

RWAs: A Safe Haven for On-Chain Yields?

SEPTEMBER 2024



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Key Takeaways

- ❖ Real-world assets (“RWAs”) refer to tokenized, on-chain versions of tangible and intangible non-blockchain assets, e.g., currencies, real estate, bonds, commodities, etc. Total on-chain RWAs are at all-time highs at US\$12B+ (excluding the US\$175B+ stablecoin market).
- ❖ Key categories within the RWA space include tokenized US Treasuries, private credit, commodities, stocks, real estate, and other non-US bonds. Emerging categories include air rights, carbon credits, and fine art.
- ❖ The increased involvement of institutional and traditional finance (“TradFi”) in the RWA space has been a notable recent growth driver. BlackRock’s BUIDL tokenized Treasury product is the category leader (market cap > US\$500M), and their US spot Bitcoin and Ether ETFs are the largest in the market. Franklin Templeton’s FBOX is the second largest tokenized Treasury product, while WisdomTree has expanded even further with their tokenized equity products and other “Digital Funds”.
- ❖ The foundational infrastructure of RWAs include smart contracts, oracles, identity & compliance, and custody solutions. Oracles are critical as they ensure that on-chain representations accurately reflect off-chain, real-world data. They also help initiate on-chain actions based on off-chain legal agreements. The development of RWA-specific oracles is an interesting development to keep an eye on.
- ❖ In our project analysis, we cover six projects. These include Ondo (structured finance), Open Eden (tokenized Treasuries), Centrifuge (tokenization, structured credit, aggregation), Parcl (synthetic real estate), Toucan (tokenized carbon credits), and Jiritsu (zero knowledge tokenization).
- ❖ There are several technical risks to be aware of when considering RWAs. Among these, we have centralization (due to the very nature of RWAs and regulatory requirements), third-party dependencies (particularly for asset custody), whether the complexity of the system is worth the yield, the robustness and dependency of oracles, as well as privacy & compliance considerations.
- ❖ From a macroeconomic perspective, we are set to commence on a historic rate cutting cycle in the US, which might have consequences for many RWA protocols, particularly those focused on tokenized US Treasuries. The concern around the legal landscape surrounding RWAs also remains.

The idea of **bringing real-world assets (“RWAs”) onto blockchains has long been a topic of interest to web3 entrepreneurs and startups**. The concept of an interoperable and aggregated universe of tokenized equities, bonds, real estate and many other types of assets, without the walled gardens, information asymmetry, and high transaction costs of the traditional finance (“TradFi”) world is certainly an endeavor worth pursuing.

However, **as with most worthwhile endeavors, progress has been steady and slow**, with plenty of setbacks. Private credit, a leading RWA category, has been affected by adverse selection-driven bad debt and lower demand on the back of record high interest rates, while tokenized equity and real estate has come with its own regulatory uncertainty. The demand for tokenized commodities, primarily gold, has slowly grown, although this interest has not particularly transferred over to other precious metals or other hard assets like oil.

Nonetheless, as things stand, **RWAs are seeing a sustained period of growth and increasing participation from the stalwarts of high finance**. TradFi giants, BlackRock and Franklin Templeton, have helped to take the **tokenized Treasury market to new highs**, while private credit is experiencing its own renaissance. Non-US tokenized debt, as well as tokenized equities and real estate, are also slowly growing. The **tokenization of alternative assets, such as carbon credits and air rights are some of the newer innovations** in the market, while some startups are also pursuing their own RWA-focused blockchains.

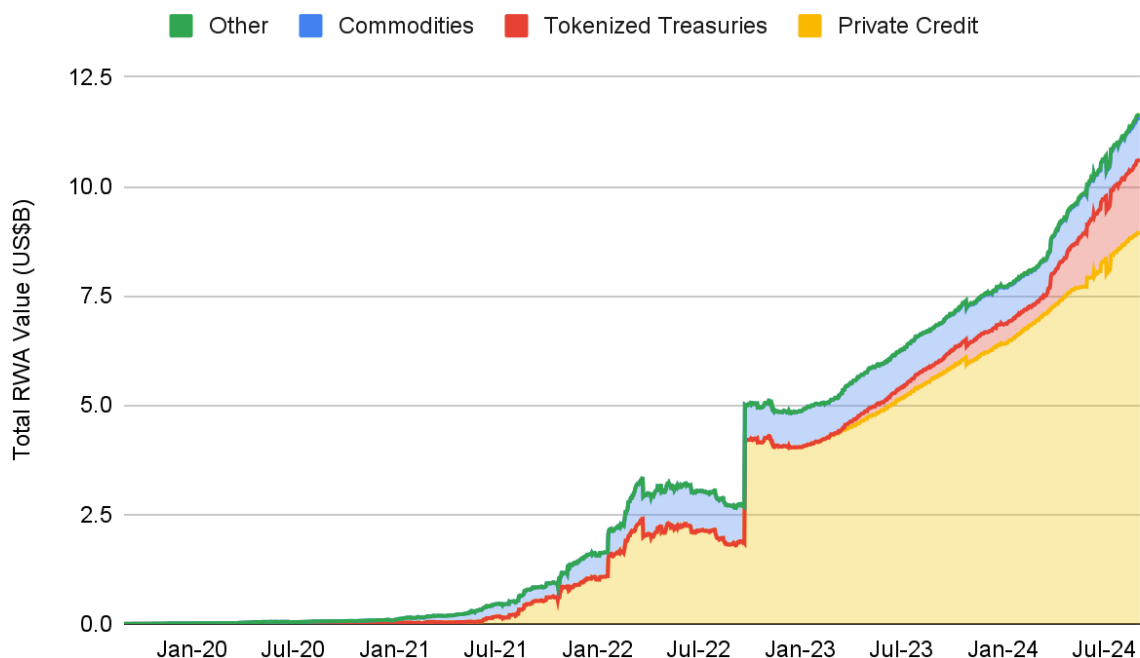
As crypto markets continue to evolve and gain acceptance among both the wider population and TradFi incumbents, the **growth of RWAs represents a natural progression**. In this report, we provide background on the various key categories within the RWA space, recent TradFi involvement, before taking a tech-driven tour of a handful of the most interesting major protocols in the space.

Basics of Real-World Assets (“RWAs”)

A Short Primer

RWAs refer to tokenized, on-chain versions of **tangible and intangible non-blockchain assets**, e.g., currencies, real estate, bonds, commodities, etc. Various asset classes exist within the broader RWA space, including stablecoins, government debt (largely dominated by US government bonds, i.e., Treasuries), stocks, and commodities.

