered by CBC module.

Called by customer wallets to get a list of available banks to share their KYC docs to.

Returns a list from **banks** db of allowed banks to create KYC TnT docs with

bankName, bankDID, bankUrl.

The bankUrl can be used by customer wallets to connect to the bank's backend module.

POST /init_KYC_share

Offered by Bank module

Called by a KYC wallet to initiate his KYC docs sharing. In the request the wallet must include the hash of the encrypted KYC docs, its did:key and a self-signed empty vp_token to prove ownership of the did. A new TnT document will be created with the provided hash and then grant **delegate** access to the **did:key** of the requesting customer's wallet.

Req:

```
{
  documentHash: encrypted docs hash
  did: customer's wallet did:key
  customerName:
  vp_token: a self-signed jwtvp to prove ownership of did:key
}
```

It will also add in **tntdocs'** db the customer's name, customer's did and documentHash.

POST /add_event

Offered by bank module

Called by KYC wallet to inform the bank that a new event has been added. **Not related to TnT events.**

Req:

```
{
  tntId:
  eventId:
  event_type: 'KYC_docs_shared'/'Personal_data_shared'
  customerName:
}
```

Stores tntId, eventId, event_type, customerName, status=pending in **events'** DB

Admin portal APIs

All admin's portal APIs require an access token as a bearer, issued from /login API. Called from the admin portal web GUI app.

POST /login

called to get an access token. Admin's Userid and password must be provided.

POST /genPIN

Offered by CBC's module

Generates a pin that can be used by a bank's employee to initiate the onBoard process for his bank.

Req:

```
{
```

```
bankDID:
}
```

Stores in banks' DB the bankDID and pin. An existing record with the same bankDID is deleted first, if exists.

Returns a pin which must be given to the bank employee to be used when calling the GET /getOnBoard API.

GET /walletcap

Offered by bank and CBC module

Displays the wallet's capabilities. DID, DID registry contents, TIR registry contents and if has TnT **create** access.

GET /newwallet

Offered by bank and CBC module

Generates a new ent did and private/public key pair for a new wallet setup

Following this, the admin must update the module's env file with the generated data.

GET /reqOnBoard?CBCurl=url&pin=pin

Offered by bank's module

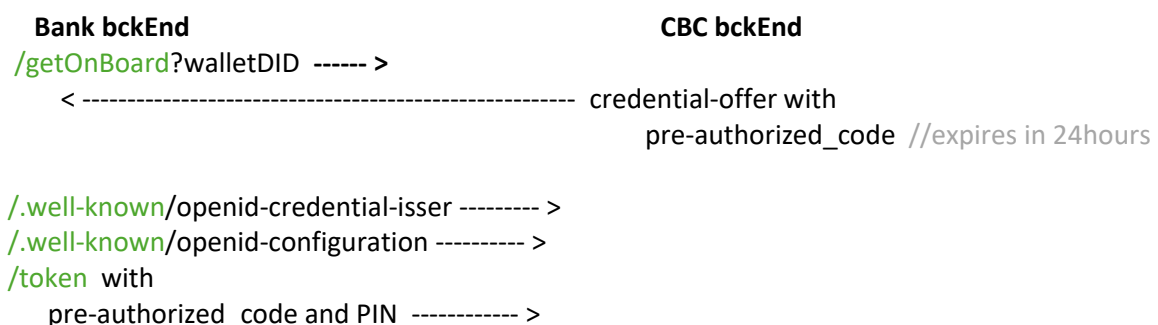
Used by Bank's admin to initiate the onboarding process for the bank.

It calls the **GET /getOnboard** API on the CBC module url which will return a pre-authorized credential offer for an **VerifiableAuthorisationToOnboard** vc. It will then have to provide a pin to get the vc from CBC and then use it to register its DID in DIR registry.

Following a successful registration in DIR the **GET /getTnTaccess** API on CBC module will be called.

Note that for accessing TnT services is only required that a DID is registered in DIR. No need to be registered in TIR (ie no need to become a Trusted Issuer).

