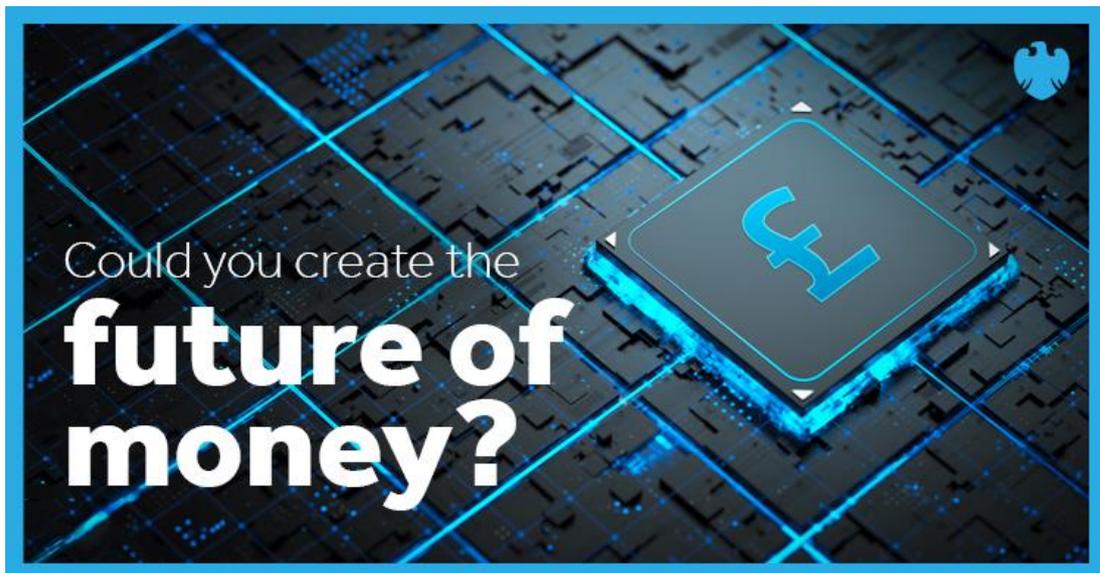




# Barclays CBDC Hackathon 2022 Challenges

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# Introduction

This document describes the challenges for Barclays CBDC Hackathon 2022. Participants in the hackathon will code solutions to the challenges described in this document. The document also refers to the prerequisites participants must complete before starting the challenges and provides an overview of the criteria that will be used to assess the participants' solutions.

## Background

A central bank digital currency (CBDC) is a new digital payment instrument, denominated in the national unit of account, that is a direct liability of the central bank. Central banks across the world are actively engaging in CBDC research including experiments, proofs-of-concept, and pilots. Barclays is collaborating with the industry on the developments in this field.

There is currently significant attention on CBDC design choices to ensure that the risks of CBDC adoption are mitigated and opportunities are identified. One such risk is fragmentation in payments markets and retail deposits unless both existing and new forms of money are interoperable and have similar operational characteristics.

## Overview of the Challenges

Participants in the Barclays CBDC Hackathon 2022 will compete by coding solutions to the challenges described in this document. Participants will connect to Barclays' simulation of a central bank, Payment Interface Providers (PIPs), commercial banks and other ecosystem services. This simulation follows the Bank of England's 'platform model' for retail UK CBDC provision.

Participants will also have the opportunity to explore how industry ecosystem services can be leveraged to solve these challenges across both existing and new forms of money, including retail UK CBDC and commercial bank deposits.

The challenges in this document start with a simple challenge and then increase in complexity as the participants progress through the hackathon. The final challenge is a 'stretch' challenge where we encourage participants to be creative and demonstrate a novel concept.

We advise participants to read all the challenges before starting so that they can consider building re-usable components that could help them across the challenges.

## Reminder of Prerequisites

Before starting the challenges, a reminder that you should have:

- Reviewed the Bank of England's [discussion paper](#) that describes their 'platform model' for CBDC provision and Barclays [paper](#) on an illustrative industry architecture
- Setup your access to Barclays hackathon platform (NayaOne)
- Reviewed the API specifications (in the form of a Swagger/ OASv3 file) from the Barclays hackathon platform
- Retrieved and safely stored your team's API Key from the Barclays hackathon platform
- Secured access to the platform that you will use to develop your solutions for the hackathon challenges
- Completed the pre-event exercises shared earlier

## Assessment of Solutions

A panel of industry judges will evaluate the participants' solutions in the afternoon on the second day of the event. This evaluation will be based on the following:

- Participants showcasing and presenting their solution to the judges (8 min per team).
- Participants delivering a public presentation to the event audience (3 min per team).