Figure 1: Total on-chain RWAs are at all-time highs at US\$12B+ (excluding the US\$175B+ stablecoin market)



Source: rwa.xyz, Binance Research, as of September 12, 2024

The **issuers of RWAs** are typically the most important actors in the pipeline, being responsible for the **acquisition of the asset in the real world, the tokenization of the asset, and the eventual distribution of the RWA tokens**. Some issues are decentralized protocols, while others are centralized companies, with many being some combination of the two.

Although stablecoins i.e., tokenized versions of currencies, are a fundamental RWA, we will largely focus on other parts of the RWA stack in this report. Stablecoins, with a US\$175B+ market cap, have found significant product-market fit and operate independently to the more nascent RWA markets of assets like debt, commodities, and stocks.

RWAs:

1. Allow traditional finance (“TradFi”) users to benefit from the efficiency, transparency, and speed of blockchain technology;
2. Allow web3 users to gain exposure to TradFi investments, and;
3. Bridge the gap between TradFi and DeFi, creating ways for traditional investment classes to be used across DeFi.

We cover some of the key mechanics behind RWAs, including the tokenization process, early sector growth, and a number of different protocols, in our previous reports [Real World Assets: The Bridge Between TradFi and DeFi](#) and [Real-World Assets: State of the Market](#).

In this piece, we will build on those reports and provide an update on the strong growth recently experienced by RWAs, and also look at some of the most interesting protocols across the major categories within the RWA space.

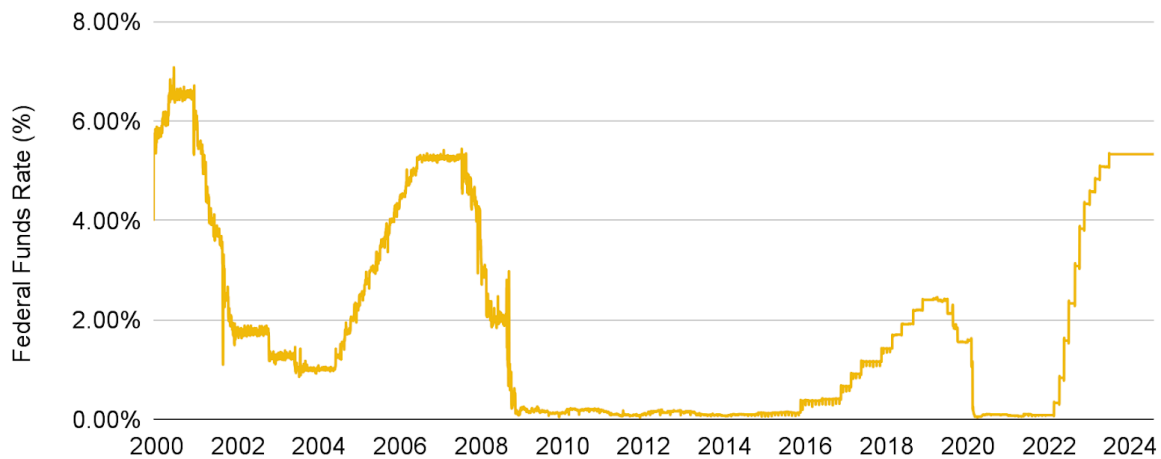
Key Categories

1. Tokenized Treasuries:

- Digital representation of US government bonds i.e., tokenized Treasuries, have experienced **explosive growth in 2024**, growing from US\$769M at the start of the year to **over US\$2.2B in September**. This came less than five months after hitting US\$1B in size back in late March.
- This growth has likely been impacted by **US interest rates being at a 23-year high**, with the federal funds target rate having been held steady at 5.25 - 5.5% since July 2023. This has made the US government-backed yield of Treasuries an attractive investment vehicle for many investors. We should note that US Treasuries are widely considered among the safest yield-bearing assets in the market, often being quoted as “risk free”, given that they are backed by the US government.
- Given the US Federal Reserve (“Fed”) is widely expected to start its rate cutting cycle later this month in the September FOMC meeting, it will be **important to monitor how the tokenized Treasuries market evolves as the yield starts falling**. Nonetheless, with rates so high at the moment, the size and regularity of any cuts will be crucial. As things stand, the major

tokenized Treasury products yield between 4.5 - 5.5%⁽¹⁾, thus it will take quite a few cuts before these yields become uncompetitive.

Figure 2: After holding rates at their highest level since 2001, for 8 consecutive meetings, all eyes point to a rate cut in the next FOMC meeting on September 17-18.



Source: macrotrends.net, Binance Research, as of August 30, 2024

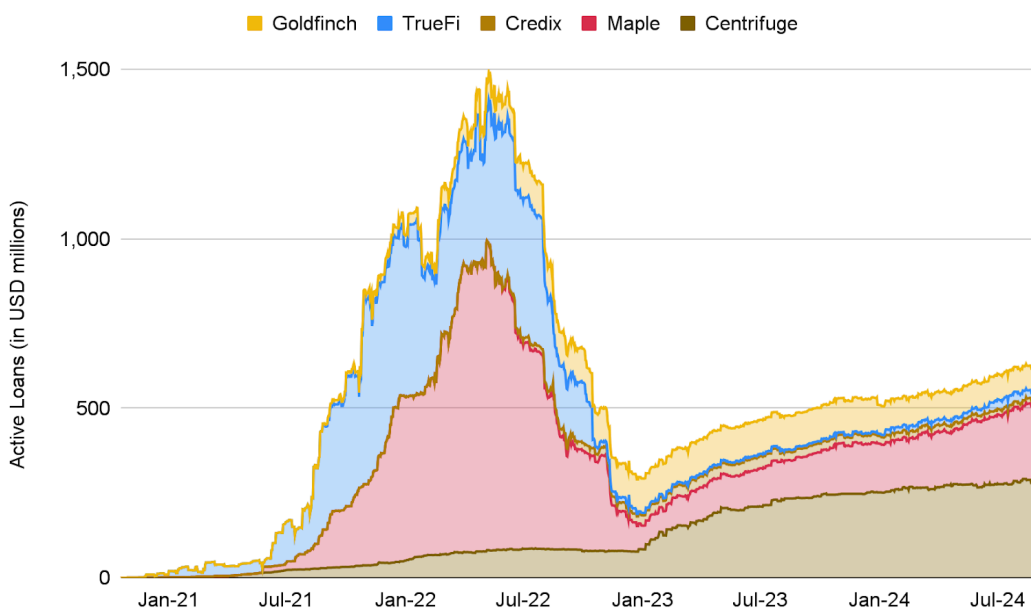
- Key players include Ondo, Securitize (who have partnered with BlackRock for their BUIDL fund), Franklin Templeton, Hashnote, and Open Eden.