Detailed flow:



```

< ----- access_token //expires in 24h. added in db rec.
                                //ok if record with pin && DID in
                                // pre-authorization_code
                                // exist in db

/credential with access_token and jwt proof ----- >
< ----- vcjwt //uses access_token to get vc from db
                                //issues VerifiableAuthorisationToOnboard

```

Get accessToken from Authorization API using vcjwt
 Register DID Document
 Call GET **/getTnTaccess** on CBC

GET /encrypted_docs?eventId=id

Offered by bank's module

Used to get and decrypt the encrypted data on the off-chain storage associated with the specified tnt id event.

Get eventId

If event metadata = {event_type == '**KYC-docs-shared**' && sharedForDID==myDID} then get encryptedEncryptionKey and off_chain_url

KYC-docs-shared event contains **customer's random secret key** encrypted with my public key in **encryptedEncryptionKey** property of its metadata.

encrypted_data = GET off_chain/download?file=url

calculate hash of encrypted_data and verify it is the same with tntId

customer_key = decrypt encryptedEncryptionKey with my private key

clear_data = decrypt encrypted_data with customer_key

return clear_data

POST /kyc_verified

Offered by bank module

Bank admin adds a **KYC_docs_verified** event to a TnT doc following a successful manual verification of some KYC docs in off-chain storage.

Req:

```

{
  tntId:
  personalData: {

```

```

    firstName:
    LastName:
    Id:
    Address:
    Salary:
    ...
    ...
  }
}

```

Get TnT doc and check if I am the creator or have been given write access by the customer.
 Encrypt personalData with a random key. personalData is the result of the manual verification process.
 EncryptedEncryptionKey: the **random key** encrypted with customer's public key
 EncryptedPersonalData: personalData encrypted with **random key**

```

event_data = {
  event_type: 'KYC_docs_verified',
  verifiedBy: 'my Name',
  EncryptedEncryptionKey,
  EncryptedPersonalData
}

```

Call add_event_inTnT(tntId, event_data)
 Stores tntId, eventId, event_type= **KYC_docs_verified** , customerName, **randomkey**, status=completed in events' DB

GET /kyc_tnt_docs?bankName=name

Offered by bank's and CBC module
 Returns a list of all kyc tnt docs created by this or any other bank

Get all TnT docs where documentMetadata includes "KYC"
 If bankName exists filter results where documentMedata includes bankName
 If bankName == myName
 For each entry in resulted list add customerName from **tntdocs** db
 Return list with tntId, createdBy, customerName (optional)

GET /kyc_tnt_doc/:id

Offered by bank's and CBC module

returns a json of the tnt doc details and of all its events details

GET /events?status=completed/pending/all

Offered by bank's module

Returns a list of events from **events** db

KYC front-end (Admin portal)

A reactJs web application accessed by the bank or CBC admins.

On loading displays login page. User enters userID/password and calls the **POST /login** API on KYC backend. The /login API returns an access token which is saved in session storage.

On successful login go to **Get Events** page, if a bank operated module, and **Get KYC docs**, if a CBC module.

Menu Options displayed on a vertical menu bar on left of the page:

Get Events (for bank module only)
Get KYC docs
Req OnBoard (for bank module only)
Gen Pin (for CBC module only)
View Wallet
New Wallet
Logout

Get Events

Available to a bank admin

Title “check events submitted by KYC customers”

Gives the option to select **one** of the following:

- **Pending events**
- **Completed events**
- **All events**

When the ‘**Get Events**’ button is pressed:

Call **GET /events?status=pending/completed/all** from **local events** db.

Display a list with event-type, customerName, and status (if all)

The list also includes tntId and eventId but not displayed.

