

CASE STUDY

CBDC Sandbox Testing

MAY 2022

CBDC SANDBOX TESTING CASE STUDY

Exactpro, April 2022



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The software testing approach described in this case study is ready to support CBDC solutions transformation from a Sandbox into large-scale production implementations.

Please contact the Exactpro team at info@exactpro.com for more information.

Introduction

Central bank digital currencies (CBDC) represent a digital form of a country's fiat currency issued by central banks or monetary authorities. As a digital version of bank notes, they provide a risk-free alternative to private bank deposits.

R3, a leading provider of enterprise technology and services (<https://www.r3.com/>), has developed a R3 Sandbox for Digital Currencies – the platform that combines distributed ledger technology (DLT), guided learning paths from industry experts, and a ready-made global payments network in a single environment to enable the issuance, management and distribution of CBDC's.

The **Digital Currency Sandbox** is an R3 managed SaaS offering powered by Corda.

The first release of the **R3 Sandbox for Digital Currencies** provides an environment for users to explore the possibilities of a distributed ledger technology solution for Central Bank Digital Currencies in a wholesale setting.

The Sandbox provides the power and security needed for transactions between central banks, wholesale banks, and other financial institutions.

Exactpro provides independent software testing services for mission critical technology that underpins global financial markets. The firm is experienced with trading and clearing & settlement platforms, risk management systems, central data warehouses, accounting and treasury systems, regulatory reporting.

Exactpro's area of expertise spans functional and non-functional testing, as well as testing at the confluence of functional and non-functional requirements. Exactpro's DLT-related projects include large-scale initiatives in Australia, Switzerland, UK and US.

In this case study, we focus on the approaches for functional testing of a CBDC solution. Please note that whilst the Sandbox does not allow for complete Non-Functional Testing (NFT), Exactpro are happy to discuss our recommendations for testing in this area.

If you are also interested in our Non-Functional Testing approach, you may visit our [website](#) or contact us.

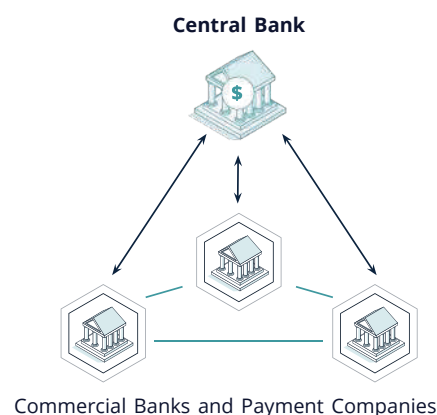
CBDC Sandbox Test Requirements

In the Sandbox, a user can deploy their own private network to act as a central bank or any of three wholesale banks. Each of these actors has a Corda node and a notary that they use to transact with other parties on their network.

As a Central Bank, you can define and issue assets to Wholesale Banks on your network. You control access to the assets you create using Member Access States. You can also approve or deny requests from Wholesale Banks to exchange bonds for assets.

As a Wholesale Bank, you can request to exchange bonds for CBDC if you have the correct Member Access State. Once you have the asset, you are able to transact it using push transactions, pull transactions, redemption requests, and DvP transactions.

R3 Sandbox for Digital Currencies Fully managed SaaS testing and development platform for CBDCs (stablecoin functionality coming soon)	Technical Environment	Demo CorDapps CBDC SDK
	R&D Program	Technical Deep Dives (Monthly Series) Domestic + International Test Runs
	Assessment Toolkit	Assessment Toolkit Overview Assessment Toolkit Applied
	Reference Architectures	Decision Tree Tool Reference Architecture Applied
	Subscriber Resources	Knowledge Series (22 Session Library) Monthly Newsletter and Active 'Newsroom'
	Research Center*	Opportunity to Contribute to Research Featured in events, case studies, etc.