2. Private Credit:

- Private credit refers to the business of **non-bank financial institutions providing debt financing, often to small and medium sized companies**. The IMF [estimated](#) this market to be worth over US\$2.1 trillion in 2023. Although the **on-chain private credit market** is only worth around 0.4% of this, at **~US\$9B**⁽²⁾, it has been growing and active loans are up by ~56% over the past year.
 - i. We should note that the **majority of this TVL (over US\$8.3B) can be attributed to Figure**. Figure is a fintech company that provides lines of credit collateralized by home equity i.e. essentially a loan against your home⁽³⁾.
 - ii. Figure uses the **Provenance blockchain** to streamline their process and lower costs. However, **Provenance is largely a permissioned blockchain**⁽⁴⁾ and operates very much in the background (although they do have a public network now too). Due to this, Figure's users are not exactly using web3 RWA technology, but rather continuing to operate in a web2 setting.
 - iii. Excluding Figure, private credit RWA protocols have still exhibited growth over the last year (although by a smaller amount).

- In general, private credit has grown as an overall share of the wider economy due to banks facing stricter lending standards since the 2008 financial crisis. Key benefits of bringing this market on-chain is to **increase transparency, integrate smart contracts (e.g., for automated payouts), and reduce transaction costs**. On the other hand, borrower default risks remain a key risk (similar to private credit businesses in the TradFi world).
- Key players within the on-chain private credit market include Centrifuge, Maple, and Goldfinch (excluding Figure as mentioned above). As we can see in the **total active loans chart** below:
 - Market share dominance has been difficult to sustain**, with each provider experiencing their own period of dominance. As things stand, Centrifuge is the largest player, although this may very well change in the coming years.
 - Despite recent growth, **total active loans are down ~57% from their height in 2022 (excluding Figure)**. This makes sense since it **coincides with the aggressive rate hiking from the Fed** as seen above in Figure 2. Naturally, many borrowers were affected by rising interest payments (especially as many private credit loans are structured as floating rate agreements), leading to a corresponding fall in active loans.

Figure 3: On-chain private credit has been bouncing back over the last 12 months. With a rate cutting cycle on the horizon, will the market get back to its 2022 heights?



Source: rwa.xyz, Binance Research, as of September 4, 2024

3. Commodities:

- This category is largely dominated by **tokenized gold** products and the leading two tokens, Paxos Gold (\$PAXG) and Tether Gold (\$XAUT), have around ~98% market share⁽⁵⁾ of the **~US\$970M market**.
- The **concept of tokenizing commodities is very logical, given the frictions associated with holding them** e.g., storage, transportation, divisibility. However, **gold ETFs solve this issue** and have been quite successful, with a market cap upwards of US\$110B⁽⁶⁾. Investors are evidently still reluctant to take their gold holdings one step further, on to the blockchain.

4. Bonds & Stocks:

- These are **much smaller markets** and are relatively nascent in their development (~US\$80M market cap⁽⁷⁾).
 - i. In terms of bonds, there are a few **non-US Treasury government debt products, including European debt**, as well as a small number of tokenized corporate bonds.
 - ii. Popular **tokenized stocks include Coinbase, NVIDIA, and an S&P 500 tracker** (all issued by Backed).
- Spiko and Backed are among the leading protocols in this category.

5. Real estate, air rights, and others:

- Tokenized **real estate** is one of the oldest ideas in crypto, and although it has not quite reached mass adoption, the category very much still exists. We cover [Parcl](#) in this report, who are pioneering tokenized real estate on Solana.
 - i. There are also more niche sub-categories within real estate RWAs. For example, SkyTrade is an early stage startup working on **tokenizing and trading of air rights** i.e. the ability to build or use the space above a given area of land⁽⁸⁾.
- We also have various other strategies, such as [Toucan](#) who are facilitating the **tokenization of carbon credits**. Firms like Toucan incorporate principles of **regenerative finance (“ReFi”)** in their services. ReFi describes an approach which tries to align financial incentives with eco-friendly and sustainable outcomes.
- Some companies are taking a broader approach, such as Plume Network who are developing a **modular L2 which seeks to tokenize all sorts of assets**, from watches to fine art.

Underlying Technology Enabling RWAs

Foundational Infrastructure

At the **core of RWA tokenization are DeFi protocols or layer-1 (“L1”) blockchain networks equipped with smart contract capabilities**. These platforms serve as the foundation upon which RWA-focused solutions are built. A critical component of this infrastructure is the integration of **oracles**, which act as **bridges between on-chain smart contracts and off-chain real-world data**. This connection is vital for tracking and reflecting the status and value of physical assets in the digital realm.

To ensure regulatory compliance, many RWA protocols implement permissioned roles at the smart contract or chain access level. This feature allows for controlled access and operations, aligning the decentralized nature of blockchain with the regulatory requirements of traditional finance.

1. Smart Contracts: The Building Blocks

Smart contracts play a pivotal role in RWA tokenization. These contracts typically leverage token standards such as ERC20, ERC721, or ERC1155 to create digital representations of off-chain assets. A key feature of these contracts is the **automatic revenue accrual mechanism, which distributes off-chain yields on-chain**. This can be achieved through rebasing tokens (like stETH) or non-rebasing tokens (such as wstETH).

“Smart contracts play a pivotal role in RWA tokenization. These contracts typically leverage token standards such as ERC20, ERC721, or ERC1155 to create digital representations of off-chain assets.”

Another essential aspect of RWA-focused smart contracts is their **ability to enforce regulatory requirements**. This includes limiting token ownership and transfers based on KYC/AML procedures, and implementing filters to exclude addresses associated with illicit activities (e.g., those linked to Tornado Cash). These compliance measures are often integrated directly into the token contracts' transfer functions.

2. Oracles: Bridging on-chain and off-chain worlds

Oracles serve two critical functions in RWA protocols:

1. **Data Feeds:** They provide access to off-chain data such as treasury rates and asset valuations, ensuring that on-chain representations accurately reflect real-world values.
2. **Legal Agreement Triggers:** Oracles can initiate on-chain actions based on off-chain legal agreements, such as triggering smart contract functions in response to loan defaults.

The **development of RWA-specific oracles is a key step in integrating RWAs into DeFi**. While general-purpose oracles like Chainlink provide data for a wide range of use cases, RWA-specific oracles are designed to handle the unique challenges of tokenizing and managing real-world assets like real estate, commodities, and invoices.

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These specialized oracles are necessary because **RWAs come with complexities such as legal compliance, accurate valuation, and regulatory oversight**, which generalized oracles may not fully address.

