Beyond Tokenisation

Progress in developing digital Financial Products

Peter Kohl-Landgraf, DZ BANK

Fintech Connect Conference, 04.12.2024

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DZ BANK is the Central Institution for the German Cooperative Financial Network

DZ BANK is the second-largest commercial bank in Germany and the central institution in the Volksbanken Raiffeisen-banken cooperative financial network

	Public banking sector	Cooperative banking sector	Private banking sector and foreign banks
Domestic market share[1]	34 %	24 %	< 10 % (each)
Structure	• 5 Landesbank groups • DekaBank • approx. 370 Savings banks	• Cooperative central institution • Specialized cooperative companies • **697 cooperative banks**	Varied

[1] Market share according to deposits of private households

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Agenda

1. Recap DLT: Opportunities for Financial Industry

2. Update: “Smart Derivative Contract”
   - Revisiting Product Design and Business Case
   - 2024: ECB Exploration Phase - Integration of a CBDC
   - Proceedings on digital Standardization

3. “Between Asset and Cash” - Tackling Interoperability
   - Atomic Transfer and HTLC revisited
   - ERC-7573 - Decentralized Delivery-versus Payment

4. “Beyond Transfer” - Digitalize the complete Security Live Cycle
   - Approach to Standardization: Project Guardian (MAS)
   - Our notion of a ‘Smart Bond Contract’

1. DLT

Opportunities for Financial Industry

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Added Value of ‘DLT’ and ‘Smart Contracts’ in Financial Markets

- **DLT** enables Digital Disintermediation
  - Distributed Representation of Digital Claims (Tokenisation)
  - Distributed Code Execution (Smart Contracts) - A SC can serve as a **Digital Escrow**

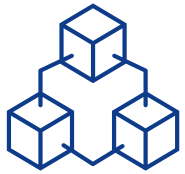
- **DLT** can be seen a technological Framework which allows
  - to **design** new frictionless digital Financial Products and Processes
  - to **foster** cross-company Collaborations to work on digital Standards

Our Approach: “In the end it is not the infrastructure we choose

but rather new digital product design we have integrated and ideally standardized”

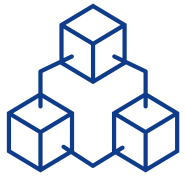
DLT-based Use Case Categorisation in Traditional Finance

Tokenised Securities



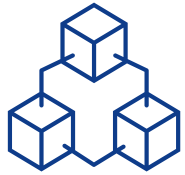
The claims of a tokenised security can be digitally managed on a DLT

Digital Currencies



2024: The ECB Exploration Phase has enabled testing of DLT applications with digital forms of central bank money

Digital Financial Products



Design of new Products as Computer Protocols which enable new business opportunities

2 | Smart Derivative Contract (SDC)

Update ‘24

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‘Rethinking Financial Derivatives’: The SDC redesigns the Live Cycle as a Smart Contract

Digital Trade Data
Format defines all trade and process terms, can be stored immutably on DLT

No Contract Risk ✓

Valuation Model
is part of the legal contract and determines calculation of the settlement amount

No Disputes ✓

Settled-2-Market
procedure is based on a prefunding mechanism and removes existing collateral processes

No Collateral Process ✓

Prefunding
is required and gets verified at the beginning of each settlement cycle. This guarantees settlement

No Counterparty Risk ✓

Termination Feature
is based on pre-agreed fees reduces uncertainties and shortens the close-out period

No Close-Out Risk ✓

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Smart Derivative Contract - Mechanics Illustration

SDC
Post-Trade Process
starts

Check

Trade an SDC

Valuation

Settlement (**max M**)

Check

ok

fail

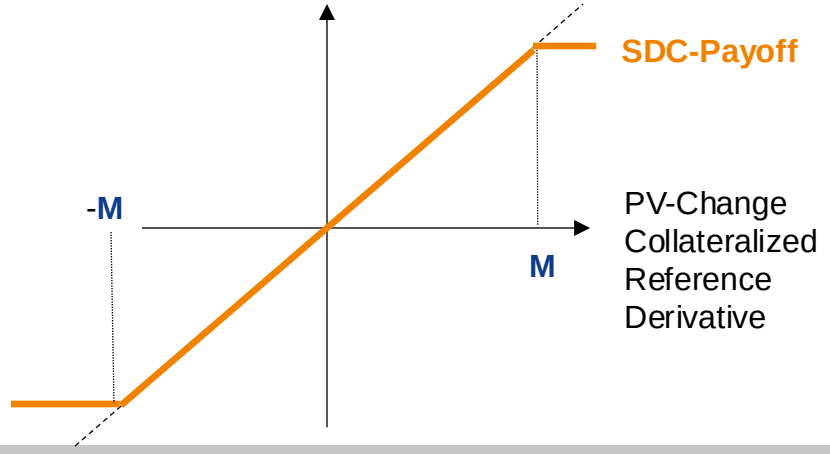
Trade Initialization

Prefunding of
M (Margin Buffer) and
P (Termination Fee)

Trade Termination

different implementation variants possible

SDC is a new Structured Financial Product



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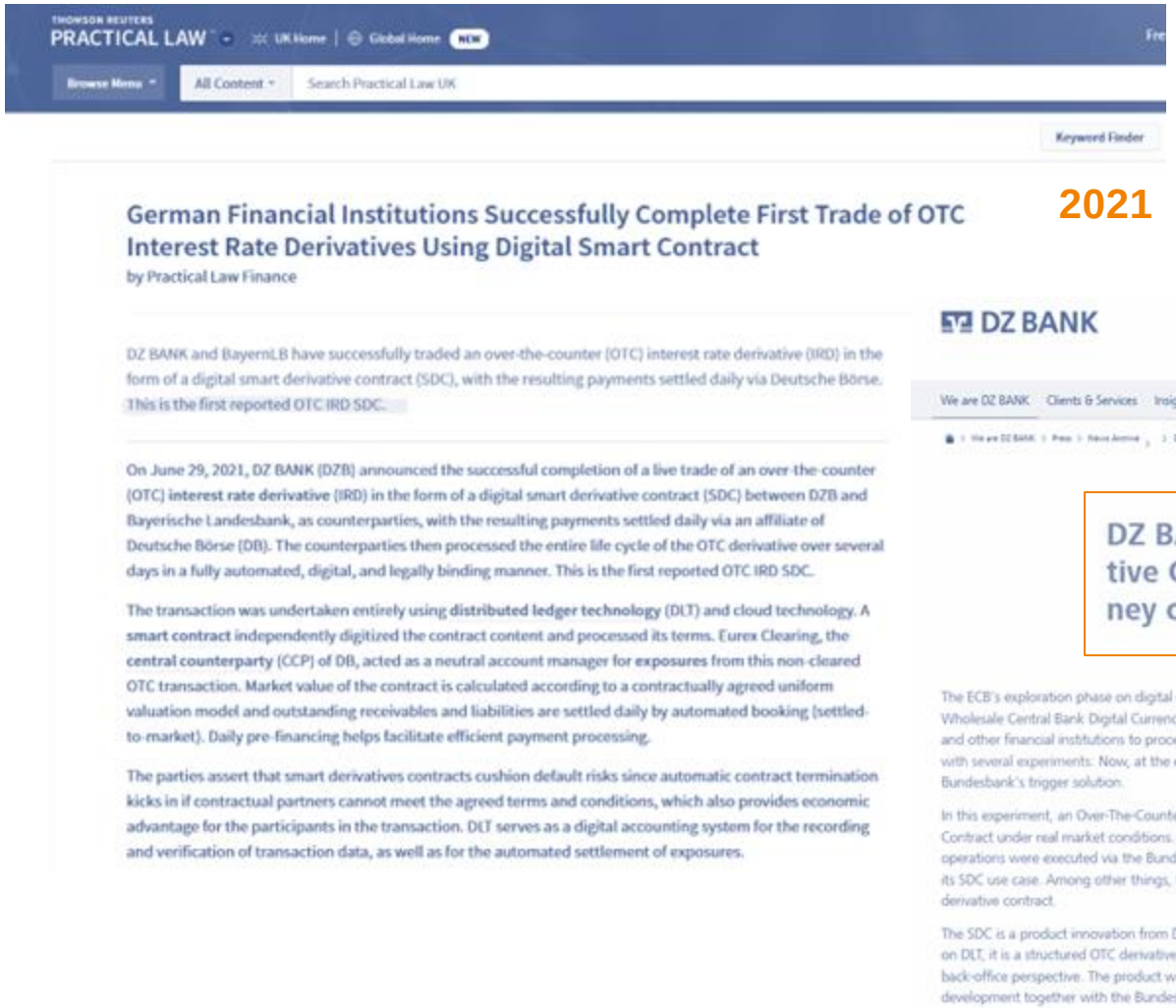
SDC Realizations 2021 – 2024



