## [Abstract](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=abstract)

This whitepaper introduces **WEDGE TOKEN**, a decentralized protocol to build trustful e-Commerce solutions on blockchain. The protocol defines 4 main subsystems of e-Commerce: Marketplace, Trading, Redemption and After-Sale. Each of the subsystems can work independently with supporting modules to manage the assets, users, and products. When discussing the topic, this whitepaper also introduced **Stateful Universal Token (SUT)**, a new standard to represent the state changes of the token when presenting real-world products in the e-Commerce processes.

## [Motivation](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=motivation)

It has been over a decade since blockchain became a technology under people’s focus. However, there are some challenges to make blockchain a pervasive platform for landing trustful and decentralized e-commerce applications. There are concepts proposed for physical backed tokens that represent the real-world items, also people may think about using the Semi-Fungible Token5 to address the transformation from fungible items to collectables.

However, existing solutions still require off-chain activities to maintain the security of the transactions and lack a way to represent the state of the token itself, whether it is backed by products or the product it represents has been used.

To make an e-Commerce system running independently and fully decentralized on blockchain, building a decentralized e-commerce protocol is essential.

**WEDGE TOKEN** is a set of rules, contracts and data models for a decentralized e-commerce platform, there is no central authority there, and the rule is equal and trusted by everyone, no matter if you are an e-commerce giant, or a common customer. Everyone has the equal opportunity to sell, buy, redeem, trade, return and refund based on the contracts – the platform is driven by TAP and run by a set of smart contracts on blockchain.

In general, TAP provided the following solutions for these challenges of running e-Commerce on blockchain.

### [Decentralized Platform for e-Commerce](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=decentralized-platform-for-e-commerce)

Existing e-Commerce solutions planned to run on blockchain leverage the off-chain activities to secure the transactions. The off-chain activities could be unnecessary for TAP because 3rd party involvement may be costly and impact the efficiency.

**WEDGE TOKEN** Is a fully decentralized platform for e-commerce and   
**WEDGE TOKEN PROPERTIES** Allows everyone to buy Real Estates in Dubai.   
All the users rely on the smart contracts for these activities. The quality of services leverages an after-sale subsystem to prevent loss from fake sellers and improper operations.

### [Credibility of Sellers](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=credibility-of-sellers)

The challenge of landing e-commerce on blockchain is the consensus of trust. It is hard to determine the credibility of a seller and the service quality during the anonymous system, especially for the level of trust without the judgment of a centralization system or 3rd party.

WEDGE TOKEN introduced a credibility system for all users who want to sell items, it prevents sellers from withdrawing the funds before the whole process of sale is completed (e.g., the return window is due after redemption). The credibility is graded and visible for all users, so customers know how secure to deal with this seller.

### [States Transition](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=states-transition)

Currently there is no token standard to represent product states. For example, whether a token has been redeemed or not. If a token has no product backed, it may still have value for its collectable properties (e.g., a concert ticket or a gift card).

### [Customer Loyalty](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=customer-loyalty)

As with some of NFT use cases, WEDGE TOKEN leverages SUT to represent the connections between sellers and customers, because a SUT itself keeps the information of the original of the token (who minted this token or produced the item). Sellers can mint product backed tokens and pure crypto tokens and put memorable designs on the token to attract customers and make them collectable after redemption.

## [User Stories](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=user-stories)

This section lists all the user stories, these user stories summarise TAP. Before defining user stories, the whitepaper refers to the following 5 roles of personals in TAP:

**Merchant:** the person who sells real-world products, or product backed tokens. **Customer:** the person who redeems real-world products with product backed tokens. **Seller:** the person who sells tokens (no matter if the token is backed by a product or not), which is a superset of merchants. **Buyer:** the person who buys tokens (no matter if the token is backed by a product or not), which is a superset of customers. **User:** all the persons make transactions with TAP; it includes buyers and sellers.

Based on the problems the decentralized e-commerce platform going to solve, WEDGE TOKEN implements the following user stories in the following 4 parts:

### [Marketplace](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=marketplace)

Marketplace is a platform where merchants can sell products, and customers can browse and buy products. **Merchants** are technically defined as: the account who can mint stateful universal tokens (SUT) which can represent the real-world products. In the marketplace:

* Everyone can register him/herself as a seller with seller profiles.
* Real estates, Developers in Dubai Can list estates on the platform to stimulate and ease the process of buy and sell properties, allowing attracted both locals and foreign investors in a tax-free country.
* Merchants can list items in the marketplace for sale.
* Everyone can buy items sold in the marketplace.
* The buyers can get the tokens or get the products delivered once they paid, based on their preferences.
* Merchants can set the items non-refundable when/after listing but before it is sold.
* Merchants can set the items unredeemable when/after listing but before it is sold.