Remember, **accurate auditing of off-chain assets and data is critical to RWAs**. It provides the end user with assurances that off-chain providers are acting properly and not misusing protocol-owned assets. For example, **consider the example of private credit**, where lenders may be handing out RWA-collateralized loans, on-chain. Without high-quality oracles relaying how funds are being used, borrowers might not follow the loan agreements, take risk, and possibly default. This underscores the importance of oracles in the RWA space.

Figure 4: Comparing general-purpose and RWA-specific oracles

	General-purpose Oracles	RWA-specific Oracles
General vs Specific Focus	General-purpose oracle for diverse use cases, including RWAs.	Specialized in integrating and tokenizing RWAs in DeFi.
Data Sources and Validation	Aggregates data from multiple sources; uses decentralized validation.	Tailored data feeds for RWAs; often integrate with traditional institutions.
Ecosystem Integration	Widely integrated across blockchains; modular for customization.	Focused on RWA ecosystems; offers deep, tailored integrations with compliance support.
Security and Decentralization	Highly decentralized with a reputation system for reliability.	Varies by platform; may prioritize compliance over decentralization.
Use Cases and Adoption	Broadly adopted across DeFi, including some RWA projects.	Primarily used for RWA projects; growing in niches like asset-backed lending and real estate.

Source: Binance Research

Chronicle Protocol

- ❖ Used to secure MakerDAO's DAI treasury, Chronicle Protocol delivers high-frequency, real-time data with low latency, ideal for DeFi applications requiring continuous updates, including potential RWA use cases.
- ❖ They recently [launched](#) their **RWA oracle with an integration with the stablecoin minting protocol, M⁰**. Chronicle will act as an independent validator that verifies M⁰'s collateral balances by providing data on the off-chain collateral that mints use to generate the M stablecoin.

Chainlink's Proof of Reserve ("PoR")

- ❖ Though not exclusively an RWA oracle, Chainlink's PoR service is specifically designed to verify the collateralization of RWAs, ensuring that tokenized assets are backed by real assets.

DIA ("Decentralized Information Asset")

- ❖ An open-sourced, cross-chain oracle platform offering transparent and validated data for DeFi, including feeds related to RWAs.

Tellor

- ❖ A decentralized, censorship-resistant oracle network providing off-chain data with a focus on trust-minimized feeds, suitable for RWAs.

3. Identity and Compliance

Compliance is a cornerstone of RWA tokenization. Tokens must adhere to relevant regulations, including KYC/AML requirements. Protocols often implement whitelisting/blacklisting capabilities and support regulatory reporting. For certain RWAs, permissioned blockchains or hybrid models may be necessary to restrict access and maintain privacy.

Emerging technologies like **soulbound tokens (“SBTs”)** are being explored for identity verification, while **zero-knowledge SBTs (“zkSBTs”)** offer a promising approach to verifying identity while protecting sensitive user information.

4. Asset Custody

The custody of physical assets backing RWA tokens is managed through a combination of on-chain and off-chain solutions:

- ❖ **On-chain:** Secure multi-signature wallets or multi-party computation (“MPC”) wallets are used to manage digital assets.
- ❖ **Off-chain:** Integration with traditional custodians who hold the physical assets, along with legal authorities to ensure proper ownership and transfer mechanisms.

Institutional / Traditional Finance (“TradFi”) Players

The increased involvement of institutional and TradFi in the RWA space has been a notable recent growth driver. A quick look at some of the major players and their involvement:

BlackRock (AUM: US\$10.5T)

BlackRock’s USD Institutional Digital Liquidity Fund (“**BUIDL**”) is a **leading tokenized Treasury product**, and as things stand, the market leader in terms of market capitalization (“market cap”), at **over US\$510M⁽⁹⁾**. BUIDL has been key to the growth of tokenized Treasuries this year, and has seen incredible growth, having only launched in late March and quickly becoming the largest product in the space.

Securitize, a leading RWA tokenization company, is a notable partner to BlackRock for BUIDL and **is acting as the transfer agent, tokenization platform, and placement agent**. This means that they are responsible for managing the tokenized shares, reporting on fund subscriptions, redemptions, distributions, as well as, making the fund available to eligible investors. **BlackRock is acting as the investment manager** choosing the appropriate allocation between cash, US Treasuries, and repurchase agreements (“repos”).

Outside of their foray into the tokenized Treasury space, BlackRock has also been a key player in the US spot ETF market. As things stand, **BlackRock is the issuer of both, the largest spot Bitcoin and spot Ether ETFs⁽¹⁰⁾**.

Franklin Templeton (AUM: US\$1.5T)

Another TradFi giant, Franklin Templeton has also been getting increasingly involved in the RWA space. Their **OnChain US Government Money Fund (“FOBXX”) is currently the second largest tokenized Treasury product**, with a market cap of over US\$440M. While BlackRock’s BUIDL runs on Ethereum, FOBXX is active on Stellar, Polygon, and Arbitrum (although Stellar dominates with over 99% of market cap⁽¹¹⁾).

They also added further functionality to FOBXX with **Benji**. Benji is their blockchain-integrated investments platform, which lets users browse tokenized securities, while also being able to invest in FOBXX. Benji wallet holders can also **convert USDC to FOBXX** and transfer their shares to other peers on-chain.

Franklin Templeton also **runs nodes on a number of notable proof-of-stake networks**, including Ethereum, Solana, Avalanche, Cardano, Arbitrum, and Base (among others).

WisdomTree Investments (AUM: US\$110B)

Global ETF giant and asset manager, WisdomTree Investments, has gone even further and has **launched multiple “Digital Funds”**. This includes tokenized Treasury products, as well as equity and other strategy-related funds⁽¹²⁾. The overall AUM of all of these products is US\$23M+.

Comparison Table

Figure 5: An overview of the RWA players whom we will discuss

	Ondo	Open Eden	Centrifuge	Parcl	Toucan	Jiritsu
Product Type	DeFi	DeFi	Substrate-Based L1 chain	DeFi	DeFi	L1 with ZK-MPC nodes
Product Focus	Structured Finance	Tokenized US Treasuries	RWA Tokenization & aggregation	Synthetic real estate derivatives AMM	Carbon credit tokenization	RWA Tokenization & Verification
Chain(s) Supported	Ethereum, Solana, Aptos, Sui, Mantle, etc.	Ethereum, EVM-compatible chains	Substrate chains, Ethereum	Solana	Base, Celo	Potentially integrable with multiple chains
Asset Assurances	Overcollateralized (103%+), Custodial trust	US Treasuries stored in trust accounts	SPVs manage RWAs, real-time audits	Oracle-based, no direct ownership	Carbon credits verified by registries (Puro)	Cryptographically provable compliance
Level of Compliance	High Regulated custodians, KYC for assets	High CMS licensed, Trust structures	Medium SPVs for RWA asset verification	Medium Synthetic asset, no direct ownership	Medium Verified carbon credits, various standards	High Regulatory compliance embedded in tokens
Centralization	High Controlled roles in contract	High Centralized with regulated trust	Moderate Uses decentralized governance, SPVs	Low Oracle risk but synthetic exposure	Low Oracles and decentralized carbon credits	Low Provable compliance, limited reliance on regulatory bodies
Tokenization Standard	ERC-20	ERC-20	ERC-721(individual assets), ERC-20 (pooled assets)	SPL (Solana Program Library)	ERC-20	Likely ERC-20