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Keyword Finder

2021

German Financial Institutions Successfully Complete First Trade of OTC Interest Rate Derivatives Using Digital Smart Contract

by Practical Law Finance

DZ BANK and BayernLB have successfully traded an over-the-counter (OTC) interest rate derivative (IRD) in the form of a digital smart derivative contract (SDC), with the resulting payments settled daily via Deutsche Börse. This is the first reported OTC IRD SDC.

On June 29, 2021, DZ BANK (DZB) announced the successful completion of a live trade of an over-the-counter (OTC) interest rate derivative (IRD) in the form of a digital smart derivative contract (SDC) between DZB and Bayerische Landesbank, as counterparties, with the resulting payments settled daily via an affiliate of Deutsche Börse (DB). The counterparties then processed the entire life cycle of the OTC derivative over several days in a fully automated, digital, and legally binding manner. This is the first reported OTC IRD SDC.

The transaction was undertaken entirely using distributed ledger technology (DLT) and cloud technology. A smart contract independently digitized the contract content and processed its terms. Eurex Clearing, the central counterparty (CCP) of DB, acted as a neutral account manager for exposures from this non-cleared OTC transaction. Market value of the contract is calculated according to a contractually agreed uniform valuation model and outstanding receivables and liabilities are settled daily by automated booking (settled-to-market). Daily pre-financing helps facilitate efficient payment processing.

The parties assert that smart derivatives contracts cushion default risks since automatic contract termination kicks in if contractual partners cannot meet the agreed terms and conditions, which also provides economic advantage for the participants in the transaction. DLT serves as a digital accounting system for the recording and verification of transaction data, as well as for the automated settlement of exposures.

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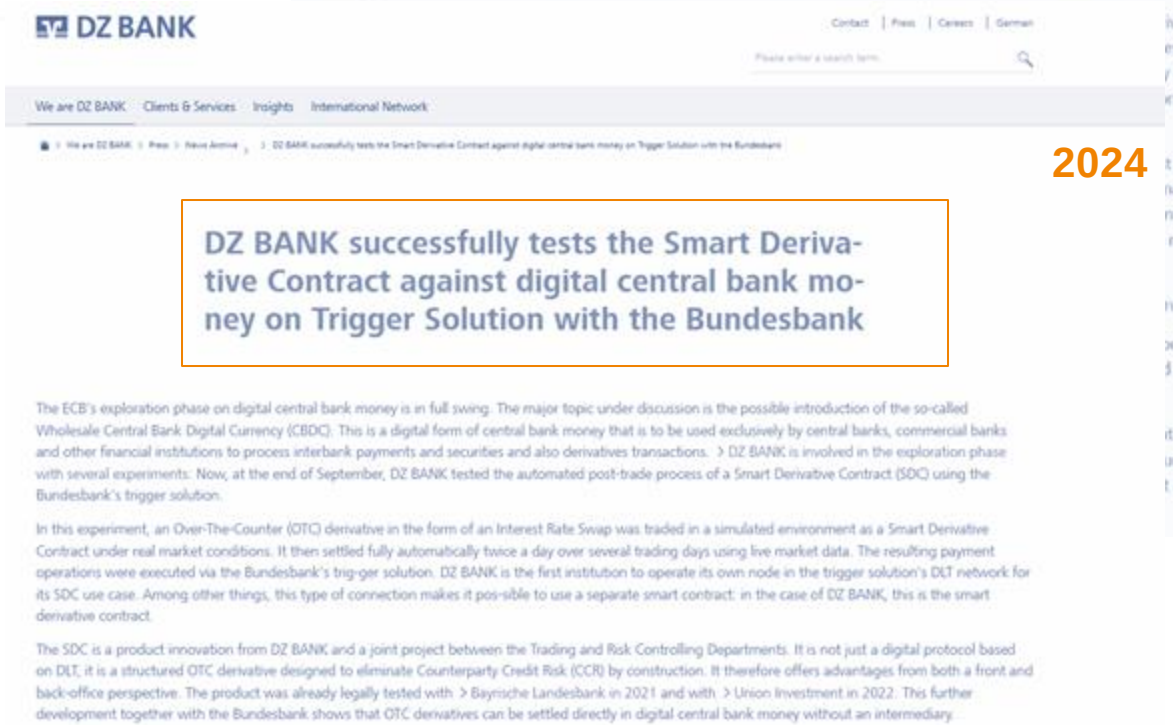
2022

New digital standard: DZ BANK and Union Investment trade OTC derivative as smart contract



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2024

DZ BANK successfully tests the Smart Derivative Contract against digital central bank money on Trigger Solution with the Bundesbank

The ECB's exploration phase on digital central bank money is in full swing. The major topic under discussion is the possible introduction of the so-called Wholesale Central Bank Digital Currency (CBDC). This is a digital form of central bank money that is to be used exclusively by central banks, commercial banks and other financial institutions to process interbank payments and securities and also derivatives transactions. > DZ BANK is involved in the exploration phase with several experiments. Now, at the end of September, DZ BANK tested the automated post-trade process of a Smart Derivative Contract (SDC) using the Bundesbank's trigger solution.

In this experiment, an Over-The-Counter (OTC) derivative in the form of an Interest Rate Swap was traded in a simulated environment as a Smart Derivative Contract under real market conditions. It then settled fully automatically twice a day over several trading days using live market data. The resulting payment operations were executed via the Bundesbank's trig-ger solution. DZ BANK is the first institution to operate its own node in the trigger solution's DLT network for its SDC use case. Among other things, this type of connection makes it pos-sible to use a separate smart contract: in the case of DZ BANK, this is the smart derivative contract.

The SDC is a product innovation from DZ BANK and a joint project between the Trading and Risk Controlling Departments. It is not just a digital protocol based on DLT, it is a structured OTC derivative designed to eliminate Counterparty Credit Risk (CCR) by construction. It therefore offers advantages from both a front and back-office perspective. The product was already legally tested with > Bayrische Landesbank in 2021 and with > Union Investment in 2022. This further development together with the Bundesbank shows that OTC derivatives can be settled directly in digital central bank money without an intermediary.