### [Redemption for Products with Tokens](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=redemption-for-products-with-tokens)

Here we define a customer as the buyer who redeems the product. In redemption workflow:

* Customers can request redemptions for products with tokens(product) they purchased during the redemption window.
* Merchants can accept redemptions by delivering the products.
* Merchants can reject redemptions and return the payment back to customers.
* Merchants have the following options when converting the product backed tokens to crypto collectables:
  + Transfer the token back to the customers.
  + Transfer the token to the merchants (self, but not common).
  + Burn the token.
* Any customers can get the payment back if the redemption request cannot be fulfilled after redemption expiration time.
* Merchants can define the redemption windows and redemption expiration time and they must be visible to everyone.
* Customers can cancel redemptions before the acceptance of redemption.

### [Trading Tokens](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=trading-tokens)

Trading allows everyone (both merchant and non-merchant) to sell tokens. Here we define a seller as a general person who can be a buyer of the marketplace, but not the original merchant who sold this token(product). For trading:

* Everyone can list their tokens for sale at any prices for trade-in the product they no longer want to redeem.
* Everyone can list their tokens for sale at any price for trading the pure crypto token after redemption (Similar to crypto collectable).
* Anybody can buy tokens whether they are backed by products or not.
* If a user who wants to list the token that is he/she is the minter (original seller), the operation will be rejected.

### [After-Sale Services](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=after-sale-services)

After-sale services are provided for buyers who redeemed the token to return and get the refund. With after-sale services:

* Customers can request returning items with the tokens at any time within the return window, with or without a reason.
* Merchants can approve the return requests and do a full refund or custom refund to buyers; refund terms should be visible to everyone before items are sold.
* Customers cannot receive refunds if sellers don’t approve the returns.
* Merchants may not get the income if return status is pending (neither approved nor rejected).
* Merchants should make decisions to refund or reject the return if the return request is initialized within the return window.
* Customers cannot return items that are not refundable, return window expired or return status is pending.

### [Credibility](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=credibility)

Each account has both customer credibility and merchant credibility. Customer credibility is coming from the merchant's rating to the customer. Merchant credibility is calculated based on both customer’s rating and credit score. For ratings, WEDGE TOKEN allows:

* Customers can rate and give comments to merchants.
* Merchants can rate and give comments to customers.
* The ratings are visible to everyone.

For merchants, the credibility determines when they can get the income from the buyers’ payments. It protects buyers from losing assets by holding the funds in smart contracts, this urges sellers to process buyer’s requests so they can get the income. Please check the “User Management and Credibility” section for more information.

## [Architecture](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=architecture)

WEDGE TOKEN is a complex system that consists of multiple modules and subsystems, each module or subsystem is implemented as a separate smart contract, so it follows the principle of high cohesion and low coupling. The modules are broken down by the entities so each module can manage different types of entities, and subsystems are divided by processes. There are 3 the main entities:

* **Token:** here the token means **Stateful Universal Token (SUT)** we introduced to represent the items to be sold in WEDGE TOKEN. The **Token Management** module is managed and enriches the information of the token, or anything to be sold / traded in WEDGE TOKEN.
* **User:** it represents the users of WEDGE TOKEN. The public information (not private information) is stored on IPFS as JSON metadata. The information includes but is not limited to the name, bio, and other information of the user. Other on-chain data including the credibility, registration time are also included in the user profile. All the users are managed by the **User Management** module.
* **Asset:** The assets are the tokens collected from customers who paid for the items, but not yet withdrawn by sellers. The asset tokens can be different, such as BTC, BNB or USDT. These assets are kept in the Asset Management module, and they will be used to pay back sellers and after-sale services like refund customers.

Figure 1: The Architecture of WEDGE TOKEN Smart Contracts

Besides the 3 entities and their management modules, there are 4 subsystems to handle the workflows based on business divisions:

**Marketplace:** this is the marketplace for merchants to sell product backed tokens, it means the SUT whose state is available. Because the merchants have the liability for after-sale services, this is a smart contract for the user who can list and deliver the products.

**Trading:** this is the trading platform where anyone can trade their SUT which is backed by products or not. The seller here is not the original seller who minted the token. It allows customers to trade the products that he/she doesn’t need anymore with SUT before redemption or trade the tokens as pure crypto assets.

**Redemption:** this is the subsystem to allow customers to redeem SUT for real-world products. Only the owners of the SUTs can request for redemption for the products and only the minter (merchant) can accept the redemption. There is a time frame between customer’s request and merchant’s acceptance, it allows the merchant to ship or deliver the product(s) before accepting the request.

