# Smart Bond Contract 2.0

NRW.BANK Wir fördern Ideen

DZ BANK

Disintermediating the Lifecycle of a Tokenized Bond linked to Central Bank Money
Transaction Report · November 2026

| The Asset Leg | The Cash Leg | Interoperability | Standardization | Result |
|---|---|---|---|---|
| Ethereum | ECB Pontes | Decentralized DvP | Open Protocols | Lifecycle Mechanism |
| Smart-Contract Governed Bond Lifecycle | Participant-Operated Settlement in Central Bank Money | Disintermediated Interaction Flow with Asset-Locking | Open Standards for Bond Data, DvP and Trade Confirmation | Issuance in **30 Min** Automated, Efficient, Transparent |

## Rationale

Developing a programmable lifecycle for a tokenized bond on a public blockchain requires a deliberate redesign of how participants interact, with the aim of functionally harmonizing workflows and lifecycle events. This approach creates opportunities to streamline existing procedural structures and opens room for innovation. Smart contracts can serve as digital escrows, providing a distributed interaction layer on a public blockchain that acts as a market-neutral infrastructure. Decentralized interoperability with central bank money through the Eurosystem's Pontes solution enables seamless, participant-operated settlement. This is the rationale behind the Smart Bond Contract (SBC). This report documents the second legally binding execution of a fully disintermediated bond lifecycle, demonstrating a concept ready for further practical application.

## The Asset Leg

For our second pilot transaction, we chose Ethereum as a market-neutral DLT-infrastructure. The parties involved interact according to the SBC's predefined, smart-contract-based coordination mechanism, which forms a deterministic protocol layer for the entire lifecycle of the tokenized bond. The SBC process is compliant with the eWpG: The registrar acts as a notary service, granting the SBC address the allowance to transfer tokens. The use of the SBC protocol for the issuance process as well as the digital master data set are part of the legally binding issuance documentation.

## The Cash Leg

With the launch of the ECB-Pontes pilot phase, eligible market participants are enabled to process an automated delivery-versus-payment (DvP). This enables the design of a participant-operated settlement processing for issuance, coupon payment and redemption. Given the T2 eligibility of the participants involved, a separate settlement operator exposed to the cash side is not needed.

## Interoperability

The SBC includes a decentralized interoperability mechanism allowing participant-operated settlement without a central operator. The mechanics to operate the DvP in connection to Pontes are managed by a separate smart contract module. While the first pilot transaction applied this interoperability mechanism with cash-locking via the Bundesbank Trigger Solution, the second uses a comparable procedure with asset-locking. Moreover, a coupon payment also constitutes a DvP as cash is exchanged against the corresponding coupon claim.

## Lifecycle Standardization

The concept makes use of four technical open standard protocols on a modular basis: DLT-based data representation in combination with the ICMA-BDT, interoperability based on ERC-7573, the ERC-20 token standard and ERC-6123 for trade confirmation. With ERC-8100 the smart contract serves as a distributed single source of truth for all relevant data. The bond's master data are stored on-chain whereas the smart contract serves as an on-chain state representation of the product and transaction mechanics. This provides a clear audit trail and allows the contract to coordinate interaction depending on its current state.

## Future Work

With our second transaction, the SBC provides a high level of functional standardization in line with regulation and legal frameworks. The issued bond can serve as a basis for further experimentation throughout its lifetime. We emphasize that the modules of the SBC can serve as shared utility mechanisms rather than concepts to be commercialized. Therefore, we invite market participants and the public sector to use the setup and explore it further on other infrastructures. We will also work on extending this concept to further use cases.