User can select one from the list. On selection:

if **KYC_docs_shared** event then give option to

- Get off-chain docs
- add **KYC_docs_verified** event – only if status == pending
- Mark as completed – only if status == pending

If **Personal_data_shared** event then give option to

- View verified personal data
- Request off-chain data access -> sends email to customer
- Mark as completed – only if status == pending

if **KYC_docs_verified** event (added by myBank) then give option to

- a) view verified data

Get KYC docs

Available to bank and CBC admins

Title “check for KYC TnT docs created by me or any other bank”

Call get **/banks** CBC API

Created by : drop down list of available banks + ‘all’

Call **get /kyc_tnt_docs?bankName=selection** //if all is selecte no parameter is added to the query

Display list with createdBy, date, customer Name (only if bankName==myName)

User can select one from the list and press ‘**show**’ button

When show is pressed call **get /kyc_tnt_doc/tntId**

KYC Wallet

A standalone reactJs web application created and used by customers.

On loading, it checks the browser's local storage for the existence of wallet keys. If not found it offers the option to "Create a new Wallet". If found, it displays the login page.

If create new Wallet is selected, it asks to enter/confirm a password and a new DID (did:key:xxx) and a pair of **ES256** public/private keys is created and stored encrypted in local browser's storage. A second DID and key pair is also generated for **ES256K**. Both key pairs are generated from the same random private HEX key. **The user's password is used to encrypt data stored in local storage.**

Login Page

It displays an entry field for the password.

There is no server login. **Only local login.** When a password is selected during wallet creation the word "success!" is encrypted with the password and stored in local storage with the key= "access". During normal login the password entered is used to decrypt the phrase stored with the key "access". The login is successful if the decrypted word is "success!". If successful it sets the isLoggedIn variable to true.

Following a successful login, it displays the following options on a vertical side menu bar:

- My Wallet
- My Name
- My Activity
- Prepare KYC docs
- Upload KYC docs
- Share KYC docs
- Share my Verified data
- Logout

On top left of the page, it also displays the customer's name from **myname** key in local storage. If the key does not exist in local storage it displays '*please add your name using My Name option*' in red.

On the page's body the **My Activity** screen is displayed. see option below.

My Wallet

Displays ES256 and ES256K DIDs and key pairs from local storage. No mnemonic phrase is used.

My Name

Title “Add or Change my name”

Displays the value in key=**myname** in local storage, if exists

If it doesn't exist it shows an empty entry field with a ‘**add name**’ button

If it exists it displays the existing name in an entry field with a ‘**change**’ button.

If added or changed the display on left top of the page is updated.

My Activity

Title “Activities performed with my KYC docs”

User is asked to select one of the following options:

- Docs uploaded to off-chain
- Docs shared to banks
- My verified data by banks

when ‘**proceed**’ button is selected:

Docs uploaded to off-chain option:

Gets and decrypts key=off-chain array from local storage

Displays a list with file-names. User can select one from the list.

When an entry is selected and ‘**show**’ button is pressed the offchain encrypted data is fetched using the off-chain-url and decrypted using the random key in local storage.

The decrypted doc is displayed

When an entry is selected and ‘**delete**’ button is pressed the off-chain doc is deleted from off-chain storage and from local storage array.

Docs shared to banks option:

Gets and decrypts key=off-chain array from local storage

For each Hash in the array

Get TnT doc

If doc exists and event-type == “**KYC_docs_shared**” event exists

Add to list file-name (in array), shareForName, off-chain-url (in event)

Display the created list (omit off-chain-url). User can select one

When an entry is selected and ‘**show**’ button is pressed the offchain encrypted data is fetched using the off-chain-url and decrypted using the random key in local storage.

The decrypted doc is displayed

My verified data by banks option:

Gets and decrypts key=off-chain array from local storage

For each Hash in the array

Get TnT doc

If doc exists and event-type == "KYC_docs_verified" event exists

Add to list file-name (in array), verifiedBy (in event), eventId

Display the created list (omit eventId). User can select one

When an entry is selected and 'show' button is pressed

Get eventId

Decrypt EncryptedEncryptionKey and get bank's random encryption key

Decrypt personal data with bank's random encryption key

show personalData

Prepare KYC docs

Title "Prepare KYC docs for upload"

When 'select files' is chosen user is asked to select one or more files (pdf or image) from local drive.