Judges will assess participants' solutions based on the following criteria:

- Correctness
- Completeness
- Novelty and innovation
- Final presentation

## Support

During the event, participants can contact:

- Barclays' hackathon support team for any queries regarding the challenges, architecture, API specifications, and access to WiFi and workspaces at Barclays Rise London.
- IBM support team for any queries regarding the Hyperledger Fabric platform.
- Industria support team for any queries regarding the Corda platform.
- Digital Asset support team for any queries regarding the DAML platform.

Note that EY will be an independent observer throughout the event.

# Challenge 1: Deposit physical cash into a CBDC account

The first challenge will enable users to deposit physical cash into their CBDC account. This will enable CBDC convertibility with an existing form of public money.

## Background and Context

In this challenge a user deposits physical cash into a CBDC account at a point-of-presence operated by a PIP where the user has opened their CBDC account. The PIP holds its own CBDC balance from which value equal to the physical cash deposited is transferred to the user's CBDC account to effect the deposit.

This challenge is intended to support participants' hackathon journey by starting off with a simple example that funds CBDC accounts for use in subsequent challenges.

Note that future possibilities to explore could include physical cash withdrawal and depositing physical cash at another PIP or an ecosystem member, who either has a CBDC balance or transfers the deposited funds via existing payment rails and central bank settlement accounts.

## Challenge Description

- *Deposit £100 in physical cash into a CBDC account owned by Party A at PIP 1*

## Prerequisites

- Party A onboarded with CBDC account at PIP 1.

## Hints and Guidance

- Ensure the creation of the relevant prerequisite resources: *environment, currency, PIP, party*, and finally an *account*.
- Participants can use the POST `/pips/{pip_id}/accounts/{account_id}/deposit` API to directly deposit into an account.
- The simulation APIs require that the amounts are specified in the unit of the currency. For example, in GBP currency amounts will be specified in pence (so a value of 100 would represent £1).
- Participants may wish to build a simple UI form to simulate a PIPs point-of-presence terminal, to accept deposit of funds in CBDC account.

## Challenge 2: Transfer value between two CBDC accounts

The second challenge will enable users to transfer CBDC from their account to another party's CBDC account. This will help users to settle their obligations using their CBDC balances to pay a beneficiary who also holds a CBDC account.

### Background and Context

In this challenge a user transfers value from their CBDC account to the CBDC account of another party, using the user interface provided by their PIP. The transfers should be instant and seamless (e.g. using payee validation).

Note that future possibilities to explore could include CBDC users initiating transfers from another PIP or transferring value to a commercial bank account. The latter is explored in the next challenge.

### Challenge Description

- *Transfer £20 from Party A's CBDC account at PIP 1 to Party B's CBDC account at PIP 2*

### Prerequisites

- Payer and payee parties have their CBDC accounts opened at their respective PIPs.
- Party A has sufficient funds in their CBDC account. (e.g via physical cash deposit).

### Hints and Guidance

- Ensure the creation of the relevant prerequisite resources for transfer: *environment, currency, PIP, party, and accounts*
- Barclays' simulation provides an ecosystem API (Domestic Payment Processor API) to transfer value across CBDC and commercial bank accounts.
- Participants may wish to build a simple PIP's interface/channel to transfer money. Note as Party A uses its own PIP's interface to transfer money, no consent is required from the account owner to transfer money from his/her CBDC account.
- As mentioned in the pre-event exercises, users will only know the CBDC account number alias assigned by their PIPs and will not know the CBDC account number at the core ledger maintained by the central bank. It is the PIP's responsibility to maintain mapping between the two account numbers.

## Challenge 3: Transfer value from a CBDC account to a commercial bank account

The third challenge will enable users to transfer CBDC from their account to another party's commercial bank account. This will help users settle their obligations using their CBDC balances to pay a beneficiary who holds a commercial bank account, thereby enabling interoperability across different forms of digital money.

### Background and Context

In this challenge a user transfers value from their CBDC account to the commercial bank account of another party, using the interface provided by their PIP.

Note that future possibilities to explore could include transfers from commercial bank accounts to CBDC accounts and integration with point-of-sale and online payment services.

Ecosystem services can effect such transfers via payment schemes (e.g. Faster Payments Service). This capability can support several use cases, some of which are explored in subsequent challenges.

### Challenge Description

- *Transfer £30 from Party A's CBDC account at PIP 1 to Party B's commercial bank account.*

### Prerequisites

- Payer (party A) CBDC account with sufficient funds.
- Beneficiary (party B) commercial bank account.

### Hints and Guidance

- This challenge is similar to the previous one except that Party A is transferring value from his/her CBDC account to a commercial bank account.
- Barclays' simulation provides an ecosystem API (Domestic Payment Processor API) to transfer value across CBDC and commercial bank accounts.
- Participants may wish to build a simple PIP's interface/channel to transfer money. Note as Party A uses its own PIP's interface to transfer money, no consent is required from the account owner to transfer money from his/her CBDC account.