# 1 Transaction Report Summary

### Project Rationale

On 17 November 2026, NRW.BANK as issuer and DZ BANK as investor completed the issuance of a tokenized bond (ISIN: **DE000NWB2Z16**) under the eWpG, based on the Smart Bond Contract (SBC) protocol developed by DZ BANK [1]. This second SBC transaction follows the March 2026 issuance with DZ BANK as issuer and KfW as investor [2]. The core idea remains unchanged: The SBC orchestrates the bond's digital lifecycle without intermediaries and is deterministically designed using smart contracts. What is new: Delivery versus payment in central bank money has been further standardized. The SBC protocol includes a participant-operated payment adapter which connects to the Eurosystem's newly launched Pontes Pilot [3] instead of the Bundesbank Trigger Solution. Cash-locking from the first pilot transaction has been replaced by asset-locking[1]. Each party operates its own ECB Pontes A2A connection. Coupon payments are fully automated and also designed as a DvP. DLT-based master data representation via ICMA-BDT [4] is now further standardized through the open ERC-8100[2] standard [5]. In line with our collaborative approach, we openly share the lessons learned with the industry.

### Transaction Setup

The setup included the following participants, who interacted on-chain via the SBC's deterministic interaction logic. Ethereum served as a public, market-neutral infrastructure for the ecosystem. The issuance process is coordinated among the involved parties via smart contracts on the public blockchain with no central orchestrator required.

| | |
|---|---|
| Issuer | NRW.BANK |
| Investor | DZ BANK |
| ISIN Distribution | WM Datenservice |
| Regulated Registrar (eWpG) | Cashlink |
| Market DLT | Ethereum |
| Cash Leg | ECB Pontes A2A |
| Digital Custody | DZ BANK |
| Token-Standard | ERC-20 |
| SBC Adress | 0x266F10C81500A54121 60fDf9959F9c7D93268E94 |

### Transaction Results

The transaction shows that the SBC concept can be connected in a clean and modular way with the Eurosystem's new settlement infrastructure. With regard to settlement for issuance and redemption, the corresponding DvP mechanism is designed to be fully decentralized. Both T2-eligible market participants operate their own off-chain Pontes A2A connections, which are used for the central bank money payment leg. On each coupon date, the coupon payment gets processed through another DvP transaction, exchanging the payment claim for the corresponding payment in central bank money via RTGS. Using the ERC-8100 standard, the on-chain storage and documentation of bond master data based on the ICMA-BDT XML format is optimized and standardized. Conducting the second transaction on public Ethereum after Polygon PoS in the pilot demonstrates that the SBC is infrastructure-agnostic. Its deterministic lifecycle and interaction logic efficiently removes operational risks and frictions.

# 2 The Smart Bond Contract

### What is the Smart Bond Contract?

The Smart Bond Contract (SBC) provides a deterministic mechanism for managing the full lifecycle of a tokenized bond. This transaction shows the SBC in operation from issuance to redemption on Ethereum. Smart contracts define which actions each party may perform at each stage of the lifecycle. Issuance, trade confirmation, DvP, coupon payment and redemption follow a predefined transaction logic. The SBC builds on **three layers**:

- A market-neutral blockchain providing a tamper-proof, auditable, distributed transaction ledger.
- The data layer representing the bond's claims digitally as ERC-20 tokens.
- The smart contract layer orchestrating the interaction of the parties involved and acting as a digital escrow in the DvP process.

### From Digital to Smart

Digitalization of a bond issuance falls into **three stages:** from centrally hosted digital records to a distributed tokenized representation, and, ultimately, to a programmable lifecycle. In the first stage, a physical global note is dematerialized. In the second stage, the bond's claims are tokenized and recorded in a smart contract on a DLT. This enables cross-chain DvP in central bank money, e.g. via Pontes, but processing at this stage is most likely to be centrally orchestrated. Smart Bond Contracts go one step further by providing an overall lifecycle mechanic (issuance, trading, settlement, interest and redemption). Each stage reduces coordination effort and can lower operational risk and increase liquidity efficiency. This reduces the need for an orchestrating intermediary. In particular, processing the DvP without a third party strengthens market participants' autonomy.