Complexity of Tech	Moderate Tokenization of Treasuries	Moderate Simple asset tokenization	High Cross-chain DeFi integrations	Moderate Synthetic pricing and real estate indices	Moderate Carbon credit tokenization, pool structure	High ZK-Proofs, MPC, TEE
Main Risks	Oracle manipulation, reliance on custodians	Oracle failure, reliance on custodians	SPV default, reliance on originators	Oracle failure, synthetic pricing mismatch	Oracle manipulation, liquidity risks	Centralized node operation, external storage dependencies
Unique Selling Point	Accessibility to TradFi products on chain	Accessibility to regulated institutional products	Pioneer in RWA tokenization with a focus on business financing	Providing liquid, index-based exposure to real estate markets	Facilitating decarbonisation through on-chain methods	Secure and private asset verification

Source: Binance Research

Ondo

Introduction

Ondo Finance's mission is to make institutional-grade financial products available to everyone. They operate a platform for creating on-chain financial products by collaborating with institutional partners to tokenize RWAs and enable crypto users to invest in these assets directly. They operate an asset management platform that creates and manages these products, as well as a technology-focused arm that develops DeFi protocols.

Product Line Overview

Ondo Finance offers **tokenized exposure to US Treasury bonds** through their products. These allow DeFi users to invest in **stable, yield-bearing assets** traditionally only available for TradFi investors. The platform works with partners like institutional funds and custodians to manage the underlying assets.

Users can access Ondo's offerings through two primary products: USDY and OUSD⁽¹³⁾.

USDY

The USDY ("US Dollar Yield") token is a **tokenized note secured by short-term US Treasuries and bank demand deposits**. It is designed to **combine the accessibility of a stablecoin with US dollar-denominated yield**.

Users, upon passing KYC requirements, can swap USDC for USDY, an ERC-20 rebase token that represents their earned yield. USDY tokens are only issued 40-50 days after the initial deposit, following a 3-day approval and a minimum 40-day restricted period.

Redemptions from USDY to cash take 5 business days. The underlying assets are held in cash custody accounts at Morgan Stanley and StoneX, ensuring they are not rehypothecated.

USDY is currently supported on a number of different chains, including Ethereum, Solana, Sui, Arbitrum, and others. It currently has a TVL of **US\$395M** and a **5.35% APY**.

OUSG

The **OUSG (“Ondo Short-Term US Government Treasuries”)** token provides **liquid exposure to short-term US Treasuries**, with 24/7 tokenized subscriptions and redemptions.

Currently, the **majority of this portfolio is in BlackRock’s BUIDL and FedFund**, with the remainder in bank deposits and USDC for liquidity purposes.

Only “qualified purchasers” are able to access this OUSG, which is currently available on Ethereum, Polygon, and Solana. It currently has **US\$227M in TVL** and a **4.79% APY**.

Comparison

Both USDY and OUSG are institutional-grade tokenized cash-equivalent assets. However, there are some differences.

- ❖ OUSG provides tokenized exposure to short-term US Treasuries, whereas USDY is secured by tokenized Treasuries and bank deposits.
- ❖ OUSG represents an equity interest in a fund holding Treasuries, whereas USDY is an interest-bearing note.
- ❖ OUSG is only available to “qualified purchasers”, but across the world. USDY is available to all types of investors, but only in certain jurisdictions (excluding US, UK, Canada, Russia, Japan, Korea, etc.)

Asset Security

The protocol ensures the overcollateralization of its offerings, maintaining at least a **103% collateral ratio**. Ankura Trust Company acts as both the verification and collateral agent, enforcing strict eligibility criteria and having the authority to initiate a wind-down in cases of non-compliance.

In the event that Ondo USDT LLC fails to meet a redemption request on time, an Event of Default will be triggered, requiring Ankura Trust to liquidate the investment portfolio and repay token holders, pending USDT holder approval. Despite using regulated custodians, reliance on third-party custodians still introduces risks, as issues like insolvency or regulatory challenges could compromise access to the real-world assets.

Technical Assessment

Ondo Finance's technical architecture includes several important considerations. Its **cross-chain integration** introduces potential challenges, as vulnerabilities in the bridges connecting different blockchains could impact security. The protocol's use of **oracles**, such as Pyth, to bridge off-chain financial data for USDT pricing across multiple blockchains could also lead to issues such as mispricing or inaccurate payouts if the oracle fails or is manipulated.

Additionally, there are some **centralization aspects** in the governance of USDT and OUSG, with roles like BURNER_ROLE and LIST_CONFIGURER_ROLE having the ability to **blacklist/whitelist or burn tokens**, and the contracts being upgradable. Users are also required to sign up with their email addresses to deposit, introducing an element of centralization compared to fully decentralized DeFi systems.

OpenEden

Introduction

OpenEden's mission is to bring RWAs to DeFi and make RWA yield accessible to everyone in order to create a more permissionless and inclusive economy. They offer 24/7 on-chain access to tokenized US Treasuries and since launching in 2023, have become the **largest issuer of these products in Asia**.

Product Line Overview

OpenEden's primary product is the **OpenEden Treasury Bills TBILL Vault, which gives users direct exposure to a pool of short-term US Treasury bills through the minting of the TBILL token**. The TBILL token is backed 1:1 by the US Treasuries and a small portion of USD.

Users can mint and redeem TBILL tokens using USDC. TBILL is an ERC-20 token that represents the underlying Treasury bills, and accrues the requisite yields earned by the bills.

Users can only purchase the TBILL token if they “qualify as an Accredited Investor or Professional Investor”. For the typical consumer, a base requirement would be to have a **net worth of at least US\$1,000,000**, which could be prohibitively high for many.