## Challenge 4: Pay at merchant website using CBDC

The fourth challenge will enable users to pay for goods and services using CBDC. This will also help users to purchase products and services from merchants that do not accept physical cash payment.

### Background and Context

In this challenge a user pays for their online purchase using CBDC, which includes authorising the payment initiation request.

Ecosystem services that provide interoperability between CBDC and commercial bank accounts help ensure that merchants can receive funds in their existing commercial bank accounts.

Note that future possibilities to explore could include paying for in-person purchases, 'cash on delivery' and using other payment media such as cards to make the payment. Some of these possibilities are explored in subsequent challenges.

### Challenge Description

- *Party A visits a merchant website and pays £40 for products/services purchased on the site using their CBDC account held at PIP 1*
- *The consent of Party A must be secured before payment*
- *The funds are transferred to the merchant's commercial bank account*

### Prerequisites

- Consumer CBDC account with sufficient funds.
- Merchant commercial bank account.

### Hints and Guidance

- Assume the merchant and the acquirer<sup>1</sup> are the same entity.
- Participants can use the Open Banking: Payment Initiation Service Provider (PISP) APIs to secure consent and initiate the payment. The PISP API will require the following:
  - The "consent requesting banking entity"
    - This is the entity (commercial bank/PIPs/acquirer) which is requesting consent from the party to initiate the payment.
  - The "consent granting party"

- This is the party (Party A) which owns the account and will grant consent from which the payment is initiated.
- The Open Banking PISP consent API provided by the simulation always returns an approved consent from the account owner. Note in the real world, parties' consent will be obtained e.g. via mobile app
- The 'bankingEntityWhereConsentGrantingPartyIsRegisteredRef' is the entity (PIP 1) where the consent granting party is registered
- Participants may wish to build a simple UI form to simulate merchant's website that accepts payments in CBDC.

1- *An acquirer is a financial institution that acts as an intermediary between merchants and payment networks and banks.*

## Challenge 5: Crowdfunding via multiple debits and a single credit

The fifth challenge will enable several parties to make a combined crowdfunding payment to a project creator, across CBDC and commercial bank accounts. This capability (multiple debits and a single credit) requires the synchronisation of transactions across multiple ledgers and could be used in several other use cases such as splitting a bill amongst friends or colleagues.

### Background and Context

In this challenge we explore a crowdfunding platform where CBDC and commercial bank users can contribute towards a fundraising goal with collected funds being transferred to the project creator on successful completion of the crowdfunding. Pledged funds are held in an intermediary escrow account and can be refunded if the crowdfunding fails.

Note that future possibilities to explore could include implementing earmarking funds in CBDC or commercial bank accounts (instead of transferring to escrow). Earmarking is currently not supported by Open Banking APIs for commercial bank accounts and so we have not enabled this capability in the simulation for either CBDC or commercial bank accounts.

### Challenge Description

- *A project creator sets their project's funding goal and deadline on a crowdfunding platform.*
- *Multiple parties (Party A, Party B, ..., Party Z) pledge certain amounts of money from their CBDC or commercial bank accounts to the project on the crowdfunding platform. This triggers the transfer of value from their CBDC or commercial bank accounts to an escrow account maintained by the crowdfunding platform at a commercial bank*
- *The consent of the respective party must be secured before payment is initiated from their account.*
- *If the project succeeds in reaching its funding goal within the deadline, the collected funds are transferred from escrow account to the commercial bank account of the project creator.*

## Prerequisites

- Donors (Party A, Party B ..., Party Z) have a CBDC, or a commercial bank account, with sufficient funds.
- Project creator's commercial bank account.

## Hints and Guidance

- Create a party and a commercial bank account for the crowdfunding platform.
- Refer to the hints and guidance on the previous challenge for a description of the fields required to use the Open Banking PISP consent API.
- Participants may wish to explore the scenario where the project doesn't reach its funding goals on time.
- Participants may wish avoid the complexity of implementing a time based deadline and instead use a trigger to simulate the end of the crowdfunding period.
- Participants may wish to build a simple UI form to simulate the crowdfunding platform website that accepts payments from donors using their CBDC or commercial bank accounts.

## Challenge 6: Stretch Challenge

The final challenge is a 'stretch' challenge where we encourage participants to be creative and demonstrate a novel concept. We have provided three examples of stretch challenges for inspiration. Participants can either select one of these or demonstrate a novel idea of their own choice.