### Current Market Environment and Regulatory Alignment

The SBC combines these building blocks into a complete, native on-chain mechanism equipped with a deterministic lifecycle. It thus replaces central operation with a distributed protocol: Within the regulatory framework of the eWpG, the smart contract orchestrates the interaction and reduces the need for central intermediary services. Programmable workflows, a shared data layer and tamper-resistant transaction records can make processing more efficient and reduce reconciliation effort between market participants. Realizing these benefits requires transparent technical standards, resilient governance and legally sound integration into market infrastructure. The eWpG and the EU DLT Pilot Regime provide key foundations but must evolve further for broad market adoption. Open issues include connectivity to trading and settlement infrastructures, insolvency-resilient transfers, settlement finality and Eurosystem collateral eligibility.

[1] Pontes currently only enables DvP with asset-locking.

[2] ERC = Ethereum Request for Comments

## 3 Key Features and Design Aspects

### DLT-Based Single Data Source

The bond's terms are described in an XML document structured according to the ICMA Bond Data Taxonomy, a market standard that DZ BANK helped refine. The data stored on-chain is split between two separate smart contracts. The SBC stores the trade-specific parameters that define the transaction during its lifecycle, such as notional amount, coupon payment dates and lifecycle events. In addition, the bond implements the public ERC-8100 standard [5] by referencing a separate contract address that stores an immutable (ICMA-BDT) XML template with placeholders for these parameters. Multiple bonds with different terms can reference the same template, so the XML template no longer has to be redeployed again for every bond, reducing deployment costs. Together, the data stored in the bond and the template produce the complete XML document. Standard transformations (XSLT, also stored on-chain and referenced by the SBC) converts the bond's XML into its legal documentation or proprietary input formats for trading and middle-office systems as well as for connected market infrastructure providers such as WM Datenservice Given the SBC address, a generic renderer can produce all those documents. The SBC thus becomes the single source of truth for the transaction parameters and all derived documents.

### Participant-Operated Decentralized DvP

Tokenized bonds move on the blockchain, while cash moves in the Eurosystem's T2 system. For issuance, coupon payments and redemption, the SBC orchestrates a DvP based on the public ERC-7573 standard [6]. The SBC manages the asset leg, and the cash leg is settled via Pontes. Unlike the first pilot, which used cash-locking, settlement now relies on asset-locking: the SBC locks the security tokens with the hashed keys of an XvP payment instruction created in Pontes and verifies this instruction. Once the counterparty executes the payment via Pontes, the success key is released and the tokens can be claimed. Otherwise, they return to the sender. The open standard used supports locking on either sides. Depending on the economic rationale of a respective transaction we encourage providers of the cash leg to support both mechanisms.

To keep the payment leg separate from the bond logic, the SBC interacts with a single payment contract. This contract coordinates and verifies all payments due over the bond's lifecycle. Business logic and settlement logic remain cleanly separated. The SBC still orchestrates all lifecycle events and initiates every payment step.

### Generalized On-Chain Settlement Adapter

The communication with the payment system is fully generic as the SBC communicates solely through an ERC-7573 payment contract interface. Each party connects its own Pontes backend to an on-chain ERC-7573 proxy contract, keeping full control over its own security keys and proxy contract. This concept of a participant-operated settlement connector [7] ensures that each party creates and executes only verified and authorized payments, and central bank access stays explicitly with the party, see Figure 1. For the present transaction, the parties provided on-chain Pontes proxy contracts, but other settlement systems can be connected in the same way.