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2.1 | SDC as official Use Case of the ECB Exploratory Phase

“We want to proof that the SDC-Concept can work frictionless against Digital Central Bank Money”

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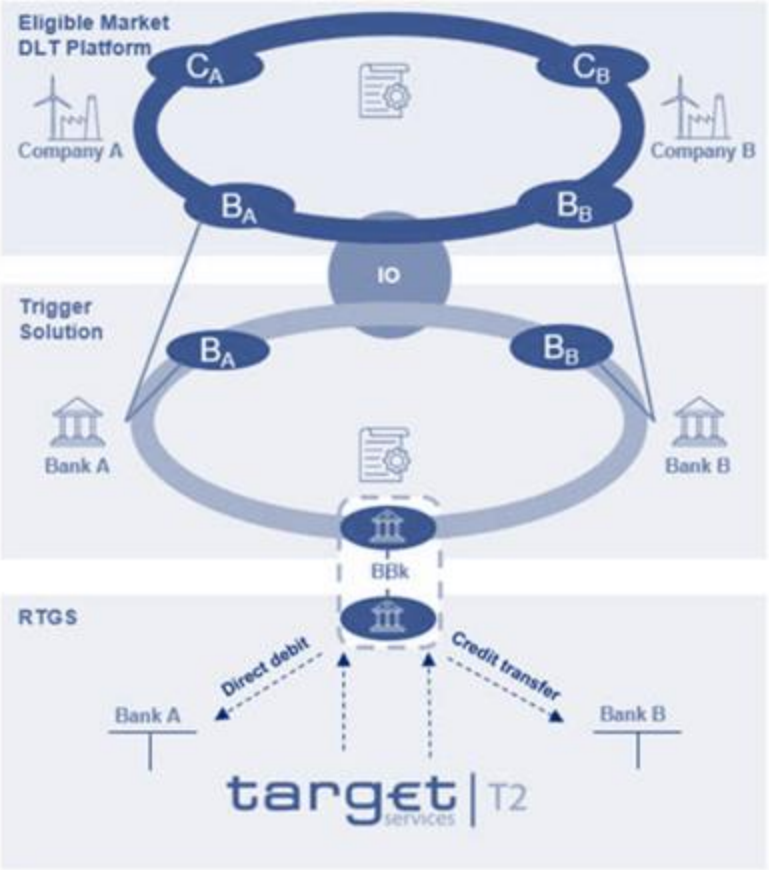
ECB Exploratory Phase & Bundesbank Triggersolution

- ECB's 2024 Exploration Phase allows exploration of CBDC settlement processes, focusing on creating **Interoperability Mechanisms** with “Market DLT-Platforms”.
- Deutsche Bundesbank's **"Triggersolution"** relies on **Hyperledger Fabric** DLT to facilitate Delivery-versus-Payment transactions in central bank money within T2 RTGS.
- Participants can access Triggersolution via **API** for standard connectivity or **operate their own Node** for enhanced customization and security.
- **Operating an own Node** offers a much higher degree in designing decentralized and automated transaction flows – in its core, implementing a Smart-Contract based **Event-Driven Architecture** (EDA).

Interoperability Mechanism



https://www.bundesbank.de/resource/blob/934768/f2de5d3bf13c45b55c01971eb19054b4/mL/process-description-aenderungen-data.pdf

SDC-Settlement on Bundesbank Trigger-Chain

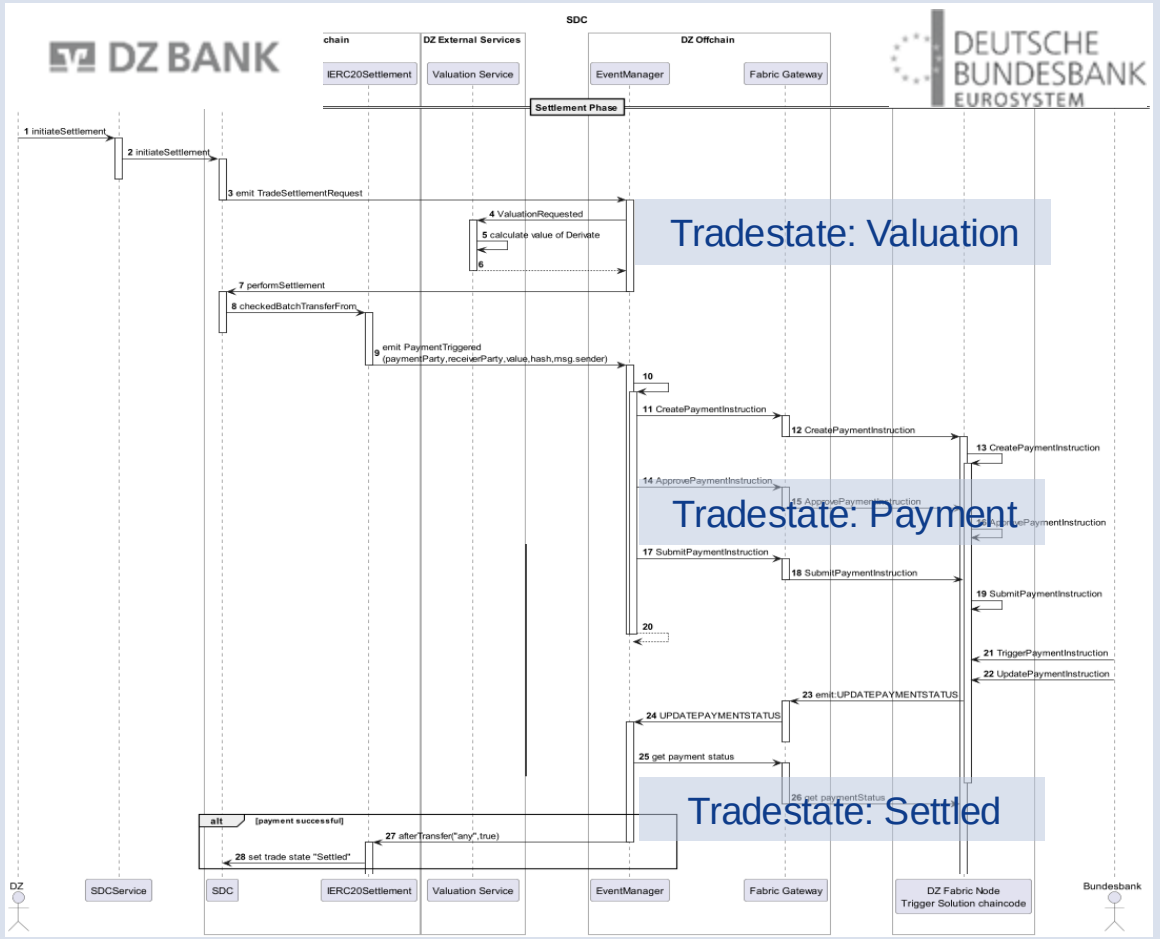
SDC as Official Use Case: Envisaged Learnings

"No Intermediary needed"
A Central Bank Digital Currency (CBDC) leverages the full Potential of the SDC Concept in settling a Derivative disintermediated and completely automated."