**After-sale:** this is the subsystem to handle after-sale services like return and refund, which allow customers to return items and get refunds. The subsystem also urges merchants to satisfy customers to gain better credibility.

The SUT interacts with all above subsystems. The holders of SUT can transfer the token to these subsystems to initialize the processes. For example, if a customer transfers a token that is not redeemed to the redemption subsystem, a redemption request is created. However, each subsystem must validate the transfer through the hook and reject the transaction if it is not allowed.

## [Stateful Universal Token](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=stateful-universal-token)

**Stateful Universal Token (SUT)** is the token that represents both real-world products and pure crypto assets in WEDGE TOKEN. We call these two types of token **"Product Backed Token"** and **"Pure Crypto Token"** respectively.

SUTs can be fungible or non-fungible for both types of tokens when representing real-world products. For example, a merchant can list vehicles for sale, these vehicles can be non-fungible because each of them has different configurations and VIN (Vehicle Identification Number). Or a gas station can use fungible token to represent gallons of gas so customers can purchase any gallon of gas with the same unit price.

Figure 2: The relationships of 4 types of tokens

Figure 2 shows that multi-token (EIP-1155) scan represent both fungible and non-fungible tokens. Stateful universal token is an extension of multi-token (EIP-1155) by adding the presentation of states and relative operations to multi-token.

In WEDGE TOKEN, SUT has two states: **AVAIL:** current token is product backed, which is redeemable. **VOID:** current token is not product backed; it is pure crypto token. It can be used for digital collectables.

Figure 3: State Transitions of SUT in WEDGE TOKEN

Figure 3 shows the lifecycle of SUT in WEDGE TOKEN, we only allow one direction for state transitions to conform to the nature of e-Commerce workflow and prevent state confusion. All the users can mint product backed token (state = AVAIL) and pure crypto token (VOID) and put these tokens for sale. Fraud and fake products may occur because everyone can mint tokens with any state, however, customers can rely on the credibility system provided in the user management module.

TAP defines the interface of SUT3 for a set of events and functions. The interface allows both singular and batched operations like transferring tokens and changing states for a type or several types of tokens. Each type of token is specified as an ID.

TAP also allows smart contracts to implement the SUT Receiver interface4 to do necessary verification and logistic operation in the smart contract. It is useful when users transfer SUT to a smart contract and prevent loss of assets. All smart contracts of WEDGE TOKEN subsystems implement this interface.

## [User Management and Credibility](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=user-management-and-credibility)

Figure 1 shows that the User Management module is a standalone smart contract that is called by all subsystems for managing the information of the user involved in the transactions. It is shared across all subsystems to minimize the complexity of the system and prevent duplicated code.

In Web3, there is no need for users to register to use WEDGE TOKEN if they have a wallet. The user management module is called by these subsystems implicitly for end-users when performing transactions. The call is for recording the auditing information and credibility information of the user.

### [Auditing Information](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=auditing-information)

Auditing information is used as a summary to describe current user historic information, which are references on the numbers of transactions and completion of these transactions. It could be used as supplement information of credibility. The information includes:

* productised: number of SUT listed on Marketplace subsystem.
* nProductSold: number of SUT sold from Marketplace subsystem.
* nTokenListed: number of SUT listed on Trading subsystem.
* nTokenSold: number of SUT sold on Trading subsystem.
* nRedeemSuccess: number of redeemed products sold by current user.
* nRedeemFailure: number of products sold by current user but failed to redeem within the redeem window.
* nReturnRequested: number of return requests filed against current user.
* nReturn: number of returns against the current user that have been fulfilled.
* nReturnPending: number of returns against the current user that is pending or no response.
* nProductBought: number of products the current user bought from the Marketplace subsystem.
* nTokenBought: number of products the current user bought from the Trading subsystem.
* nRedeem: number of redeem requests filed by current user.
* nReturn: number of return requests filed by current user.

### [Descriptive Information](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=descriptive-information)

Descriptive information is used for describing the seller or the buyer like name, icon, contact information etc. They are JSON files stored on IPFS that describe the user public profile associated with wallet addresses. Merchants or any other sellers can use the descriptive information to describe their businesses.

### [Credibility Management](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=credibility-management)

TAP introduces credibility management to provide trust for e-Commerce transactions. TAP manages the credibility of every user with a credit score system. This credit score system is totally on-chain and independent with any other credit system. The on-chain activities in WEDGE TOKEN will impact the user's credit score. Meanwhile, TAP also uses a rating system for providing feedback to the user, no matter if the user is buyer or seller.