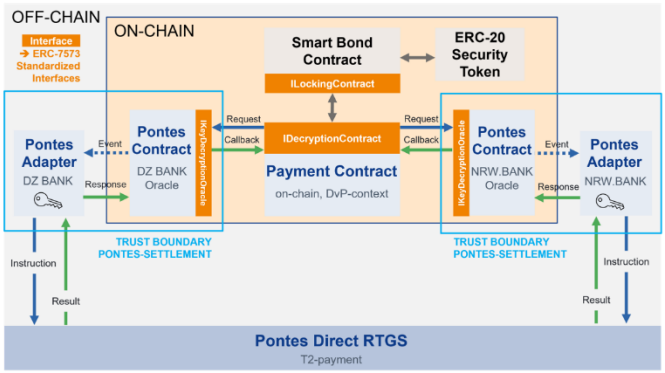



*Figure 1: On-Chain Pontes-Contracts as Participant-Operated Settlement Connectors*

### Infrastructure-Agnostic Protocol

The SBC is the core of a growing standardized smart-contract-based financial product framework. It is built on three layers: The DLT acts as a tamper-proof distributed database for transaction recording. Tokenization forms the second layer recording claims in a distributed format. Smart contracts form the third layer as deterministic distributed software logic. The SBC leverages a core benefit of smart contracts: their ability to act as distributed, digital escrows. The SBC concept is designed to be modular. Further functional modules can be added during the lifetime of the bond without changing the core functionality. The current implementation runs on any EVM-compatible infrastructure which made the switch from Polygon to Ethereum straightforward. This transaction uses a very high degree of on-chain functionality, from documentation to coupon payments, but the design allows for the use of more off-chain components. Built on open standards for interoperability, data representation the SBC concept aims to establish a common utility standard for the lifecycle of tokenized bonds.

## 4 Future Work

### Regulatory Requirements

Natively tokenized bonds issued on a market-neutral infrastructure remain economically disadvantaged compared to conventional bonds. Without a level playing field, institutional investor participation and broader market adoption are likely to remain limited. A key requirement is that crypto securities issued under the German Electronic Securities Act (eWpG) are **eligible as collateral for Eurosystem** collateral operations.

The **tradability** of these bonds outside central securities depositories also requires reliable secondary market access and settlement arrangements [8].

Another unresolved issue is **legal settlement finality** in DLT-based settlement systems. Technical transaction finality alone does not ensure protection against insolvency under the statutory settlement finality framework. Settlement under the DLT Pilot Regime therefore lacks equivalent insolvency protection to conventional settlement procedures. We therefore support the proposed replacement of the Settlement Finality Directive (SFD) by a Settlement Finality Regulation (SFR) as a key component of the Market Integration and Supervision Package (MISP) [9].

We reaffirm our support for the VÖB position paper [10] on eligible participants for securities use cases with Pontes

Enhanced. If unchanged, the eligibility criteria risk restricting competition and structurally disadvantaging innovative service providers currently eligible to act as Market DLT Operators in the Pontes Pilot.

Our transaction demonstrates that the Market DLT Operator, a crypto securities registrar under the eWpG, solely can perform a notary function, while DvP linked to the cash leg is processed in a fully participant-operated and decentralized manner, as described above.

### Future Use Cases

As emphasized above, the SBC mechanism is infrastructure-agnostic by design. An SBC can also be deployed on other DLT networks, such as Regulated Layer One (RL1) [11], the recently established, jointly governed DLT network for financial market participants. The cash leg is equally flexible[3]. Through the generic settlement adapter described above, a Smart Bond could also be settled using a stablecoin such as the one from Qivalis [12], or with tokenized deposits such as a CBMT [13], enabling market participants without access to central bank settlement to make use of the SBC.

The modular smart contract design alongside a more generic "Smart Product Framework" is subject to future work. A potential extension would be to introduce a repo transaction design based on the concept of the Smart Derivative Contract (SDC) [14].

The newly issued bond can serve as a living artifact to explore such potential use cases, assess their potential business benefits and identify multilateral win-win situations. We invite industry partners to collaborate with us in developing and validating these opportunities.

## 9 References and Contacts

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[3] SBC DvP is based on the ERC-7573 standard, which also enables cross-chain DvP, allowing the bond tokens and the cash component to exist on different DLT networks. See also [15].