Infrastructure: DZ Bank hosting two Peer Nodes

Private Hyperledger Fabric Channel

Smart Contract based automated Settlement Flow



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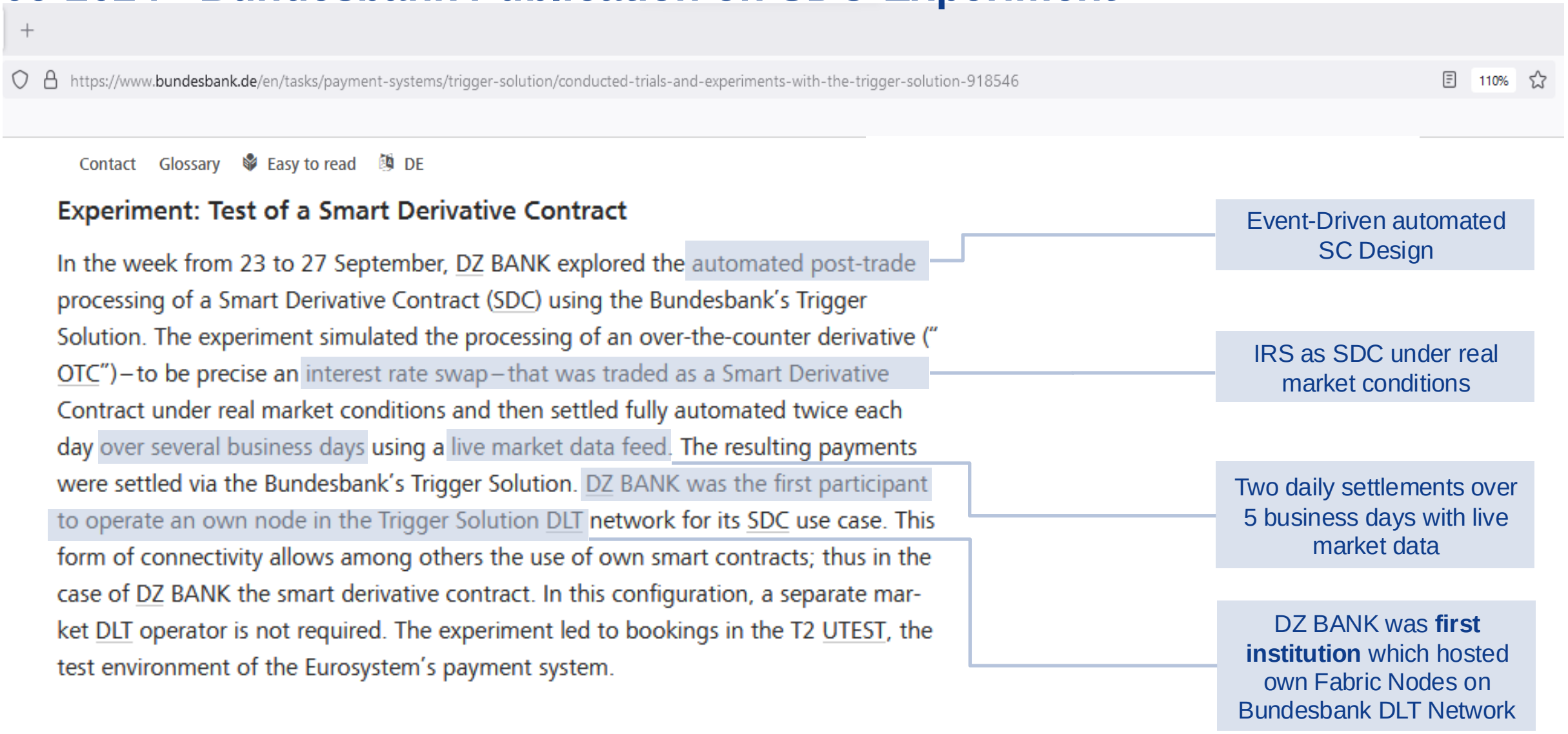
09-2024 - Bundesbank Publication on SDC-Experiment



https://www.bundesbank.de/en/tasks/payment-systems/trigger-solution/conducted-trials-and-experiments-with-the-trigger-solution-918546

110%

Contact Glossary Easy to read DE

Experiment: Test of a Smart Derivative Contract

In the week from 23 to 27 September, DZ BANK explored the automated post-trade processing of a Smart Derivative Contract (SDC) using the Bundesbank's Trigger Solution. The experiment simulated the processing of an over-the-counter derivative ("OTC") – to be precise an interest rate swap – that was traded as a Smart Derivative Contract under real market conditions and then settled fully automated twice each day over several business days using a live market data feed. The resulting payments were settled via the Bundesbank's Trigger Solution. DZ BANK was the first participant to operate an own node in the Trigger Solution DLT network for its SDC use case. This form of connectivity allows among others the use of own smart contracts; thus in the case of DZ BANK the smart derivative contract. In this configuration, a separate market DLT operator is not required. The experiment led to bookings in the T2 UTEST, the test environment of the Eurosystem's payment system.

Event-Driven automated SC Design

IRS as SDC under real market conditions

Two daily settlements over 5 business days with live market data

DZ BANK was **first institution** which hosted own Fabric Nodes on Bundesbank DLT Network

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2.2 | Proceedings on Standardization

ERC-6123

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ERC-6123: Deterministic Functional Catalogue | Finite State Machine

Inception

function inceptTrade (*address* withParty, *string* tradeData, *int256* position, *int256* paymentAmount, *string* memory initialSettlementData)

function confirmTrade (*address* withParty, *string* tradeData, *int256* position, *int256* paymentAmount, *string* memory initialSettlementData)

Settlement

function initiateSettlement ()

function performSettlement (*int256* settlementAmount, *string* settlementData)

function afterTransfer (*uint256* transactionHash, *bool* success)

Termination

function **requestTradeTermination** (*string* tradeId, *int256* terminationPayment)

function **confirmTradeTermination** (*string* tradeId, *int256* terminationPayment)

Open-Source-Code Ressources

SDC-Ethereum-Standard (ERC 6123):	https://ercs.ethereum.org/ERCS/erc-6123
GitHub-Repo (Valuation Oracle Service, Demo):	https://github.com/finmath/finmath-smart-derivative-contract
Project Page (Literature, XML-Definition):	https://www.finmath.net/finmath-smart-derivative-contract/

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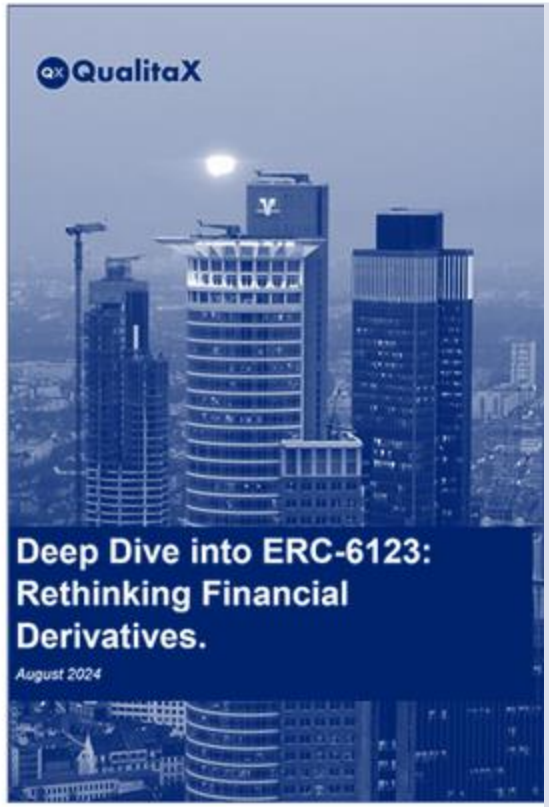
2024: ERC gains Attention - New Research Paper and new Projects



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ERC-6123: Rethinking Financial Derivatives is a deep dive into the ERC-6123, an open-source standard for creating and managing derivative contracts on Ethereum and EVM-compatible networks. By leveraging ERC-6123, market participants can benefit from a more streamlined, secure, and efficient approach to derivatives management, addressing many of the challenges present in traditional OTC markets.

stETH-based Swaps using ERC-6123

Projects

A **anaiso** 3d

We are submitting the below proposal asking for LEGO to support.