Credit score ranges from 0 to 1000 with an initial score of 500. And the following activities will impact the user’s credit score.

As shown in the above table, the rating is from 1 star to 5 stars. We allow the users to rate another party connected with each transaction. For redeeming the real-world products, the customer can rate the merchant who sells this product, and the merchant can rate the customer, but others cannot rate the buyer or the merchant outside the transaction. One thing to note is that the original buyer of the product may not be able to rate the merchant because only the buyer who redeems the product can rate the merchant.

The credit score is visible to everyone in WEDGE TOKEN, the merchant should keep a good credit score so more customers will come to shop and redeem the products. Based on the value of credit score, there are 5 grades of credibility for a user:

* Very good: credit score >= 900
* Good: 600 <= credit score < 900
* Fair: 500 <= credit score < 600
* Warning: 400 <= credit score < 500
* Fraud: credit score < 400

### [Receiving Payments](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=receiving-payments)

Sellers can receive payments after selling tokens. In TAP, there are 2 subsystems to allow sellers to receive payments: Marketplace and Trading system. Here is the default configuration for receiving payments:

**Marketplace:** WEDGE TOKEN has its asset management module to hold the payments. Sellers (Merchants) can withdraw buyer’s payment after the return window is completed. If the item cannot be returned, they can withdraw once after the items have been redeemed.

**Trading:** Sellers can receive the payment immediately after the SUTs are sold. WEDGE TOKEN doesn’t hold the payment.

The marketplace sellers (Merchants) can withdraw the payment after the item is redeemed or even after the SUTs are sold. Here are the 2 conditions to allow the merchant to do that:

1. The credit score is at least 600.
2. The merchant has completed the KYB (Know-your-business) process.

## [Token Management](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=token-management)

Token management module manages the e-Commerce lifecycles of product backed tokens from listing on marketplace to the end of sale. The module provides supplemental information and management functions of SUTs to go through the sales process.

Once merchants minted the tokens for sale, they could list with different batches. E.g., I want to sell 10 MacBook today and another 20 MacBooks next week with the same price and configuration. And they may have different redemption windows and return windows for the 2 batches. So, it requires additional information in token management for the 2 batches. The above information of items managed in this module are used by the 3 subsystems: Marketplace, Redemption and After-Sale.

## [Asset Management](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=asset-management)

Asset management is a module that manages the crypto assets of merchants. Some of the assets are held by smart contract for refund to customers, remaining assets are for merchants to withdraw as their income to sell these items. TAP requires an asset management module to urge merchants to provide the quality services to customers and protect customers from fraud sales. Like the token management module, asset management is only for managing the product backed tokens that need to go through the redeem/return processes.

TAP accepts multiple types of cryptocurrencies based on the preference of seller/buyer. The variation is also managed in this module.

## [Subsystems](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=subsystems)

TAP breaks down the processes of the whole ecosystem into several subsystems.

### [Marketplace](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=marketplace-1)

Marketplace allows merchants to list the minted SUT for sale, the SUT must represent the real-world product and buyers can buy the SUT. Figure 4 shows the supported workflows of the Marketplace subsystem:

Figure 4: The Workflows of Marketplace Subsystem

**List Item(s):** this workflow is for a merchant to list the SUTs minted by him/herself, AND the SUT should be backed by a real-world product which state should be AVAIL. The listing operation is implemented with the on SUT Received so users can use safe Transfer From or its batched version to list item(s). In the following 2 cases, the listing operation will fail:

* The transferred SUT’s state is VOID.
* The transferred SUT’s minter is not the person who initializes the transfer. Note: the transfer failure will revert the transaction and the token’s ownership will not be changed. If you transfer tokens other than SUT to Marketplace, the tokens will be permanently lost.

**Delist Item(s):** this workflow allows merchants to delist items before they are sold in the Marketplace subsystem. By delisting the item, the SUT will be transferred back to the merchant.

**Purchase Item(s):** this workflow allows buyers to purchase items. It will transfer the crypto payment to the Asset Management module and the SUTs will be transferred to buyers. The buyer must not be the merchant for the same listed items.

### [Trading](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=trading)

Trading subsystem is a separated system that allows users to sell the items because of overspending or no longer required before the redemption. Also, it allows users to list the pure crypto tokens (tokens not backed by real-world products) for sale like a NFT marketplace.

Figure 5: The Workflows of Trading Subsystem

Figure 5 shows the workflows of the Trading subsystem. Like the Marketplace subsystem, it also has 3 workflows: **List Item(s)**, **Delist Items(s)** and **Purchase Item(s)**. However, it has the following differences and restrictions:

* Users can list any SUTs for sale except the minter is him/herself AND the state of the token is AVAIL. Because the product backed token must go through the process from the Marketplace subsystem.
* When a buyer purchases SUTs, the payment will be paid directly to the seller instead of the asset management module.