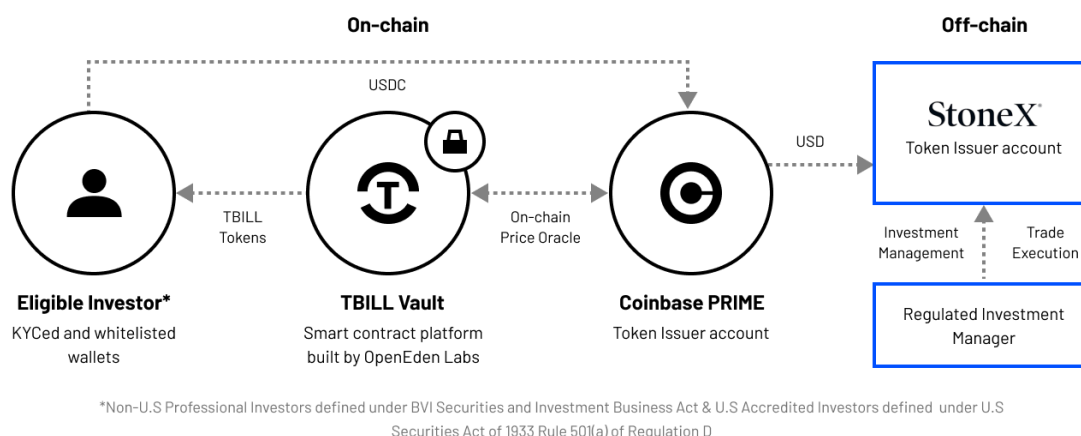
Assuming they pass this requirement, there is another hurdle: the first deposit must be a **minimum of 100,000 USDC**, while subsequent deposits can be a minimum of 1,000 USDC.

If users wish to redeem TBILL tokens in the “real world”, they would need to go through a **KYC screening process** with OpenEden.

Redemptions can be initiated with the TBILL vault contract at any time, but will be kept in a redemption queue and subject to a 1-business day lockup, before funds will be released to the redeemers.

As part of participating in the protocol, OpenEden will charge a fee of 0.3% p.a. on all existing TVL, and additional transaction fees on top of usual Ethereum gas fees during the redemption process.

Figure 6: How OpenEden works



Source: OpenEden

Asset Security

OpenEden employs a **bankruptcy-remote structure** to protect token holders, with the investment manager holding a Capital Markets Services (“CMS”) License from the Monetary Authority of Singapore. The protocol conducts regular **audits and disclosures**, with income statements and balance sheets available on their website to maintain transparency.

Treasury bills are stored in trust accounts managed according to regulatory standards, providing an additional layer of security in the event of insolvency or protocol issues. While the assets are held off-chain, OpenEden ensures **on-chain transparency**, allowing users to

track their exposure to US Treasuries and other off-chain assets. Although reliant on off-chain custodians, the protocol integrates **on-chain tracking** to minimize the opacity commonly associated with traditional finance.

Technical Assessment

The TBILL Vault smart contract is an **ERC-4626** compliant upgradable contract, controlled by a **multi-sig** through a **timelock** contract with a 24-hour delay.

These permissioned addresses are also able to make significant changes to the vault, including pausing deposits and withdrawals, managing the withdrawal queue, updating the price of the TBILL token according to the oracle, and setting fee parameters.

The smart contracts have gone through two audits since launch, which highlighted several “Medium” vulnerabilities that have since been fixed.

It is worth noting that, in the event of a smart contract breach or hack, most of the TBILL Vault assets are still held with regulated custodians.

Centrifuge

Introduction

Centrifuge is an **L1 blockchain built with Substrate** that enables businesses to bring RWAs like invoices, real estate, and royalties into DeFi by tokenizing these assets and using them as collateral for borrowing on the blockchain.

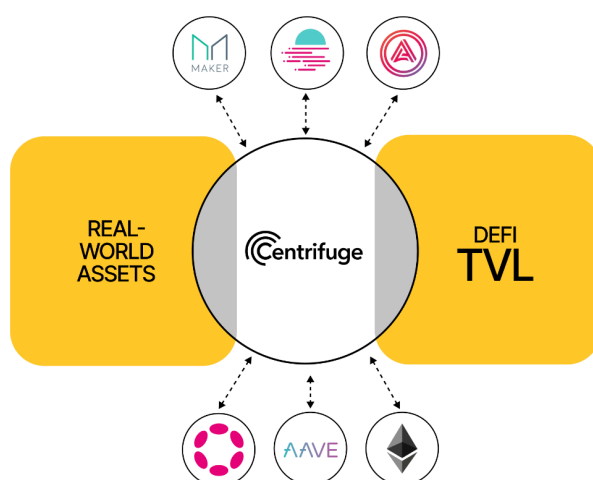
Product Line Overview

Being a custom-built RWA chain, **Centrifuge Chain** is able to tokenize RWAs and bring them onto a blockchain optimized for scalability and low-cost transactions. By creating **NFTs that represent assets like invoices and real estate**, Centrifuge Chain enables these assets to interact with DeFi platforms, facilitating financial services such as lending and borrowing.

As a Substrate chain, Centrifuge is able to **aggregate liquidity** from multiple DeFi protocols on multiple chains, including apps on EVM chains and Substrate chains through their own bridge. These liquidity pools will allow protocols to invest in RWAs, and allows issuers to access aggregated liquidity instead of having to integrate multiple sources.

Centrifuge features multiple pools that on-chain users can choose from, as well as **Centrifuge Prime**, a product targeted at large scale on-chain organizations that wish to get access to off-chain yields.

Figure 7: An illustration of Centrifuge's role in the RWA landscape



Source: Centrifuge

Asset Security

Centrifuge ensures legal enforceability through agreements between asset originators and investors, often using **special-purpose vehicles (“SPVs”)** to hold tokenized assets, which provide clear ownership claims in case of default.

Investors are involved in **decentralized governance**, giving them a say in how assets are managed through voting. However, **counterparty risk** exists due to the reliance on asset originators to tokenize assets like invoices, where misrepresentation or defaults could lead to potential losses, highlighting the need for trust in off-chain originators.

Technical Assessment

Centrifuge’s **Private Data Layer** allows secure, private management of sensitive data tied to tokenized RWAs. When creating NFTs that represent these assets, crucial asset data is hashed and anchored on-chain without being publicly exposed.

This system operates through a peer-to-peer network called **Private Offchain Data Nodes (“PODs”)**, enabling participants to selectively share asset data with specified collaborators. Users can control both read and write access, facilitating secure sharing for specific tasks such as asset pricing by third-party agents. This ensures data privacy while maintaining verifiability.

While Centrifuge is managed by a decentralized committee, its success relies on how well governance and verification are conducted on-chain. Any flaws in governance (e.g., vote manipulation, oracle inaccuracies) could lead to incorrect valuations or misuse of RWAs.

Parcl

Introduction

Parcl is a protocol that **tokenizes real estate**, allowing users to buy and sell fractions of real estate market indices, and gain exposure to real estate markets without needing to buy physical property, and with lower barriers of entry.