When 'prepare' is chosen, selected docs are combined to one file called

KYC_docs_ddmmyyyy_hhtss.pdf and saved in local drive

Upload KYC docs

Title "Encrypt and upload my KYC docs to off-chain storage"

When 'select Prepared File' is chosen, user is asked to select one of the already prepared KYC doc.

Only files which start with "KYC_docs_*" are shown for selection.

When 'upload' is chosen a random AES key is generated and the selected file is encrypted with this key.

The encrypted file is uploaded to off-chain storage by calling Post off_chain_url/upload with a self-signed vp_token. The off-chain-url is returned.

Hash of encrypted file is calculated.

Random-key, encrypted-file-name, hash, and off-chain-url is added in local storage array with key=off_chain

Share my KYC docs

Title "Share my KYC docs on off-chain storage to a bank"

Calls get /banks CBC API

The entries fields are displayed:

Bank to share to : drop down list of available bank names

KYC docs to share: drop down list of file names from local storage with key=off-chain

When **'Proceed'** is pressed

Get selected bank's API endpoints

Check if TnT doc with hash of selected file already exists

If not, Call **POST /init_KYC_share** with myName, hash of encrypted file, vp_token – **bank creates TnT doc and grants delegate access to my did:key**

If yes, check if bank has write access to tnt. If not, grant write access to the bank

encryptionKey = get random-key from local storage associated with selected file.

call **GET /jwks** on the selected bank's url to get bank's public key

encryptedEncryptionKey = random-key encrypted with selected bank's public key.

call **add_event_inTnT('KYC_docs_shared', tntId, encryptedEncryptionKey)**

Call **POST /add_event** on selected bank's url //this is only added to bank's events db not to TnT doc

Share my Verified data

Title **"Share my verified personal data to another bank"**

For each hash in local storage off-chain array

Get TnT with tntid==hash

If event_type == **'KYC_docs_verified'** exists add file-name, tntId, eventId, verifiedBy to list
where file-name is found in local storage with hash == tntId

if list is empty give pop-up window message *"you have no verified KYC docs"* otherwise proceed with the below.

Calls **get /banks** CBC API

The entries fields are displayed:

Bank to share to : drop down list of available bank names – exclude verifiedBy bank

Verified data to share: drop down list from above list with file-name, verifiedBy

When **"show verified data"** button is selected

Get eventId

Decrypt encryptedEncryptionKey in **KYC_docs_verified** and and get bank's random encryption key

Decrypt personal data with bank's random encryption key

show personalData

When **'Share personal data'** is pressed

Get eventId

Decrypt encryptedEncryptionKey in **KYC_docs_verified** and and get bank's random encryption key.

encryptedEncryptionKey = bank's random encryption key encrypted with selected bank's public key

Call **add_event_inTnT('Personal_data_shared', tntId, encryptedEncryptionKey, eventId of KYC_docs_verified)**

Get selected bank's API endpoints

Call **POST /add_event** //this is only added to bank's db not to TnT doc

Off-chain storage

A simple cloud server that provides upload and download file APIs.

Customers can use the upload API to upload their **encrypted** KYC docs. In addition to the file contents, a signed empty **vp_token** must be provided. The server will associate the stored file's path with the did:key of the sender, following validation of the key:did ownership.

Anybody can download a file but without the random AES key that was used to encrypt the file, the file can not be viewed.

A customer can also delete a file that was previously uploaded. In order to do this, a signed empty vp_token needs to be provided to the server by the wallet requesting deletion. The server will verify ownership of the did:key and that the file for deletion is associated with the requesting did:key and delete the file.

Future enhancements

A bank, having verified the KYC docs for a customer, will be able to allow a new customer to open an account with the bank.

The customer, using his EBSI KYC wallet, will present to the bank a self-signed vp_token and the TnT id associated with his **KYC_data_verified** event. After verifying that the did:key belongs to the requesting wallet, and the did:key has delegate access to the submitted TnT id, the bank will proceed to opening an account for the customer.