Proposal Summary

We propose a research project providing a comprehensive paper analyzing the risks and opportunities of stETH-based Ethereum Staking Rate Swaps for the Lido ecosystem. The Lido Staked Ether (stETH) APR represents the annualized rewards rate on ETH staked through Lido, offering a measure of staking performance that can be used as a daily floating rate benchmark. This research aims to provide valuable and actionable insights into the potential impact of ERC-6123 based stETH swaps on its ecosystem, including effects to validator strategies. Laying groundwork for a potential future ERC-6123 based infrastructure within the Lido ecosystem, and understanding the advantages and/or disadvantages of ERC-6123 in managing smart derivatives in the Ethereum staking market. For more information about ERC-6123, please see our paper "ERC-6123: Rethinking Financial Derivatives" (August 2024).

How will it aid the Lido ecosystem?

The project will aim to validate or invalidate the working hypothesis that stETH-based Ethereum Staking Rate Swaps can provide significant value to the Lido ecosystem, benefiting stakeholders staking with Lido.

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3| „Between Assets and Cash“

Tackling Interoperability

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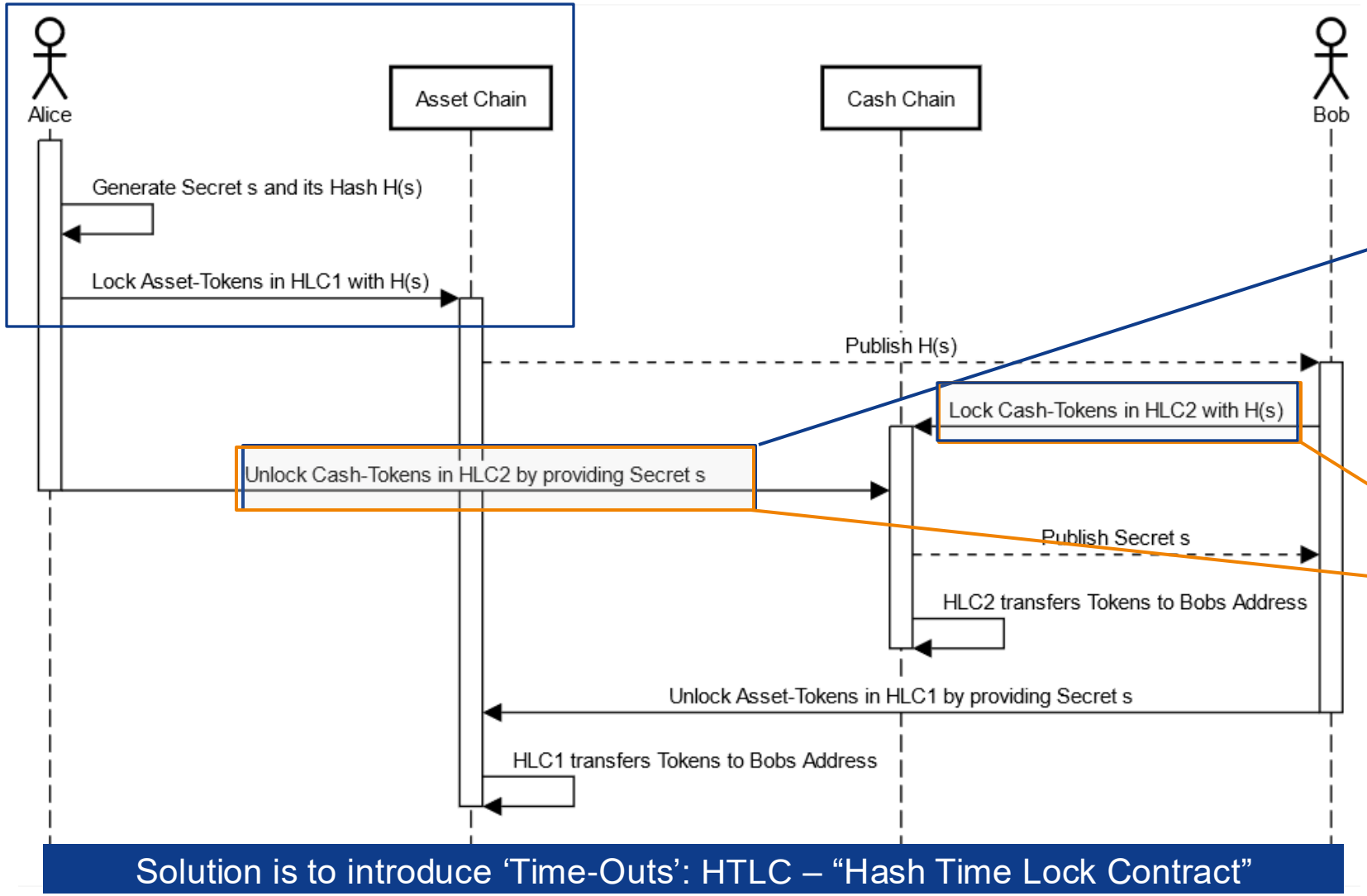
Basic Hash-Linked Swap between an Asset and a Cash Chain



'Link': To claim cash tokens Seller needs to release the Secret which the Buyer can use to claim the asset tokens

Problem: If Bob does not act, Asset Tokens remain locked. If Alice does not act, Cash Tokens remain locked

Solution is to introduce 'Time-Outs': HTLC – "Hash Time Lock Contract"

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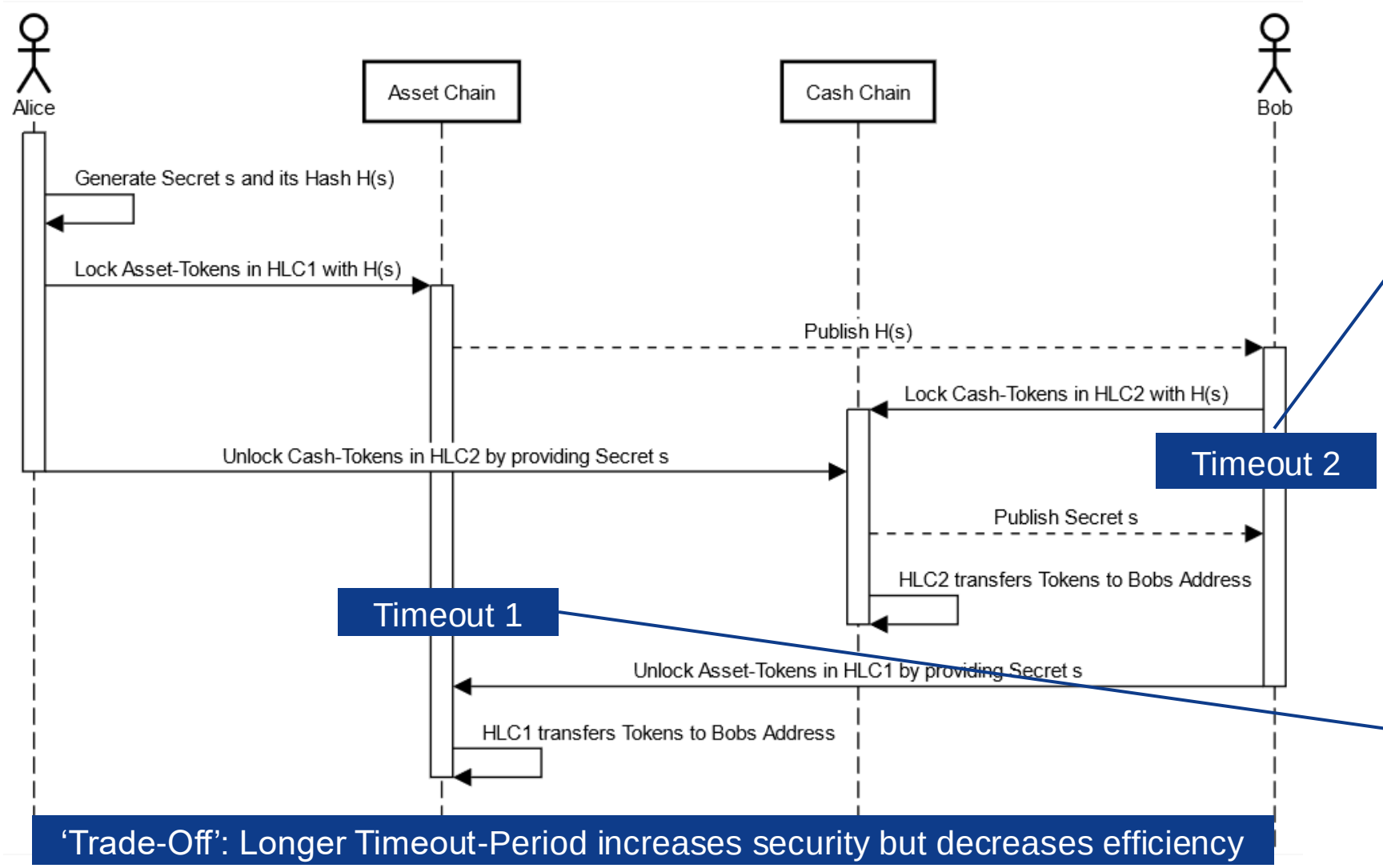
‘Hash Time Lock Contract’ (HTLC) - Problematic