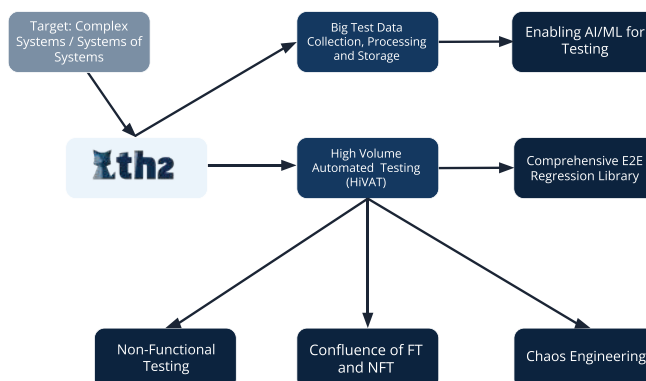


Exactpro Test Automation Approach

To connect to the R3 Sandbox in order to send requests and process the corresponding responses, Exactpro uses its bespoke test tool – th2.

th2 has evolved out of the Exactpro test tool suite that – over the past 11 years – has established itself as a go-to toolkit across half of the top 20 global systemically important financial market infrastructures. Each of the test tools has a unique focus.

th2 Purpose



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BUILD SOFTWARE TO TEST SOFTWARE

th2 – Next-Generation Framework for Automation in Testing

th2 represents the next generation of automated testing platforms. We believe its usage will eventually transform the way firms approach their functional and non-functional testing processes. The framework is successfully implemented on the majority of our projects, and we continue developing further use cases with our clients and partners.



- Delivers end-to-end automated functional and non-functional testing of complex financial systems
- Enables intelligent interaction with many widely adopted network protocols as well as API, UI, DLT and cloud endpoints
- Executes sophisticated test algorithms
- Is an open-source solution; th2 source code is available on GitHub
- Collects and processes distributed test data (for machine learning and other purposes)
- Performs model-based testing and analyses the behavior of systems under test
- Integrates with a variety of widely adopted test tools and frameworks via its open interface



PLATFORMS



Case study – Functional Testing for the R3 CBDC Sandbox

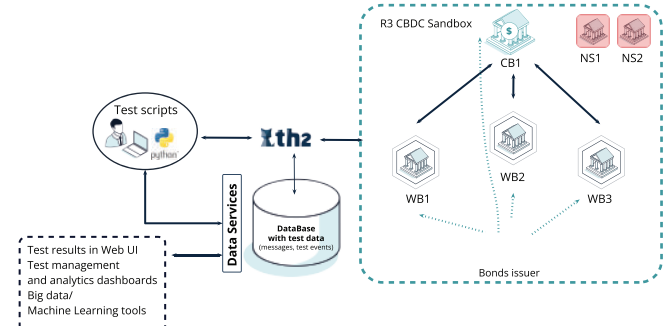
th2 enables the testing of the entire message flow between the central bank and wholesale banks, including positive (production-like) data testing.

th2 also made it possible to automate and execute test scenarios covering a complete business end-to-end cycle via initiating necessary flows, such as:

- define a new digital currency token;
- issue an amount of token to themselves or another party;
- move an amount of token to another party;
- redeem an amount of token.

The above is implemented via sending/receiving REST API requests.

Case Study – Functional Testing for the R3 CBDC Sandbox (continued)

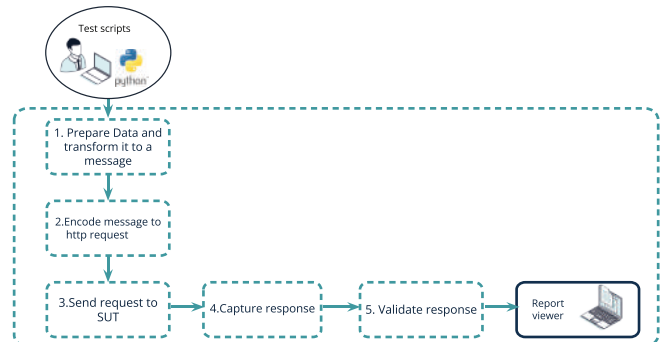


Each request that a user initiates via a test script goes through the following steps inside the th2 test framework:

th2 takes data (action and necessary parameters) from the corresponding step from a test script and sends it to the internal th2 component where a message will be constructed.