Product Line Overview

Parcl creates indexes that represent different geographic real estate markets. For example, a user could buy into an index that tracks the housing market in New York, Los Angeles, or other global cities.

Users trade on **perpetual synthetic assets**, offering price exposure to the underlying real estate market. Users can buy, sell, and trade these tokens based on their outlook on various housing markets.

Parcl uses **Pyth**, a decentralized price oracle, to provide real-time tracking of real estate prices, ensuring that token values accurately reflect underlying property market data.

Its AMM model uses isolated pools where traders gain price exposure and liquidity providers (“LPs”) supply liquidity. The protocol ensures solvency by using a bonding curve model based on the exchange rate of collateral and liquidity tokens. Price execution is tied to oracle feeds, while zero credit risk is maintained as the protocol doesn’t allow margin borrowing, instead offering leverage. Skew management and optional liquidity provision reduce risk for LPs, while delayed settlement protects against emergencies by allowing the protocol to pause and manage risks.

Asset Security

By using **multiple independent sources** for real estate market data, Parcl minimizes the risk of manipulation and ensures that the token prices accurately mirror the off-chain real estate markets.

It’s important to note that Parcl **does not provide direct ownership** of real estate but rather synthetic exposure to real estate price movements. This means that security is more focused on the **integrity of the pricing mechanisms** (through oracles) and the robustness of smart contracts managing token issuance and trading.

Technical Assessment

Parcl's reliance on oracles introduces risks related to oracle manipulation or failure. If real estate data is manipulated or not updated in time, it could result in inaccurate token prices and losses for users. At present, the Pyth oracles used are **updating prices daily**, i.e. every 24 hours. Although real estate prices tend not to be extremely volatile, this frequency could still cause some discrepancies in real world prices vs. what is being shown on chain, resulting in **potential arbitrage opportunities**.

Additionally, since users don't own real-world property but instead have synthetic exposure, they are vulnerable to **risks tied to the performance of the underlying data feeds**. Synthetic tokens can diverge from real-world prices.

Parcl's smart contracts went through two rounds of audits by a single smart contract company, and its contract source code is not public as of time of writing.

Toucan

Introduction

Toucan is a platform that **tokenizes carbon credits** to allow companies and individuals to purchase, trade, and retire carbon credits to offset their carbon emissions, all in a decentralized manner.

Product Line Overview

The **Base Carbon Tonne**, or BCT for short, is the main token representing carbon credits in Toucan's ecosystem. BCT is a fungible token that represents 1 tonne of verified carbon offset. Users can trade BCT or "retire" them to offset their carbon footprint.

Toucan has established marketplaces where users can buy and sell tokenized carbon credits. These marketplaces provide liquidity for environmental projects that create carbon credits and users who wish to offset their carbon footprint.

Toucan integrates with protocols like **KlimaDAO** and **Curve** to create additional use cases for tokenized carbon credits. For example, users can stake their carbon credits for yields or use them in various DeFi protocols to incentivize positive environmental impact.

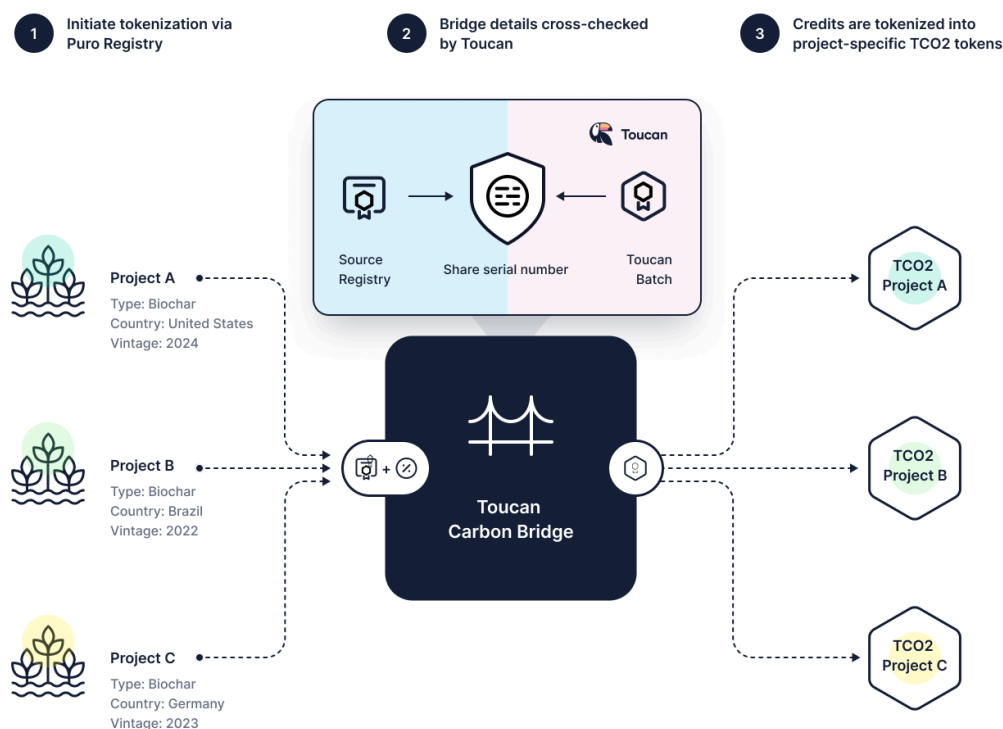
Asset Security

Toucan Protocol's collaboration with Puro.earth enables the tokenization of **Puro-certified carbon removal credits ("CORCs")**, which are converted into CHAR tokens. These credits

are issued through the **Puro Carbon Bridge**, which allows carbon removal projects verified by Puro.earth to be represented on-chain as TCO2 tokens.

Each TCO2 token represents one tonne of carbon verifiably removed from the atmosphere, providing transparency and traceability, and a whitelist of eligible TCO2 tokens is maintained by the Toucan team to determine which tokens can be deposited into the CHAR pool.

Figure 8: The Toucan tokenization process



Source: Toucan Protocol

Toucan also features a **dynamic pool health fee** to promote diversification within the carbon pools. The fee is applied to deposits and redemptions, and its size is based on the pool's post-transaction composition. For TCO2 deposits, fewer CHAR tokens are issued as a project's share of the pool grows. For CHAR redemptions, fewer TCO2 tokens are received when a project's pool share decreases. The fees are deducted in CHAR, with full transparency provided to users before transactions. Toucan may update these fee parameters over time.

Unlike some of the other RWA protocols we have seen, Toucan does not require a KYC process, and CHAR tokens can be bought permissionlessly on DEXes such as Uniswap.