Free Option: Alice is allowed to collect Bobs cash tokens within a certain time. She is free to choose if or when.

Scheme can be compromised: Bob needs to collect the asset tokens within a certain time, otherwise it goes back to seller. Consider a DoS Attack against Bob

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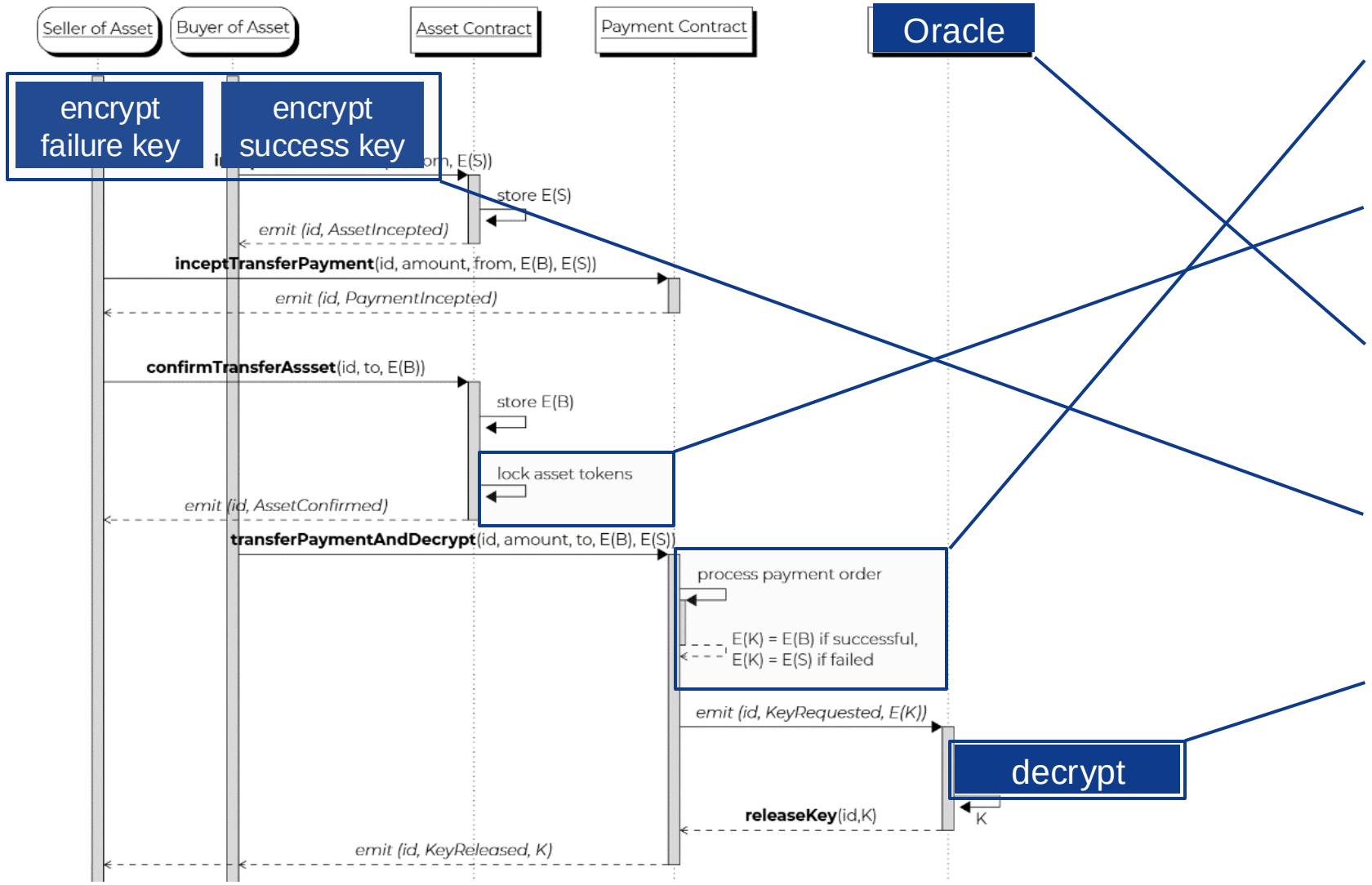
ERC-7573: “Conditional Encryption for Decentralized Delivery-versus-Payment”



Most digital Payment Infrastructures can provide instant Evidence of a Payment failure or success

Based on this **only** Asset Tokens need to get locked

An Oracle Service offers Encryption and Conditional Decryption

Parties can generate encrypted keys for Payment Success or Failure

Depending on Payment Success of Failure the respective key gets decrypted and published

Banca d’Italia 2022: “Integrating DLTs with market infrastructures: analysis and proof-of-concept for secure DvP between TIPS and DLT platforms”

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4| Beyond „Transfer“

Digitalizing the complete Security Live Cycle

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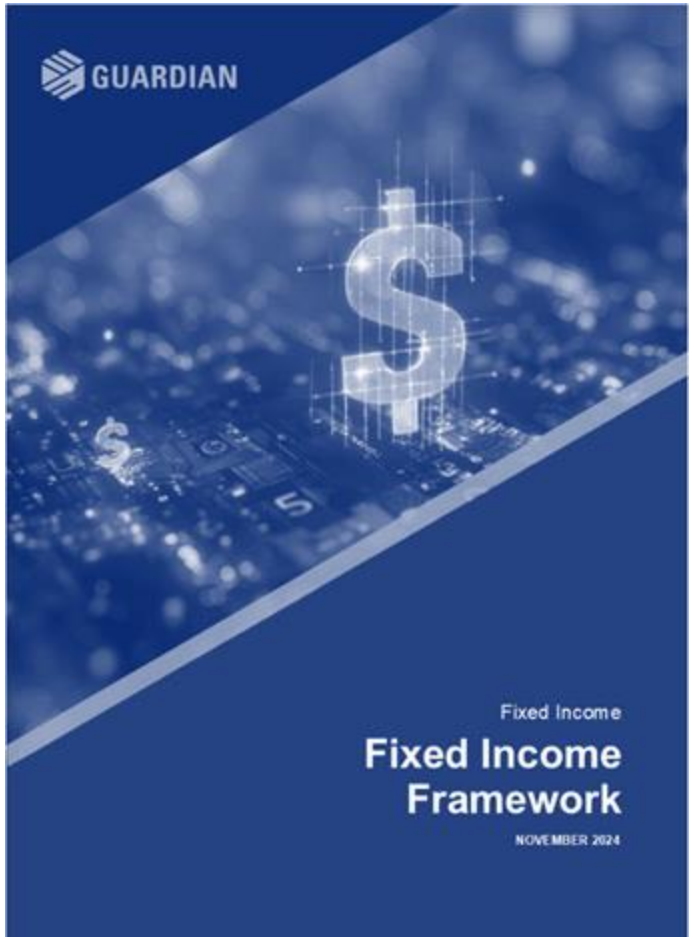
Project Guardian – Fixed Income Framework (11-2024)