### [Redemption](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=redemption)

Redemption is the subsystem to handle redemption requests from customers. Here the customers are the real customers of the products, not the buyer who purchased the SUT.

The workflows of the redemption subsystem include:

**Request to Redeem:** the request could be made within the redemption window of the item or not. The SUT to be redeemed should be sent to the redemption subsystem no matter in which case. Only the SUT whose state is AVAIL, and the redeemer must not be the minter of the token.

**Cancel Redemption:** the customer can cancel redemption before the merchant handles the cancel request. The SUTs will be transferred back to the customer.

**Accept Redemption:** the merchant should accept redemption if the redemption request is filed within the redemption window. By accepting redemption, the token is transferred back to the customer and the state is set to VOID. We recommend merchants to ship or deliver the product before accepting redemption.

**Reject Redemption:** the merchant can reject redemption if he/she cannot deliver the product to the customer. There is no penalty if the customer filed the request to redeem out of the redemption window. If the SUT’s state is set to VOID on the rejection, the merchant must refund the customer. And the merchant can lose credibility (by drawing down the credit score) if he/she rejects redemption within the redemption window.

If the merchant doesn’t respond to the request to redeem, it will also hurt the credit score of the merchant, and the customer can withdraw the fund from the asset management module.

**After-Sale**

After-sale subsystem allows the customer to request a refund if he/she is unsatisfied with the product. As you can see from figure 7, a customer can request and cancel a return request. A merchant can accept or reject the return request. If a merchant doesn’t handle the request in time, he/she may not get the income from selling the product. And the credit score may be hurt by the rating of the customer.

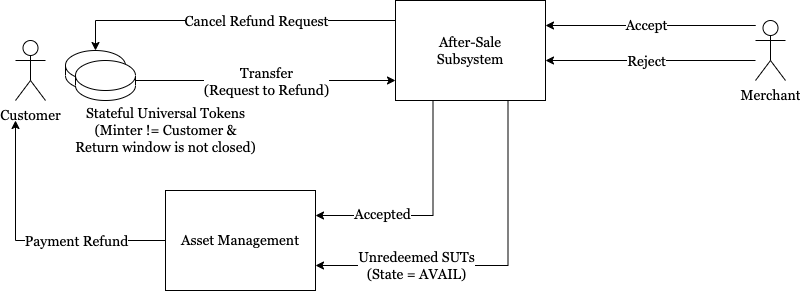


Figure 1: The Workflows of After-Sale Subsystem

The After-sale subsystem allows customers to return the SUTs that are redeemed or unredeemed. For unredeemed SUTs (state = AVAIL), customers will get the refund automatically from the asset management module. For redeemed SUTs (state = VOID), the merchants should accept or reject the request.

## [Product Integration](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=product-integration)

TAP defines a whole system to run e-Commerce on blockchain to support shopping marketplace, redeem, trading and after-sale. Like other Web3 projects, other technologies could be adopted to make a successful business for merchants who want to sell their products. Beyond TAP, WEDGE TOKEN adopts several integrations with Web3 approaches.

### [Private Information of Customers](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=private-information-of-customers)

Although the transactions happen on a chain, WEDGE TOKEN requires private information like email addresses and/or physical addresses to deliver the products. This requires the communication channel between business and customer. WEDGE TOKEN as a product will integrate this feature by notifying both parties with the updates of the transactions and making the shopping experiences smoothly.

### KYB (Know-Your-Business)

KYB is a service WEDGE TOKEN provides to give trust to businesses. The merchants who gain the KYB badge can let customers trust the business and prevent customers from making purchases from untrusted merchants.

### [Communication Channels for Business](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=communication-channels-for-business)

Like other Web3 projects, communication channels like social media are the keys to success, it allows customers to follow the updates of products and contact merchants so they can provide better services before or after sales. On the business pages of WEDGE TOKEN, the information of communication channels will be provided through the descriptive information in the User Management module.

## [Summary](https://docs.tifi.net/#/TiFiAllverse/Whitepaper?id=summary)

This whitepaper describes the WEDGE TOKEN Protocol (TAP) which is for building a trust and decentralized e-Commerce solution on blockchain and serves as. The solution covers the subsystems like marketplace, trading, redemption, and after-sale services which are essential for e-Commerce. The whitepaper also discusses the credibility of users and how to leverage the off-chain integrations to provide better services for customers with WEDGE TOKEN Protocol.