This message then goes to a component which encodes it to a http request in the REST API format.

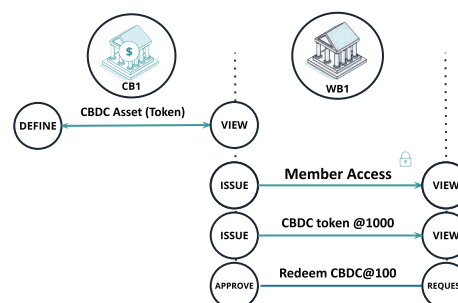
This request will be sent through the defined connection to the test system. th2 captures the response from a test system in order to verify that in a separate component (check1) where the actual received response will be compared to the expected result pre-defined in a test script.



Case Study – CBDC Sandbox Business Flows

Exactpro successfully automated and tested the following business flows:

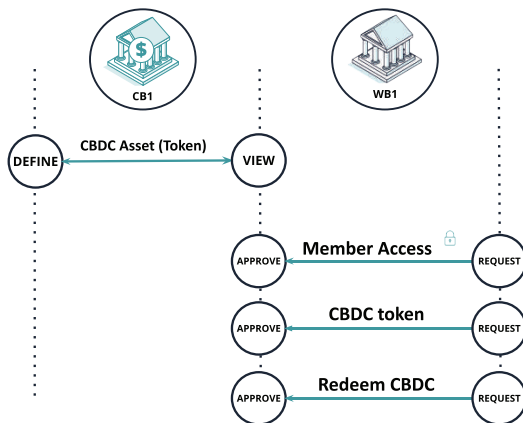
1. Issue and Redeem CBDC Asset (Token)



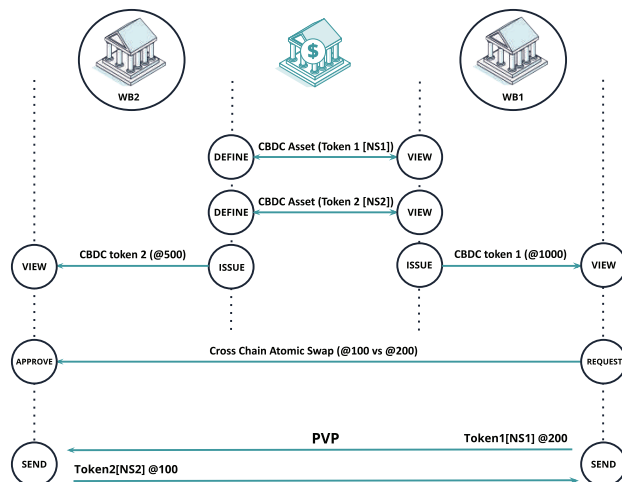
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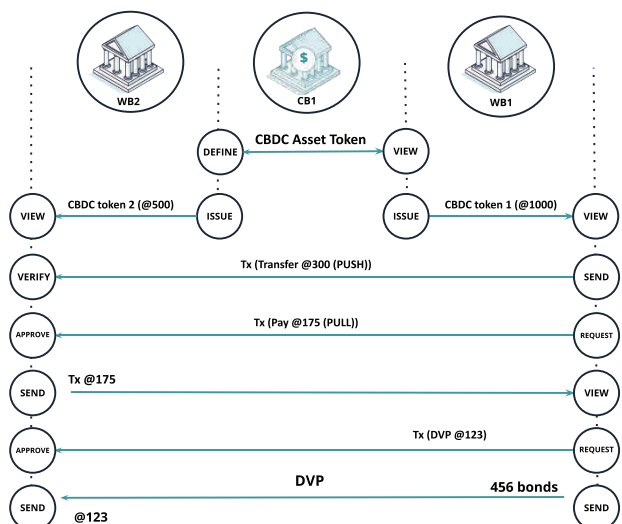
2. Request Member Access and CBDC Token