- **Project Guardian is a collaborative Initiative** organized by the Monetary Authority of Singapore (MAS)

- Aim:
  - Enhance liquidity and efficiency for Financial Markets Through Tokenisation
  - Foster Accessibility for a broader Range of Market Participants

- 11-2024: **Fixed Income Framework** (GFIF) was published as an **initial set of standards and best practices** for tokenised fixed income assets

- **Design Principles**
  - based on ICMA Data Standard (“Bond Data Taxonomy”)
  - “Transparent Code that is easy to understand”
  - “Template-based Approach”
  - “Smart Contract governs Entitlements and Roles”
  - “Terms and Conditions to be stored in full in the Smart Contract”



https://www.mas.gov.sg/-/media/mas-media-library/development/fintech/guardian/guardian-fixed-income-framework.pdf

Our Notion of a ‘Smart Bond Contract’ based on ICMA BDT

- A “Smart Bond Contract” (SBC) is a **Business-driven** digital Protocol
- SBC captures the entire live-cycle of a bond: **Primary and Secondary Market** (From Issuance to Redemption)
- SBC aims to be a platform-agnostic Protocol - with a first decentralized implementation (EVM)

- SBC consists of **modular Plugins**:
  1. Process Governance
  2. Roles & Entitlement
  3. Storage and Processing of digitized Issuance Terms
  4. Orderbook-Management and Allocation
  5. Tokenisation & Decentralized Settlement (based on ERC-7573)
  6. Functional Trading Pattern (based on ERC-6123)

- SBC builds upon **ICMA’s “Bond Data Taxonomy”** (BDT):
  - Plugins build a functional layer around this data standard
  - Complete digital documentation based on ICMA BDT

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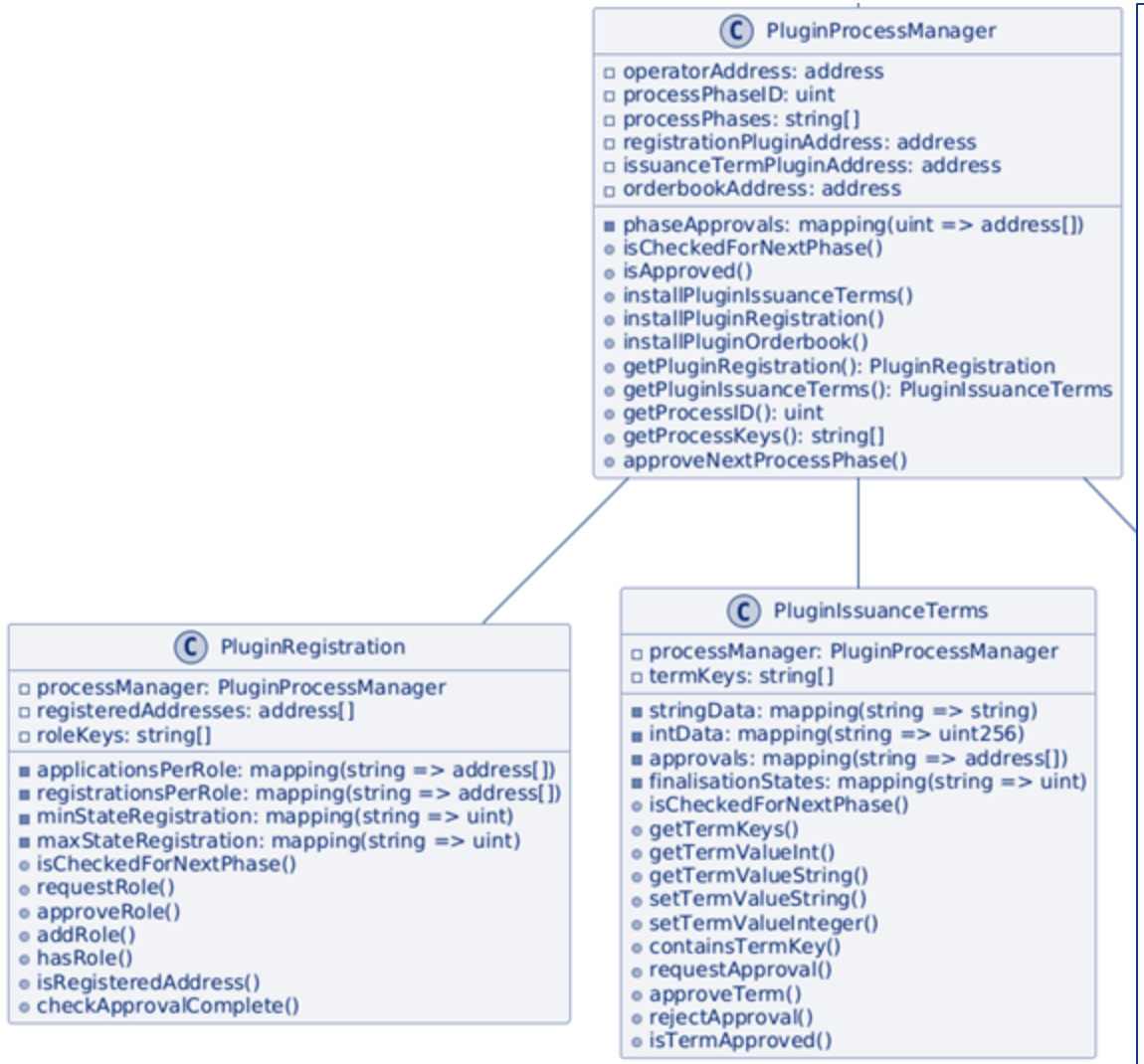
Template-Based & Lean Design: Customizable Plugin Components