### Challenge 6a: CBDC on physical delivery

This challenge enables the cash-on-delivery capability for CBDC, with users paying for online purchases using CBDC, but merchants only receiving funds on physical delivery of goods and services. This mechanism to interlink movement of funds with the delivery of goods and services will reduce risks to both consumers and merchants.

#### Background and Context

In this challenge a CBDC user pays for their online purchase using CBDC, but with the merchant only receiving funds in its commercial bank account on physical delivery. Funds are escrowed with the merchant's acquirer and paid out when the delivery agent confirms delivery with the consumer.

Note that future implementation possibilities to explore could include earmarking funds in CBDC account instead of transferring funds to escrow. Participants could, for example, explore implementing earmarks on CBDC account balances at the PIP or in the ecosystem layer.

#### Challenge Description

- *Consumer buys a product on a merchant website and escrows £50 with the acquirer using their CBDC account (after securing consent)*
- *On the day of physical delivery, the merchant/acquirer sends a delivery code (e.g. OTP) to the consumer to confirm delivery of the product. At the time of delivery, the delivery agent obtains the delivery code (OTP) from the consumer and validates it with merchant/acquirer. If validated, the delivery agent hands over the product to the consumer. At this point the escrowed funds are moved from the acquirer's escrow account to the merchant's commercial bank account*
- *Participants may also wish to demonstrate the delivery of the product being refused by the consumer or the product being lost in transit, at which point the consumer is refunded money into their CBDC account*

## Challenge 6b: Sweep funds between CBDC and commercial bank savings/deposit accounts

In this stretch challenge users configure rules to sweep funds between their CBDC and commercial bank accounts. This enables programmability by supporting transfers across CBDC and commercial bank accounts based on rules and events. This helps users optimise returns on their cash holdings.

### Background and Context

A CBDC user who also has commercial bank savings/deposit accounts wishes to sweep CBDC balances above an upper limit to their commercial bank account and sweep them back in when the CBDC balance falls below a lower limit.

Note in this challenge the CBDC balance could temporarily go above the upper limit and therefore it is not an implementation of a hard cap limit on CBDC balance. This capability can be explored by participants as a stretch challenge of their own choice.

Note that future possibilities to explore could include sweeping funds to investment accounts and initiating payments from the users CBDC and commercial bank accounts based on balances, limits, and other conditions. The latter is explored in the next stretch challenge.

### Challenge Description

- *User can setup rules and preference for automated transfer of value between CBDC accounts and commercial bank accounts*
- *When the balance in the CBDC account exceeds the upper limit set by a user, the excess amount is automatically transferred from their CBDC account to the commercial bank saving/deposit account*
- *Similarly, when the balance in the CBDC account falls below the lower limit set by the user, the CBDC balance is automatically topped-up by transferring value from the user's commercial bank savings/deposit account*
- *Participants can explore other automated rule/event-based transfer scenarios such as sweeping funds into investment accounts*

## Challenge 6c: Rules for payments using funds from either CBDC accounts, commercial bank accounts or both

In this stretch challenge, users configure rules to define how payments initiated should use the funds available across their CBDC and commercial bank accounts. This enables programmability by supporting payment initiations across CBDC and commercial bank accounts based on rules and events. This helps users to efficiently use funds available across their different accounts.

### Background and Context

A CBDC user who also has commercial bank accounts can setup rules to define how payments initiated should use the funds available across both accounts. These rules could be based on available balance and payment amount.

Note that future implementation possibilities to explore could include rules based on returns offered across the accounts (when multiple accounts have sufficient balance) and user-defined rules.

### Challenge Description

- *A user may have multiple accounts (both CBDC and commercial bank accounts) held at different PIPs and commercial banks*
- *The user defines preferences to pay from their accounts based on preconfigured rules. For example:*
  - *If the payment amount is greater than the individual balances in all accounts except one, use that account to pay*
  - *If the payment amount is greater than the individual balances in all accounts, split the payment amount across the accounts with the largest balances*
  - *If the payment amount is less than the individual balances in more than one CBDC/commercial bank account:*
    - *If amount  $\leq$  £100, pay from CBDC account*
    - *Else pay from commercial bank account*
- *Participants can explore other payment rules e.g. always pay from CBDC accounts first*

## Challenge 6d: Other Ideas

We have listed some other ideas below. Participants may select any one of these or create their own stretch challenge to demonstrate creativity and innovation.

- Cross border CBDC payment
- Implement a hard cap limit for CBDC user balances across PIPs
- Pay merchant for in-person purchases using a PIP-issued payment card that is linked to a CBDC account
- Split bill payment amongst friends (multiple debits, single credit)
- Variable recurring payments from CBDC (e.g. utility bill payments)
- Aggregate balance information across CBDC and commercial bank accounts and select payment account based on available balances
- Or anything else