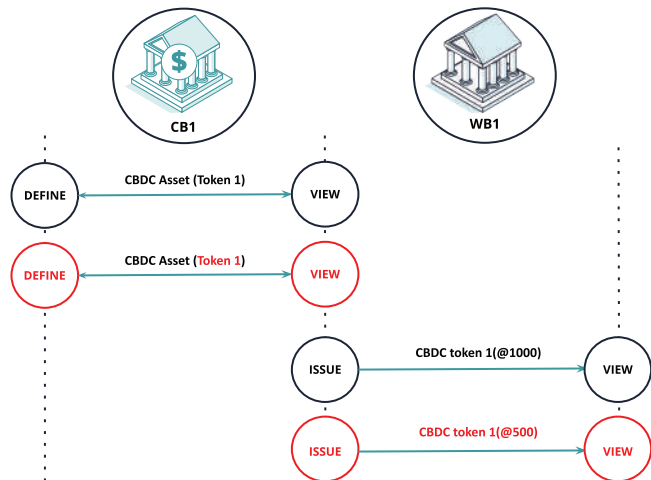
3. Cross Chain Atomic Swap (PVP – Payment Versus Payment)



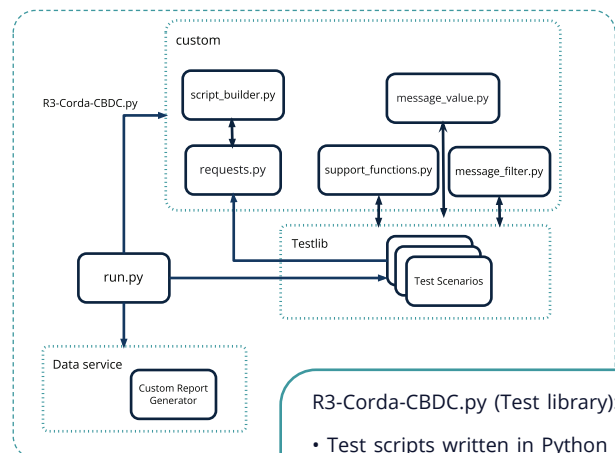
4. Transfer CBDC Token between Two Banks (DVP – Delivery Versus Payment)



5. Double Issuance of CBDC Token (Negative Scenario)



Automated Test Library Components and Structure:



R3-Corda-CBDC.py (Test library):

- Test scripts written in Python
- QA works with a local repo on their Workstation
- Run tests via IntelliJ IDEA
- Generate Custom reports

Test Case Structure:

- import th2 Python libraries
- import support functions
- import script_builder
- define scenario
 - make_event
 - Call step1
 - Call step2
 - Call stepN
- define step1..N
 - make_event
 - send request
 - verify response
- Call scenario



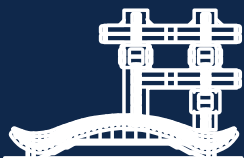
**Request
th2 Demo**

EXACTPRO DELIVERY CENTRES IN GEORGIA AND SRI LANKA



Exactpro has been operating in Georgia since 2018. It expanded fast and now occupies the space of three co-located offices. The branch employs software quality engineers and developers, both in senior and junior positions. In 2022, the Tbilisi office has become the company's largest software delivery centre.

As a leader in software testing and related software development, Exactpro has successfully focused on promoting professional excellence in Georgia, building and nurturing a local QA community, creating GeoSTQB – a Georgian representation of the International Software Testing Qualifications Board (ISTQB), establishing links with universities and actively showing support for IT students from across the country.



[Learn more about Exactpro's Office in Tbilisi, Georgia](#)



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Exactpro expanded to Sri Lanka through the launch of a delivery centre in Colombo in the fall of 2021. This enabled the Exactpro Group to continue strengthening support for global clients, including major exchanges, banks, clearing houses and technology vendors. In just 12 months, the delivery location has grown 100 specialists strong.

In his role as CEO of the Sri Lankan subsidiary, Jagath De Silva — who previously held a number of senior executive and technological engineering roles — has brought over two decades of fintech and delivery experience to Exactpro. His primary objectives have included creating and nurturing a well-balanced office culture, as well as establishing university partnerships and “industry giveback” programs to provide the technology talent in Sri Lanka with access to industry's best practices.



[Read more about Exactpro's expansion into Sri Lanka](#)



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