XML Configuration

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```


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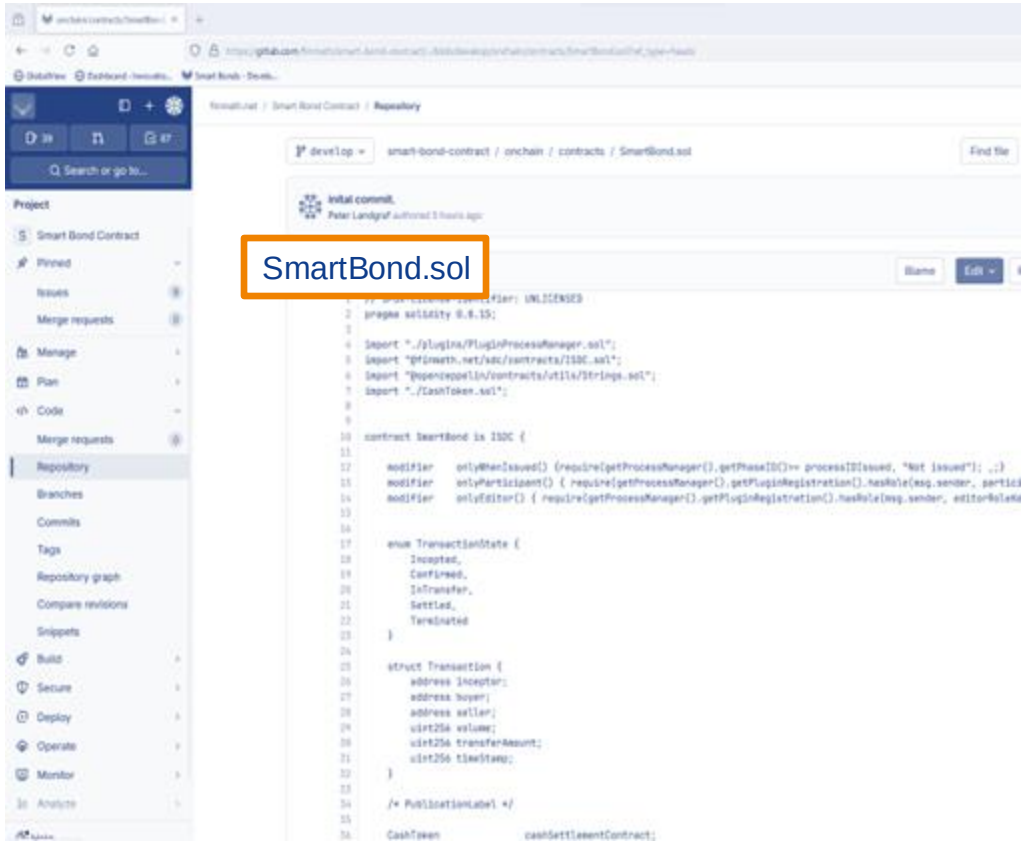
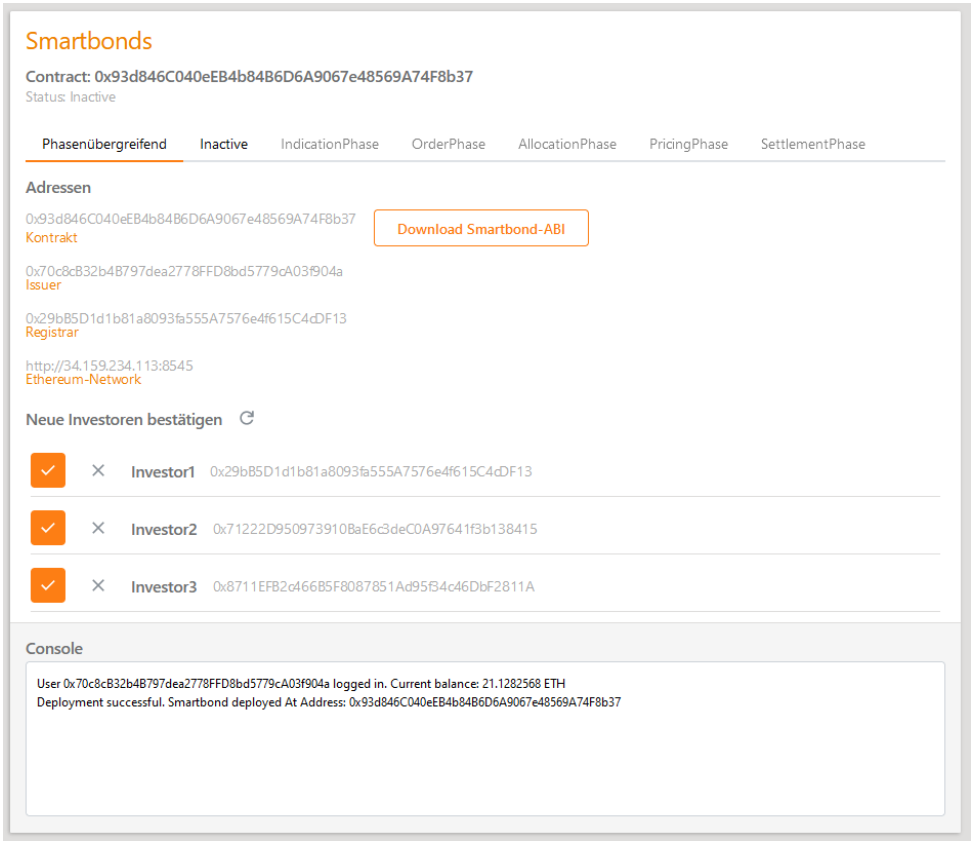
Collaborative Approach: Share our Software with selected Market Partners

– We are about to selectively share our early Code Base with interested market partners to peer review the concept and enhance it together with us.



– We are working on a full usable DApp (Contracts, Backend, Frontend) which can be used to detect Added Value at an early stage.



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Summary

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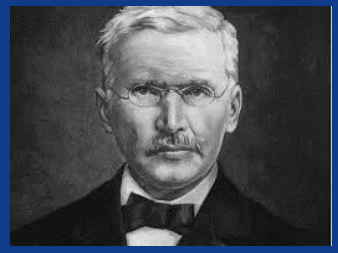
Founder of the first collaborative Bank: Wilhelm Raiffeisen (~1870)

“What is impossible for one
can be achieved by many.”



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Open-source based Collaboration drives Adoption of new Technologies

- DZ BANK works business-driven on digital financial Product-Designs with other market partners

- DZ BANK publishes digital Protocol Proposals to foster collaborative development
  - ERC-6123: Smart Derivative Contract
  - ERC-7573: Decentralized DvP
  - In Development ‚Smart Bond Contracts‘ based on ICMA-BDT

- **Collaboratively developed** digital Standards:
  - foster adoption of new technologies (as DLT)
  - help to overcome digital fragmentation
  - make future digital financial interaction more resilient

Thank you very much for your attention.
Questions are very welcome.

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Demo, Open-Source-Code, Papers and Articles

Demo-Video: Historical Simulation of SDC-Concept during Lehman Crisis: https://youtu.be/JttCVZ-Wo7w

Open-Source-Code, Project Page

- SDC-Ethereum-Standard (ERC 6123): https://ercs.ethereum.org/ERCS/erc-6123
- GitHub-Repo (Bewertungsservice, Demo): https://github.com/finmath/finmath-smart-derivative-contract
- Project Page (Literatur, XML-Definition): https://www.finmath.net/finmath-smart-derivative-contract/

Whitepapers und Articles

- „Rethinking Financial Derivatives Inspired by Smart Contracts“ https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3249430
- „Smart Derivative Contracts (original White Paper)“: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3163074
- „Implementing a Financial Derivative as a Smart Contract“: https://arxiv.org/pdf/1903.00067.pdf
- „Outsmarting Counterparty Risk by Smart Contracts“ https://www.risk.net/cutting-edge/views/7494071/outsmarting-counterparty-risk-with-smart-contracts

PoC - Press Releases / Articles:

- 2021: „German Financial Institutions Successfully Complete **First Trade of OTC Interest Rate Derivatives** Using Digital Smart Contract“ https://uk.practicallaw.thomsonreuters.com/w-031-7215?originationContext=document&transitionType=DocumentItem&contextData=(sc.Default)&firstPage=true
- 2022: „New digital standard: DZ BANK and Union Investment trade OTC derivative as smart contract“ https://www.dzbank.com/content/dzbank/en/home/we-are-dz-bank/press/news_archive/2023/new-digital-standarddzbankandunioninvestmenttradeotcderivativeas.html