Technical Assessment

Toucan relies on oracles to verify carbon credits. If the oracle data is incorrect or manipulated, it could result in tokenizing invalid credits, undermining the integrity of the system.

The CHAR and TCO2 carbon pools could face **liquidity imbalances**, particularly during market downturns, making it difficult for users to trade or redeem credits.

Having upgradable smart contracts, any changes or exploits could compromise the system's security or lead to governance risks.

Partnerships with carbon registries like Puro.earth present risks if these external entities face operational or compliance issues.

The CHAR ERC-20 token contract is an **upgradable contract** managed by a multisig of 5 signers. Toucan Protocol's smart contracts are open sourced, and have gone through 4 rounds of audits by 3 separate auditing firms.

Jiritsu

Introduction

Jiritsu is an L1 blockchain built with the Avalanche Subnet tech stack. It features a ZK-MPC oracle built to support the legal framework for tokenization of various RWAs, including gold, inventory, real estate, and TradFi products such as ETFs.

Product Line Overview

Jiritsu allows users to tokenize RWAs with embedded regulatory compliance and valuation. The platform features a **dual verification system**: one verifier handles business asset compliance and valuation, while another focuses on real-time market valuations for assets like bonds. Tokens are issued with **proof-embedded smart contracts**, ensuring compliance and usability across multiple blockchains.

Third-party developers can create and monetize ZK-MPC verifiers within the ecosystem, earning revenue through service fees. Additionally, Jiritsu's **revenue-sharing model** redistributes income to validators and nodes, supporting ecosystem growth and sustainability

Asset Security

Jiritsu's **ZK-MPC oracle** uses Zero-Knowledge Multi-Party Computation to process off-chain data, such as asset valuations, while keeping sensitive information private. It allows multiple parties to compute the data without directly sharing it, ensuring confidentiality.

The oracle posts **verifiable on-chain proofs**, which allow for transparent verification of data accuracy and integrity while remaining private. This architecture is designed to securely validate information for regulatory compliance and asset management while ensuring data remains protected from external parties.

Technical Assessment

Initially, the Jiritsu team operates the core L1 nodes, creating a potential centralization risk until further decentralization is implemented. The platform also relies on external infrastructure, such as IPFS and Amazon S3, for asset data storage, introducing dependencies on third-party services.

In terms of economic security, the \$JIRI token is staked to secure the network, but if the total staked amount is insufficient, it could reduce the overall security and effectiveness of the L1 chain.

Overall Findings

Technical risks - are the yields worth it?

Several key technical considerations emerge in the RWA tokenization landscape:

1. **Centralization:** RWA protocols often exhibit a higher degree of centralization in their smart contracts or overall architecture, which seems unavoidable given the very nature of RWAs and regulatory requirements.
2. **Third-party Dependence:** There's a significant reliance on off-chain intermediaries, particularly for asset custody.
3. **Yield Considerations:** The yields generated from RWA tokens may not always justify the complexity of the systems involved.
4. **Oracle Solutions:** There's a growing need for more robust oracle solutions, leading to the emergence of RWA-specific oracle protocols. Established players such as Chainlink are also increasing their focus on tokenized assets.
5. **Privacy and Compliance:** Zero-knowledge technology is emerging as a potential solution to balance regulatory compliance with user privacy and autonomy.

These risks, among others, have to be considered in tandem when evaluating any RWA protocol and its potential.

Why the need for new chains for RWAs?

Interestingly, a growing number of RWA protocols choose to have their own L1 or L2 blockchains. This approach offers advantages such as greater control over compliance and regulations, and the ability to easily implement KYC for all users through Web2 methods. However, it also presents challenges, including difficulties in bootstrapping network security and potential liquidity limitations.

Pros

- ❖ Easier for new protocols to launch on these chains without needing to set up their own KYC frameworks and jump through regulatory hurdles, promoting the growth of more RWA protocols

- ❖ Traditional institutions or Web2 companies that wish to adopt some blockchain features can be assured that all their users are KYC-ed / meet the necessary regulatory requirements

Cons

- ❖ New chains tend to face the “cold start” problem; it is difficult to bootstrap new chains with liquidity and ensure sufficient economic security.
- ❖ Higher barriers to entry for users who may have to set up new wallets, learn new workflows, and familiarize themselves with new products.

Is fancy tech crucial for RWAs?

While advanced technology isn't always essential for RWAs, zero-knowledge technology plays a crucial role in providing verifiable privacy and regulatory compliance without the need for centralized KYC processes. ZK technology allows users to **prove regulatory adherence** (e.g., identity, asset ownership) **without revealing sensitive details**, ensuring compliance while maintaining privacy.

ZK Soulbound Tokens (“zkSBTs”) can further embed privacy into blockchain identity systems, allowing users to meet regulatory requirements while keeping personal data secure and private. This technology enhances both security and decentralization for existing RWA protocols, while retaining the original ethos of Web3.

6 Outlook

Rate Cuts Incoming

- ❖ As we mentioned above, **US interest rates have been held at a 23-year high since July 2023**. This has made off-chain yield attractive to on-chain users and contributed to the explosive growth that tokenized US Treasuries have experienced this year.
- ❖ However, the **market widely expects the US Federal Reserve (“Fed”) to commence its rate cutting cycle starting in its next meeting on September 18**, and this has been corroborated through recent statements from Fed officials. Given this will slowly start lowering yields, what will this mean for RWA projects that have been thriving in a high rate environment?

- ❖ However, at the same time, **while yields for some RWA products may drop, they will continue to offer unique benefits**, such as diversification, transparency, and accessibility, which may continue to position them as attractive options in a lower rate environment.

Concerns surrounding legal landscape and growth limitations

- ❖ The **legal landscape surrounding RWAs is still evolving** and recent developments are helping to provide greater clarity for market participants. The likes of Centrifuge use SPVs to somewhat help this issue, however, this may not be feasible for all types of protocols.
- ❖ Many protocols still **maintain significant centralization, and there is plenty of room for various technologies, including zk, to be implemented to improve decentralization**, while still maintaining regulatory compliance. This will likely also require somewhat of a shift in traditional compliance systems to recognize new forms of verification.
- ❖ We should also note that **while many RWAs are issued on public chains, they are not necessarily permissionless**. For most applications, users still have to complete KYC checks, while others require users to be “accredited” or “professional” investors. Other products require a significant minimum balance requirement, which would exclude many, if not all, retail users.
 - This means that many current RWA protocols have similar limitations to TradFi products (with the additional crypto or blockchain aspect, which could be considered a risk to some). Most RWA protocols still have some way to go before they truly broaden permissionless access to financial products that are traditionally reserved for professional investors.

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